

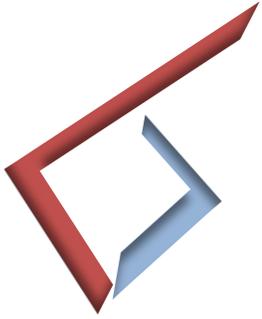
# STATE OF TRANSPORTATION IN D-8 COUNTRIES



ORGANISATION OF ISLAMIC COOPERATION

STATISTICAL, ECONOMIC AND SOCIAL RESEARCH  
AND TRAINING CENTRE FOR ISLAMIC COUNTRIES





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

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## ABBREVIATIONS AND ACRONYMS

BASEIND:	Basic Social and Economic Indicators
COMCEC:	Commercial Cooperation of the Organization of Islamic Cooperation
D-8:	Developing-8 Organization
EIA:	Energy Information Administration
GCI:	Global Competitiveness Index
LPI:	Logistics Performance Index
LSCI:	Linear Shipping Connectivity Index
IEA:	International Energy Agency
OIC:	The Organization of Islamic Cooperation
SESRIC:	Statistical, Economic and Social Research and Training Center for Islamic Countries
UNCTAD:	United Nations Conference on Trade and Development

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## FOREWORD

Transportation is a leading sector in both national and regional development which contributes to socio-economic development of societies through boosting trade, jobs and the living standards. The provision of adequate and efficient transportation services is an essential requirement not only for gaining access to national, regional and international markets, but also for facilitating the provision of healthcare and education services, which in turn, promote development and create investment opportunities.

The population of the member countries of the Organization for Economic Development Cooperation (D-8) has been growing at higher rates than those observed in the developed countries, thus placing high demand on transportation infrastructure and services. Therefore, public-private investments in transportation networks and services are becoming increasingly essential. In some of these countries, the lack of adequate and efficient transport infrastructure, particularly in urban areas which rely mainly on private vehicles, resulted in serious environmental and safety problems.

One of the main environmental negative impacts is carbon dioxide emissions. Indonesia, Iran, Malaysia, and Turkey are the largest contributor D-8 countries to carbon dioxide emissions. In this context, innovative technologies in the transportation sector should be given greater importance. Increasing the quality and level of service provided by the transportation sector should be considered as one of the top priorities of the D-8 countries. Investments and improvements in transportation sector will contribute to the expansion of intra-trade among these countries and, thus, enhancing their competitiveness at regional and international levels.

This report looks at the transportation sector in D-8 countries in a comparative perspective. It investigates the performance of the different modes of transportation under three broad categories: land, water and air transportation. The report also highlights the relationship between transportation and trade and tourism and examines the effects of population growth on the transportation sector by analysing the change in the growth rates and the urbanization. It also examines the negative impact level of transportation sector on the environment. Finally, the report concludes with some broad policy recommendations aiming at improving the efficiency of the transportation sector in the D-8 countries.

Amb. Musa Kulaklıkaya  
Director General  
SESRIC



## EXECUTIVE SUMMARY

### Transportation and Globalization

Transportation and globalization are positively correlated. In 2013, higher scores in the Global Competitiveness Index (GCI) are associated with higher port container traffic volumes in developing countries. The analysis shows that D-8 countries are not fully utilizing their transportation infrastructure in reaching a high level of competitiveness as they have lower scores in the GCI compared to the remaining developing countries with the same levels of port container traffic.

### Modes of Transportation

The Linear Shipping Connectivity Index (LSCI) measures how well countries are connected to global shipping networks. In general, D-8 countries and non-D-8 OIC countries have similar values with the highest value for D-8 countries being 104 (Malaysia) and the highest value for non-D-8 OIC countries being 65 (UAE). Among non-D-8 developing countries, China has the highest LSCI value of 165, whereas Hong Kong has the highest value among developed countries with 116.

The overall performance of the countries in the transportation sector is measured by the Logistics Performance Index (LPI). Scores have been grouped under four categories according to the World Bank thresholds. 25 percent of D-8 countries have relatively poor logistics performance as their scores are between 2.48 and 2.78. On the other hand, the other 25 percent of D-8 countries have very satisfying logistics performance with the LPI score exceeding 3.43. These figures are significantly different from both non-D-8 OIC and non-D-8 developing countries. This is because a significant percentage of non-D-8 OIC (53 percent) and non-D-8 developing countries (33 percent) are in the lowest scoring group, below 2.48. By contrast, as a group, developed countries have performed considerably better than others, with 74 percent being in the highest scoring group and 26 percent being in the second highest scoring group. Although D-8 countries score significantly lower than those in developed countries, their performance is still higher than the rest of the selected country groups' performance.

Regarding land transportation, this report first analyzes the differences in road network length. Road network length, per 1000 km<sup>2</sup>, in D-8 countries (248 kilometers) are below the world average of 282 kilometers, after adjusting for differences in land area in 2011. However, the road network length of D-8 countries is greater than that of non-D-8 developing and non-D-8 OIC countries. Likewise, the differences in road length among countries can be adjusted for the differences in population instead of land area. Even then, the road length, per 1000 person, in D-8 countries (2.69 kilometers) is still higher than that of non-D-8 OIC countries (2.37 kilometers). Second, the differences in railway network length are also analyzed. After accounting for the differences in land area, D-8 countries have 6.12 kilometers of total rail lines per 1000 km<sup>2</sup> area in 2014. This is higher than that of the remaining OIC countries and non-D-8 developing countries. Overall, it is still below the world average. After accounting for the differences in population, D-8 countries, with 0.04, are performing poorly in providing rail lines to their citizens compared with every other country groups.

With respect to air transportation, D-8 countries have the least amount of activity in terms of registered carrier departures, 2.18 per 1000 people. This figure is slightly lower than both non-D-8

OIC countries (2.25 kilometers), and non-D-8 developing countries (2.19 kilometers). Furthermore, two more measures can be employed; freight volume and passengers carried. In 2013, developed countries have recorded the highest share of freight volume with 64.8 percent, followed by non-D-8 developing countries with 31.7 percent. In terms of passengers carried by airway, the share of D-8 countries is 8.2 percent while the share of non-D-8 developing countries is 5.7 percent. In addition, non-D-8 developing countries (35.4 percent) appear to catch up with developed countries (56.4 percent) in passenger volume.

As far as water transportation is concerned, it is evident that D-8 countries, with the total fleet capacity of 86 tons, are outperforming non-D-8 developing countries, with the total fleet capacity of 71 tons, in 2014. On the other hand, D-8 countries are performing slightly worse than non-D-8 OIC countries, 90 tons in terms of total fleet capacity. Developed countries, in contrast, appear to have the highest total fleet capacity among all with 916 tons which makes the world average 201 tons (all figures above per 1000 people).

### **Transportation and Trade**

The Logistics Performance Index (LPI) is used as a proxy to measure the quality of logistics infrastructure of a country. A positive correlation has been found between the LPI score and the value of total trade. One point increase in LPI increases the log value of total trade per capita by 1.038. Further analysis reveals that D-8 countries are mainly situated below the trend line, suggesting that the value of traded goods in D-8 countries is below what is predicted by the general equation given the LPI scores of D-8 countries. In light of these findings, it can be stated that there is room for improvements in the quality of logistics infrastructure in D-8 countries and these improvements are expected to positively affect total trade of the countries.

Similar to the LPI, land transportation densities can also be used to capture the relationship between transportation and total trade per capita. Results reveal a weak positive relationship between road density and the value of total trade. Particularly, the impact of road density on total trade value is relatively small, 0.038, in comparison to the previously calculated LPI value. Based on their road density values as suggested by the equation of the trend line, it can be concluded that D-8 countries are underperforming in terms of total trade. For railway density, a positive link is found between railway density and the value of total trade of a country.

Lastly, results show that there exists a positive relationship between air transportation density and total trade value of a country. However, the impact of airway density on the value of internationally traded product is considerably smaller compared to the effects of land transportation density measures. In fact, one unit increase in air transport density increases the log of total trade value per capita by around 0.007. The impact of air transportation density on total trade in developed countries is significantly higher than that of D-8 countries.

### **Transportation and Tourism**

The observed relationship between the LPI score and the log of total value of tourism receipts in dollars per capita is positive. Specifically, one point increase in LPI leads to a 1.522 increase in the log of tourism receipts per capita. The analysis also reveals that the D-8 countries are not fully utilizing their logistics infrastructure and as a result they are underperforming with regard to tourism revenues. This situation is reversed for developed countries.

There is a positive correlation between road density and per capita total tourism receipts. In particular, one unit increase in road density increases the log of tourism receipts per capita by 0.033. Moreover, a positive relationship persists between railway density and per capita total tourism receipts but the effect is considerably bigger, 1.101, compared to the effect of road density. Overall, both land transportation density measures have a positive effect on tourism receipts in 2013.

When the effects of air transportation density on trade are measured, the results showed a positive but weak relationship between airway density and the value of per capita total tourism receipts of a country. Put differently, one unit increase in airway density increases the log of total receipts per capita by 0.009. This effect is smaller than both land transportation density measures. Moreover, D-8 countries are mostly grouped below the trend line while developed countries are mostly grouped above the trend line. Thus, it can be concluded that D-8 countries are underperforming in terms of tourism receipts according to their air transportation network density values.

### **Transportation and Population Growth**

Regarding overall trends in population growth, developed countries have a smaller population growth rate compared to developing countries. In 2014, the annual growth rate of population in D-8 countries was 1.68 percent on average while non-D-8 OIC countries had the annual growth rate of 2.24 percent. The share of urban population in total population has increased drastically over the period and this increase has been uniform across country groups. In 2014, developed countries have the biggest share of urban population by 80.3 percent. D-8 countries, on the other hand, have a share of 54.3 percent and thus more than half of the population of D-8 countries lives in urban areas.

With respect to the effects of population growth on air transportation, one percent increase in population increased passengers carried by airways by 0.72 percent on average between 1960 and 2014. In other words, higher population growth leads to a higher demand for air transportation. In addition, in some D-8 countries, air transportation demand has increased at higher rates than population growth.

### **Transportation and Environment**

Considering overall trends in environmental effects, in 2014, D-8 and the remaining OIC countries were among the least contributors to the world's carbon dioxide emission while non-D-8 developing countries were the largest emitters of carbon dioxide. Currently, the transportation sector is the second largest source of emissions with 22 percent. The largest source of carbon dioxide emissions in the transportation sector is road transportation, 73.4 percent, since this mode of transportation mostly uses petroleum based fuels. Furthermore, the differences in energy

consumption in road transportation among different country groups are analyzed, and developed countries have the highest per capita energy consumption in 2011 with 967 kilogram of oil equivalent, whereas D-8 countries have the lowest per capita energy consumption with 142 kilogram of oil equivalent.

In terms of energy consumption of the various transportation modes, some D-8 countries including Indonesia, Iran, Malaysia, and Turkey are analyzed. The share of total energy consumption in road transportation and international aviation appears to have increased in every reported country between 1990 and 2008. The biggest percentage increase in road transportation was observed in Malaysia (6.1 percent) compared to the smallest percentage change in Turkey (2.5 percent). Additionally, international aviation has increased its contribution to total emissions by the biggest percentages. Turkey is the biggest energy consumer in international aviation with 11.7 percent on average, followed by Indonesia with 7.7 percent per year increase. Lastly, there have been decreases in energy consumption levels in international shipping in some D-8 countries, such as Indonesia (1 percent) and Malaysia (2.1 percent) while Turkey increased its consumption by 10 percent during the same period of time.

# 1 INTRODUCTION

Transportation is the movement of goods beyond their local production area and movement of people between geographical locations. The need for transportation has emerged as a result of modernization and its demand is strongly correlated with population, employment growth, tourism, and trade. In fact, in the last 40 years, the populations of developing countries grew around 1.6 percent per year on average and more importantly the share of urban population almost doubled, which has led to substantial increases in the number of passengers carried by air transportation, land transportation, and maritime transportation. Moreover, all of this increased transportation activity is matched with a four-fold increase in international trade volume and an average annual growth rate of 6.5 percent in tourism volume as international arrivals. However, matching these dramatic increases in demand for transportation has not been easy for policymakers given the resource constraints on land and energy in addition to environmental concerns.

Enhanced mobility has many positive effects on economic development and social welfare including more efficient movement of goods and improved access to jobs, health services, and education. It is therefore highly prioritized by developing countries. However, since it is achieved primarily through modes of transportation that heavily rely on fossil fuels, the costs can be substantial. Given that the growth in transportation demand has been much higher in developing countries than in developed countries, more focus will be needed to address transportation issues in developing countries. Thus, in recent years, there have been many policy changes and pricing regulations in the transportation sector to limit the potential demand in these countries.

Transportation has been one of the five priority areas of the D-8 Organization. Particularly, both civil aviation and maritime sector have been extensively studied within the D-8 Organization via Working Groups. The main objectives of these Working Groups are to help promote and enhance collaboration among member countries in order to identify potencies, opportunities, challenges and offer solutions when needed.

Against this background, this report looks at the transportation sector in D-8 countries in a comparative perspective. To set the stage, the report begins with an analysis of the relationship between transportation and globalization. Section 3 first introduces the different modes of transportation by grouping them under three broad categories as land, water and air transportation. Second, by using the latest available data, it compares the overall performance of the transportation sector of D-8 countries with the rest of the world. The relationship between transportation and trade in D-8 countries is discussed in comparison to the other country organizations in Section 4. Section 5 focuses on the relationship between transportation and tourism. Section 6 deals with the effects of population growth on the transportation sector by analyzing the change in the growth rates and the urbanization. Section 7 reports the measured levels of negative impacts of the transportation sector on the environment in D-8 countries versus the others. Finally, the report concludes with stating the main findings and offering some policy recommendations aiming to improve the transportation sector at the D-8 Organization level.

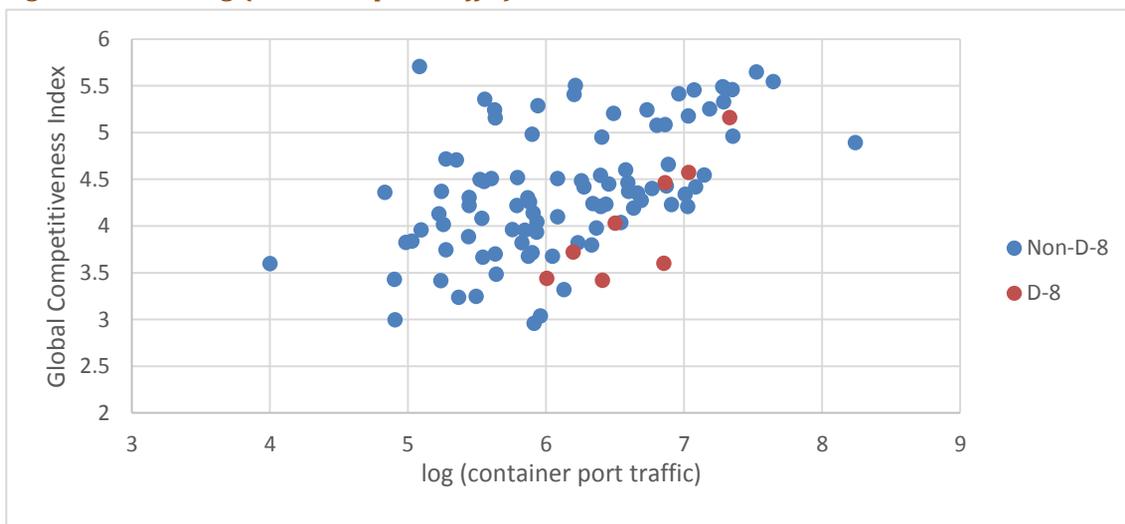


## 2 TRANSPORTATION AND GLOBALIZATION

Globalization is an ongoing process in which economic interactions become increasingly geographically unrestricted. Therefore, advances in transportation and technological innovations that reduces transportation costs have been major factors in this process by generating further interdependence of economic and cultural activities around the world. Transportation is generally referred to as an enabling factor for globalization without which globalization could not have occurred. This is mostly as a result of the fact that more than half of international trade takes place between locations of more than 3000 kilometer apart. In that regard, transportation infrastructure is of key importance in longer-term competitiveness. Of all modes of transportation, maritime handles around 90 percent of global trade and globalization can thus be considered to be the realm of maritime shipping (Rodrigue, 2013).

Figure 1 demonstrates the relationship between global competitiveness and transportation in 2013. Global competitiveness is measured by the Global Competitiveness Index (GCI) developed by the World Economic Forum. It attempts to quantify the impact of a number of key factors that contribute to create the conditions for competitiveness and measure their overall impact on globalization. It uses a 1-7 scale with higher being better. In addition, transportation is measured by the log value of port container traffic which reports the flow of containers from land to sea transport modes, and vice versa, in twenty-foot equivalent units. Port container traffic data is taken from the World Bank. Figure 1 reveals a positive relationship between the GCI and the log of container port traffic in 2013. Put differently, there exists a positive relationship between global competitiveness and transportation in developing countries. Yet it is clear that some D-8 countries appear to have low GCI score which would suggest that they are not fully utilizing their transportation infrastructure in reaching higher levels of global competitiveness. Therefore, in order to achieve global competitiveness in D-8 countries, a deeper understanding of the transportation sector is very crucial.

**Figure 1: GCI vs. log (container port traffic), 2013**



Source: World Bank and World Economic Forum



## 3 MODES OF TRANSPORTATION

The main objective of transportation is to satisfy some specific constraints on traveling, including safety, cost, comfort and time. Depending on the relative geographical location of the delivery destination, transportation may be done via different modes. These modes of transportation are separated into three basic types based on over what surface they travel – land, water and air. Each of these modes does a better job in satisfying some of the constraints above compared to the alternatives. Thus, for different purposes different modes of transportation are preferred.

This section will identify and explain the modes of transportation with respect to the classification above. Additionally, the use of these modes in the D-8 countries and the overall performance of the D-8 countries in the transportation sector will be assessed extensively.

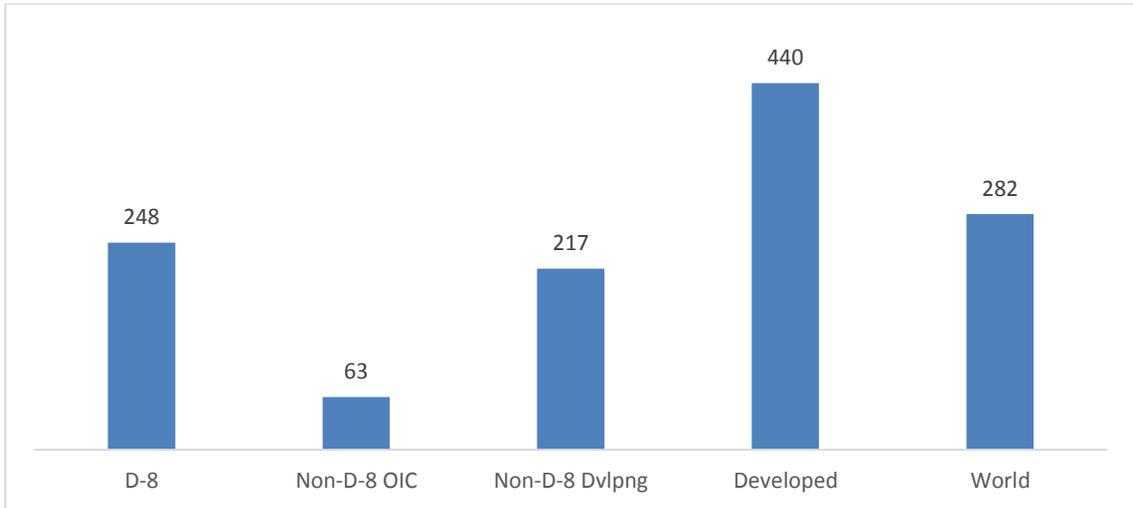
### 3.1 Land Transportation

Land transportation is also referred to as ground transportation and can be done by using different methods, with roads and railways being the most commonly used.

#### 3.1.1 Roads

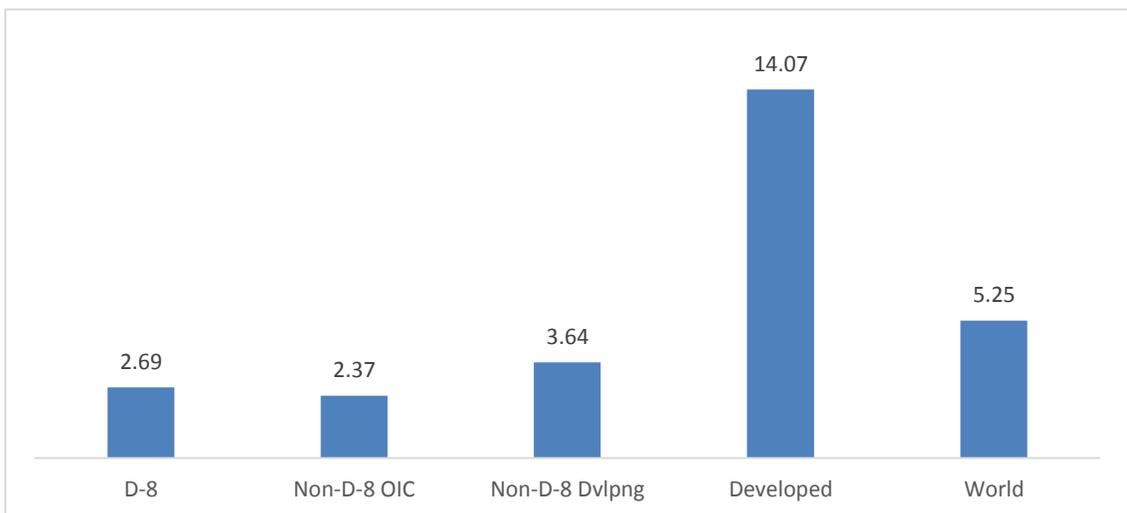
Road transportation is known to be the oldest mode of transportation, but it has expanded the most in the second part of the 20<sup>th</sup> century according to World Bank reports. Today road transportation carries on average more than 90 percent of goods in value and more than 80 percent in inland freight volume. The reason for road transportation being very popular is that it has many advantages over its alternatives. First, road transportation requires much less capital investment as compared to other modes of transportation. Its maintenance costs are also comparably lower. In addition, it is most suited for carrying goods and people to and from rural areas which are not served by rail, water or air transportation. It is more economic and quicker for carrying goods and people over short distances and its routes and timings can be adjusted and changed to individual requirements without much inconvenience. On the other hand, there are some disadvantages associated with road transportation. First, it is not as reliable as rail transport given its seasonal nature and there are higher chances of accidents and breakdowns. Moreover, it is unsuitable and costly for transporting cheap and bulky goods over long distances.

Road transportation is utilized at different rates by countries. In order to analyze these different levels of utilization, road network length for selected country groups, after accounting for the differences in land area, are presented in Figure 2. This figure shows that the road length in kilometers per 1000 km<sup>2</sup> land area for selected country groups in 2011. Developed countries, with 440 kilometers, have the highest total road network length, followed by D-8 countries, with 248 kilometers which is below the world average of 282 kilometers. However, D-8 countries have a greater road length compared to both non-D-8 OIC (63 kilometers) and non-D-8 developing countries (217 kilometers) (all figures above per 1000 km<sup>2</sup> on average).

**Figure 2: Total road length per 1000 km<sup>2</sup> for selected country groups, 2011 (km)**

Source: World Bank

The differences in road length among countries can also be adjusted for the differences in population. This way of measuring would help understand the extent of the differences in usage of road network by an individual in different countries. Figure 3 demonstrates the road length in kilometers per 1000 people for selected country groups in 2011. Apparently, developed countries have taken the lead in this matter by surpassing other countries with 14.07 kilometers. By contrast, total road length in D-8 countries accounts for 2.69 kilometers which is below the world average of 5.25 kilometers. This figure is still higher than that of the remaining OIC countries, 2.37 kilometers but lower than that of non-D-8 developing countries, 3.64 kilometers. It can be concluded that D-8 countries have less available road network (all figures above per 1000 people on average).

**Figure 3: Total road length per 1000 people for selected country groups, 2011 (km)**

Source: World Bank

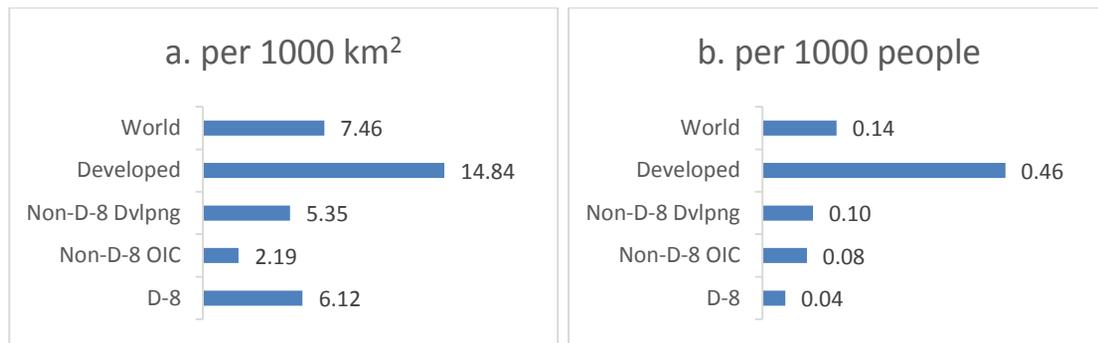
### 3.1.2 Railways

Rail transportation, which is also referred to as train transportation, is transferring goods or people by wheeled vehicles running on rails. These vehicles are guided by the tracks on which they run. The invention and development of the railway in Europe is considered to be one of the most important technological inventions of the late 19<sup>th</sup> century. Today, 10,000 billion freight ton-kilometers are travelled around. This is mostly due to the fact that railway transport is the most dependable mode of transport as it is the least affected by weather conditions compared to the other modes of transportation. Another advantage of rail transport is that it is better organized than any other form of transport. It has fixed routes and schedules. It is also economical, quicker and best suited for carrying heavy and bulky goods over long distances. In some situations, these advantages can be outweighed by its disadvantages. First disadvantage of railroad transportation is that it requires a large investment of capital and this may give rise to monopolies and work against public interest at large. In addition, railways cannot be operated economically in rural areas and short distance transfers.

Railroad transportation is also used at different rates by countries. For example, the United States, China, Russia and India were the world's leading countries in railroad transportation in 2014. As it can be noticed, these countries are all heavily populated and big in land area. Thus, for a comparison of the density of railroad transportation among different country groups, differences in land area and also in population need to be measured. First, total route of rail lines in kilometers are reported for different country groups. Then, the differences in land areas are adjusted for a comparable measure.

Figure 4a reflects that D-8 countries have 6.12 kilometers of total rail lines in 2014. This is higher than that of both non-D-8 OIC countries (2.19 kilometers) and the remaining developing countries (5.35 kilometers). Conversely, the density of railway lines in D-8 countries is still below the world average of 7.46. Developed countries have the greatest railway infrastructure with 14.84 kilometers (all figures above per 1000 km<sup>2</sup> on average).

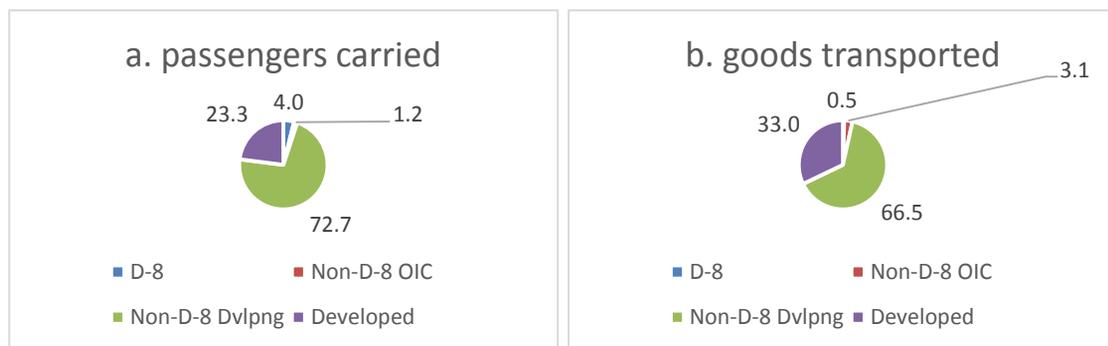
Figure 4b summarizes total rail lines per 1000 people in 2014 which reveals that D-8 countries have 0.04 kilometers of total rail lines which is below the world average of 0.14 kilometers. Developed countries, with 0.46 percent, outperform every other country group by a wide margin. Rail network density in non-D-8 OIC (0.08 kilometers) and non-D-8 developing countries (0.10 kilometers) is slightly higher than that of D-8 countries.

**Figure 4: Total rail lines for selected country groups, 2014 (km)**

Source: World Bank

Clearly, D-8 countries are performing poorly in providing rail lines to their citizens compared with other country groups. Even though, D-8 countries were performing close to the remaining developing countries, once the differences in population are accounted for, their performance is still not at a satisfactory level (all figures above per 1000 people on average).

Given data availability, railways transportation can be analyzed in two additional ways. The use of railway transportation can also be measured by passengers carried and goods transported via railways for a given country. Figure 5 presents these measures for selected country groups in 2012 as passengers carried on left panel and goods transported on the right panel. Using both measures, it can be concluded that non-D-8 developing countries have the highest share of world railway transportation activity. According to Figure 5a, D-8 countries contribute only 4 percent to passenger volume in railways transportation which is still higher than the contribution of the remaining OIC countries, 1.2 percent. However, the results shown in Figure 5b suggest that this situation is reversed, as D-8 countries contribute only 0.5 percent to the goods transported while the remaining OIC countries contribute 3.1 percent.

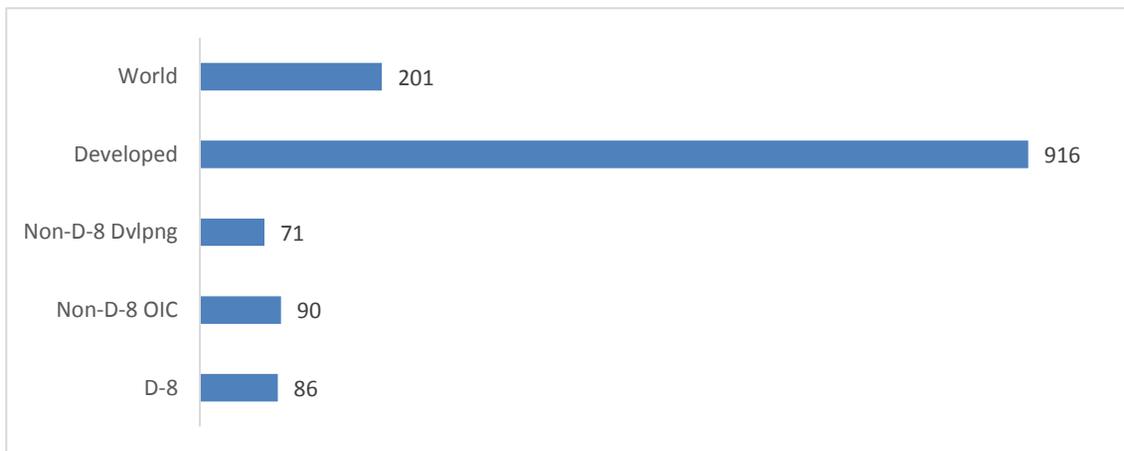
**Figure 5: Shares of railway activity for selected country groups, 2012**

Source: World Bank

### 3.2 Water Transportation

Water transportation is the process of moving goods or people by ship or sailboat over waterways. There are two types of waterways for transportation purposes, inland waterways and ocean waterways. The former refers to the use of inland water bodies like rivers, canals, backwaters while the latter refers to navigating along the coasts of countries around the world. Other than its trivial advantages as a result of geographical constraints, water transportation has a few other advantages over the other modes of transportation. First, it has the largest carrying capacity compared with others, thus it plays an important role in international trade. Second, due to the smooth surface of sea, comparatively less tractive power is required for its operation which results in a low cost of operation. Last but not least, it is known to be one of the most secure modes of transportation given that the chances of having traffic accidents are low. That being said, there are some disadvantages of water transportation. First, it is very slow in speed compared to the other modes of transportation. Second, water transportation is considered to be unreliable modes of transportation since it is highly affected by weather conditions.

**Figure 6: Dead weight tons by flag of registration per 1000 people for selected country groups, 2014**



Source: United Nations Conference on Trade and Development (UNCTAD)

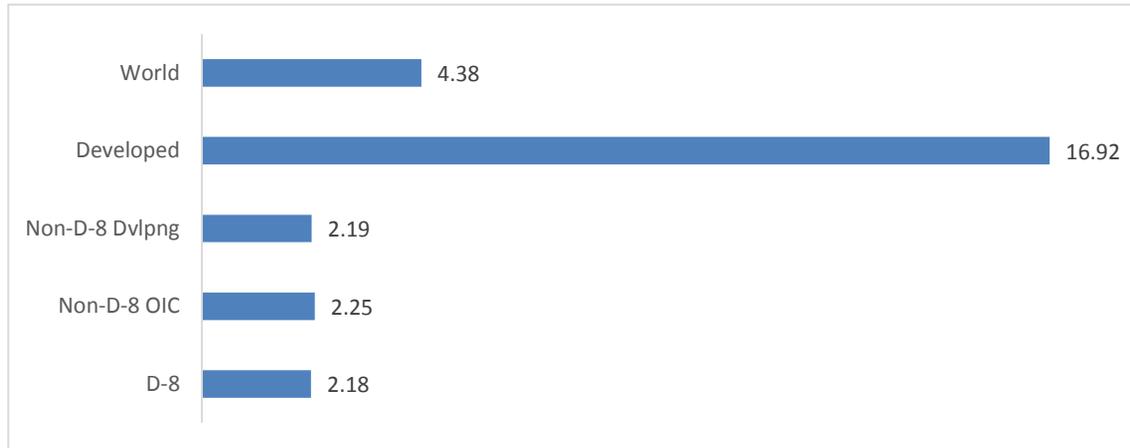
Figure 6 demonstrates the total fleet capacity of selected country groups in 2014. It is evident that developed countries have by far the highest total fleet capacity among all with 916 tons, followed by the world average of 201 tons. D-8 countries, 86 tons, are outperforming non-D-8 developing countries, 71 tons. By contrast, D-8 countries are performing slightly worse than non-D-8 OIC countries (90 tons) in total fleet capacity (all figures above per 1000 people).

### 3.3 Air Transportation

Air transportation is a relatively new mode of transportation as it has been in place since the first quarter of 20th century. Yet, its development has been fast across the world and as a result, over 3 billion passengers were carried by the world's airlines in 2013. Airport transportation also carries around 35 percent of the value of world trade shipments. This is due to the fact that it is the fastest mode of transportation. However, it is the most risky form of transport because a minor accident

may put a substantial loss to the goods, passengers and the crew. It is also regarded to be the costliest mode of transportation as a result of very high operating cost. Moreover, it is not suitable for carrying bulky and cheaper goods by virtue of its small carrying capacity.

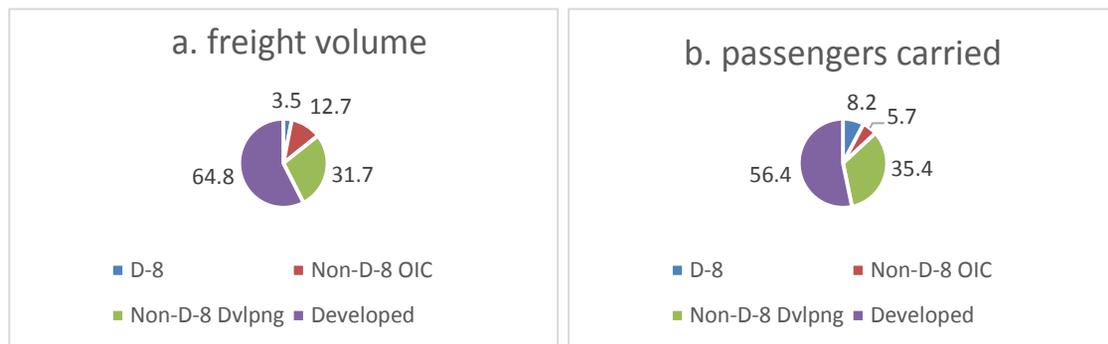
**Figure 7: Total registered carrier departures per 1000 people for selected country groups, 2014**



Source: World Bank

Figure 7 indicates total registered worldwide departures from a country per 1000 people for selected country groups. It can be deduced from the figure that D-8 countries have the least amount of air transportation activity in terms of registered carrier departures, 2.18 per 1000 people. This figure is slightly lower than both non-D-8 OIC countries (2.25), and non-D-8 developing countries (2.19). Finally, despite substantially higher air transportation activity in developed countries with 16.92 carrier departures per 1000 people, the world average stands at 4.38 in 2014 (all figures above per 1000 people).

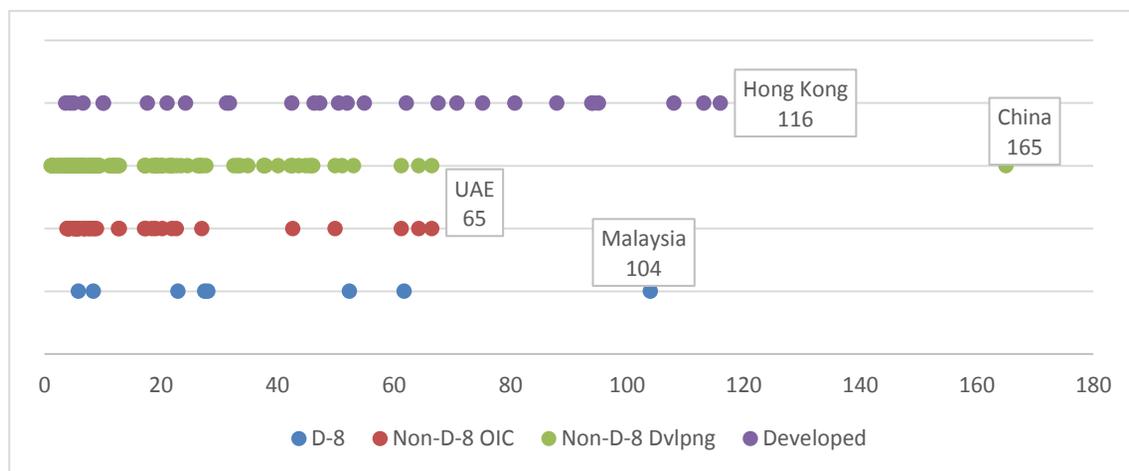
Regarding air transportation, there can be two more measures that can be employed to analyze D-8 countries. It can be suggested that analyzing the volume of freight and the total number of passengers carried are as important as analyzing the registered carrier departures in determining the activity level of air transportation. Figure 8 paints a clear picture of the distribution of freight volume and passengers carried between different country groups by air transportation. In 2013, developed countries have recorded the highest share of freight volume, 64.8 percent, followed by non-D-8 developing countries, 31.7 percent. The share of freight volume for non-D-8 OIC countries is 12.7 percent compared to 3.5 percent for D-8 countries. The percentage of passengers carried in D-8 countries (8.2 percent), by contrast, exceeds those in non-D-8 OIC countries (5.7 percent). However, non-D-8 developing countries (35.4 percent) appear to catch up with developed countries (56.4 percent) in passenger volume.

**Figure 8: Shares of airway activity for selected country groups, 2013**

Source: World Bank

### 3.4 Overall Performance of Transportation Sector

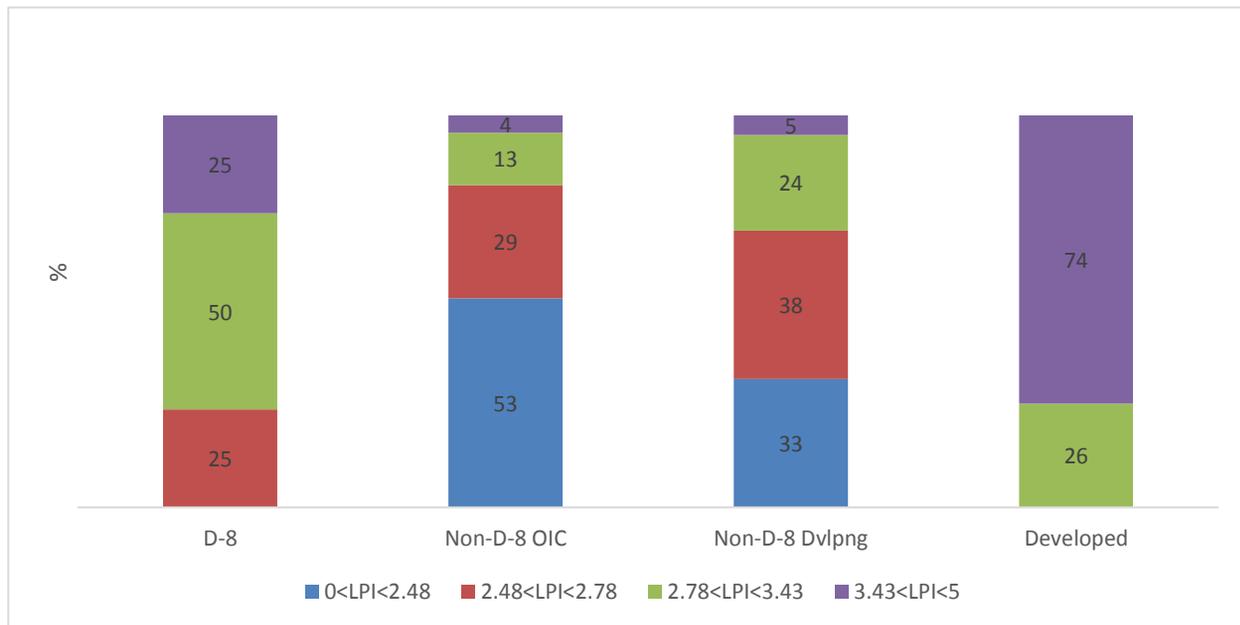
There are two available indicators that have been proposed by the World Bank and UNCTAD to assess the overall performance of the countries in the transportation sector. First, the Liner Shipping Connectivity Index (LSCI) of UNCTAD aims at capturing how well countries are connected to global shipping networks. It is based on five components of the maritime transport sector: number of ships, their container-carrying capacity, maximum vessel size, number of services, and number of companies that deploy container ships entering country's ports. This index generates a value of 100 for the country with the highest average index in 2014. Second, the Logistics Performance Index (LPI) of the World Bank reflects perceptions of a country's logistics based on efficiency of customs clearance process, quality of trade and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time. The index ranges from 1 to 5, with a higher score representing better performance.

**Figure 9: Liner shipping connectivity index (LSCI) for selected country groups, 2014**

Source: United Nations Conference on Trade and Development

The results of the liner shipping connectivity index (LSCI) for selected country groups shown in Figure 9 suggests that, in 2004, D-8 countries and non-D-8 OIC countries have similar values with the highest value for D-8 countries being 104 (Malaysia) and the highest value for non-D-8 OIC countries being 65 (UAE). In addition, among non-D-8 developing countries, China has the highest LSCI value with 165, and Hong Kong is responsible for the highest LSCI value with 116 among developed countries.

**Figure 10: Logistics performance index for selected country groups, 2014**



Source: World Bank

Figure 10 illustrates the logistics performance index (LPI) for selected country groups in 2014. As it can be seen, the scores have been grouped under four categories according to the World Bank thresholds. According to this index, 25 percent of D-8 countries have relatively poor logistics performance as their scores are between 2.48 and 2.78. On the other hand, the other 25 percent of D-8 countries have very satisfying logistics performance as their scores exceed 3.43. These figures are significantly different from both non-D-8 OIC and non-D-8 developing countries. This is because a significant percentage of non-D-8 OIC (53 percent) and non-D-8 developing countries (33 percent) are in the lowest scoring group, below 2.48. Conversely, as a group, developed countries have performed considerably better than others, with 74 percent in the highest scoring group and 26 percent in the second highest scoring group. Although D-8 countries score significantly lower than those in developed countries, their performance is still higher than the rest of the selected country groups' performance.

## 4 TRANSPORTATION AND TRADE

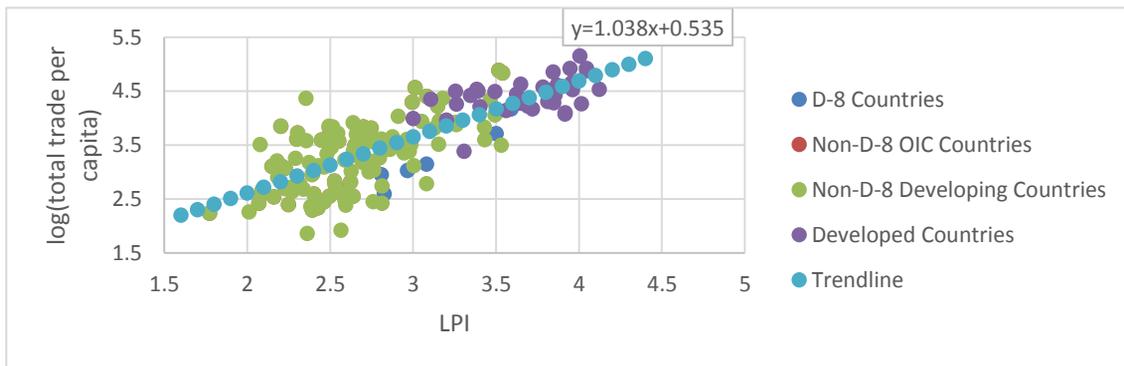
In the second half of the 20<sup>th</sup> century, world trade grew at a rapid average rate of 5.9 percent annually while the growth rate of manufacturing trade was even faster, at 7.2 percent per year. For the world as a whole, the ratio of trade relative to output more than tripled over the last five decades (Hummels, 2007). There have been several theories proposed to explain the growth of world trade over the years. The consensus from those theories is that there is a positive relationship between the quality of the logistics infrastructure and the share of a country in world trade (COMCEC, 2014).

This section will analyze the connection between the transportation sector and trade. To that aim, an analysis of the current situation of D-8 countries with respect to trade and logistics will be provided.

### 4.1 Logistics Performance Index and Total Trade

The Logistics Performance Index (LPI) can also be used as a proxy to measure the quality of logistics infrastructure of a country. Figure 11 represents the relationship between the LPI and total trade of a country in 2014. Total trade is reported as the log of total trade value in dollars per capita. Figure 11 confirms a strong positive linear relationship between the LPI score and the value of total trade of a country. More specifically, one point increase in LPI scores increases the log value of total trade per capita by 1.038. Our analysis also highlights that different country groups have different results. In fact, D-8 countries are mainly grouped below the trend line. This means that the value of total trade in D-8 countries is below what is predicted by the general equation according to their LPI scores. On the other hand, in most developed countries, total trade value with respect to their LPI scores are higher than the general trend represented by the trend line. Thus, the LPI has a positive and statistically significant impact on trade. In light of these findings, it can be safely concluded that there is room for improvements in the quality of logistics infrastructure in D-8 countries and these improvements are expected to have positive impacts on total trade of the countries.

**Figure 11: Logistics performance index and per capita total trade for selected country groups, 2014**

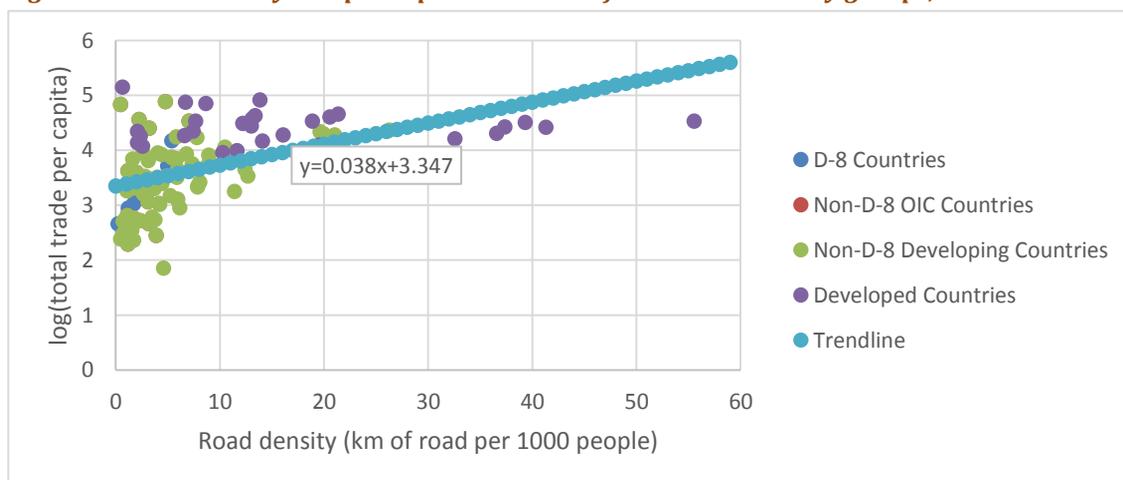


Source: World Bank and UNCTAD

## 4.2 Land Transportation Density and Total Trade

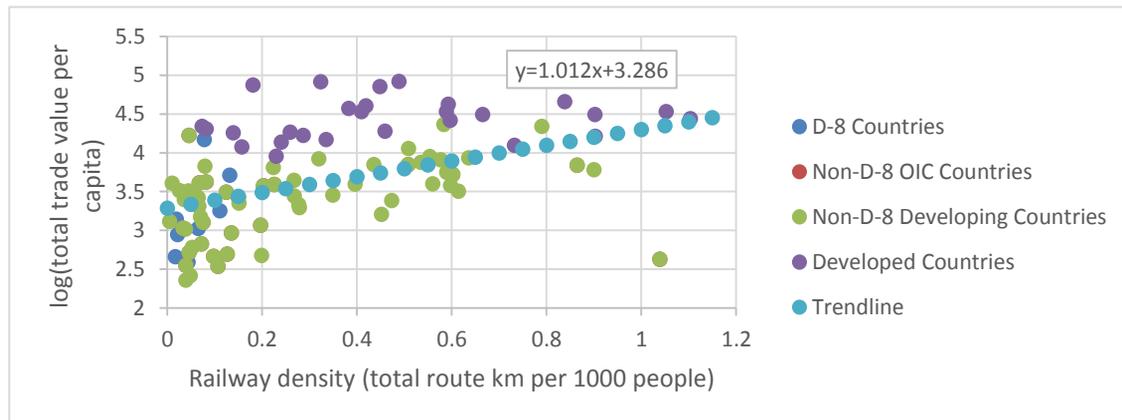
Similar to the LPI, land transportation densities can also be used to capture the relationship between transportation and total trade per capita. For the density measures used in this section, units are per 1000 people. So far, there have been two land transportation densities used in this report; road density and railway density. As shown in Figure 12, there exists a positive relationship between road density and the value of total trade of a country. However, the impact of road density on total trade value is considerably smaller, 0.038, in comparison to the LPI value of 1.038. D-8 countries are mostly grouped below the trend line. This reveals that D-8 countries are underperforming in total trade according to their road density potential as suggested by the equation. However, the situation for developed countries is opposite to that of D-8 countries. Most of the developed countries are situated above the trend line, suggesting that developed countries are prominent drivers of total trade not just at the group level but also at the individual level.

**Figure 12: Road density and per capita total trade for selected country groups, 2011-2014**



Source: World Bank and UNCTAD

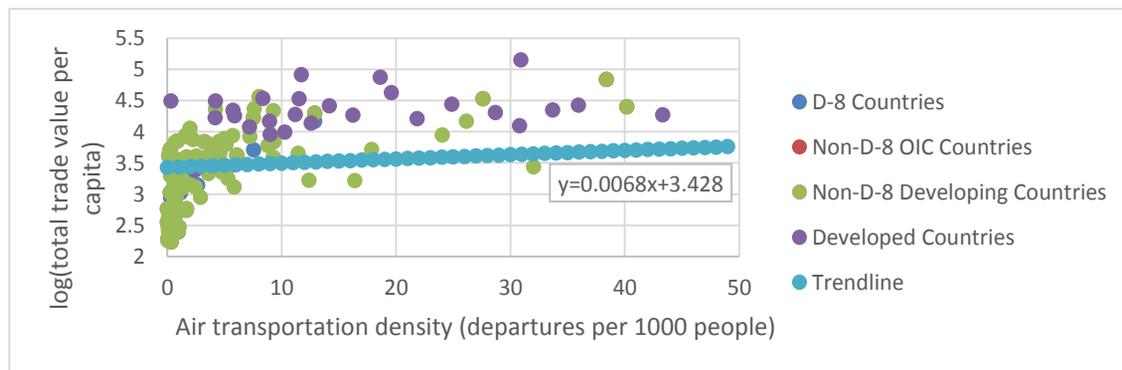
In Figure 13, a positive correlation between railway density and total trade value in dollars per capita is revealed and the effect is significant, 1.012. It can be observed from the figure that D-8 countries are mainly grouped below the trend line which indicates that they are underperforming in total trade value given their railway density. This is the opposite of the case of developed countries. Almost all developed countries appear to be positioned above the trend line. This would suggest that, between 2011 and 2014, developed countries outpaced other country groups in terms of total trade at both the group and individual levels.

**Figure 13: Railway density and per capita total trade for selected country groups, 2011-2014**

Source: World Bank and UNCTAD

### 4.3 Air Transportation Density and Total Trade

Lastly, air transportation densities can be used to investigate the relationship between air transportation and total trade. For this measure, total departures per 1000 people will be used. As depicted in Figure 14, one unit increase in air transport density increases the log of total trade value per capita by only 0.007. In other words, there is a weak positive relationship between air transportation density and total trade. Additionally, this effect is considerably smaller compared to both road and rail transportation density measures. The impact of air transportation density on total trade in developed countries is significantly higher than that in D-8 countries.

**Figure 14: Air transportation density and per capita total trade for selected country groups, 2011-2014**

Source: World Bank and UNCTAD



## 5 TRANSPORTATION AND TOURISM

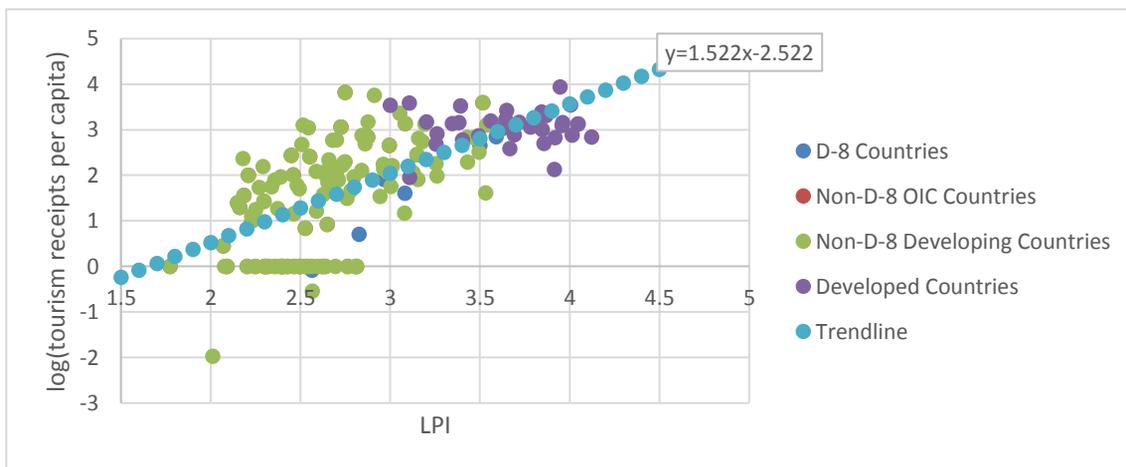
According to the International Transport Forum reports, currently there are over one billion international tourist arrivals worldwide per year, and this is expected to rise to 1.5 billion per year by 2020. More importantly, the major source of this growth will be developing economies as a result of an increase in disposable incomes of their populations. A sustainable growth in tourism sector is very crucial to developing countries as it positively affects economic development, poverty alleviation and employment levels. Transportation, on the other hand, is an essential component of tourism by definition as it provides connections between regions, domestically and internationally. Furthermore, modes of transportation are identified as important ingredients of the international tourism system. Therefore, efficiency of the transportation sector and overall quality of the logistics infrastructure are strongly correlated to the performance of tourism sector.

This section will highlight the link between transportation and tourism. The analysis will include a study assessing the effects of the transportation sector on the gross revenues from tourism related activities in D-8 countries and its comparison with other country groups.

### 5.1 Logistics Performance Index and Tourism Receipts

The LPI is used to capture the overall quality of the transportation sector and tourism receipts are used as a proxy measure for the size of the tourism sector. Tourism receipts are expenditures in dollars by international inbound visitors. Figure 15 reveals the relationship between the LPI and the log of total value of tourism receipts in dollars per capita in 2013. According to this equation, there is a strong positive correlation between LPI and tourism receipts per capita. Particularly, one point increase in LPI leads to a 1.522 increase in the log of tourism receipts per capita. Moreover, the location of D-8 countries on this figure suggests that they are not fully utilizing their logistics infrastructure and as a result they are underperforming with regard to tourism revenues. This situation is reversed for developed countries.

**Figure 15: LPI and per capita tourism receipts for selected country groups, 2013**

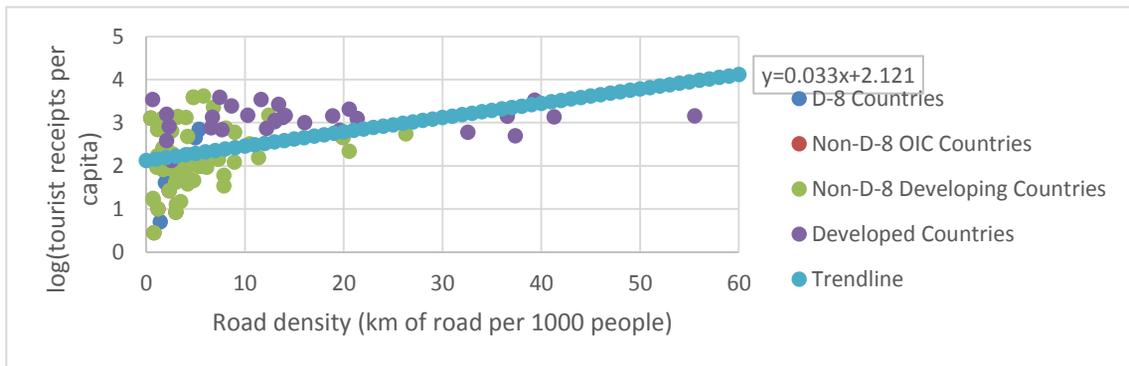


Source: World Bank

## 5.2 Land Transportation Density and Tourism Receipts

Two land transportation density measures from before are used here to observe that whether different modes of land transportation have an impact on tourism receipts. First, road transportation density is plotted against tourism receipts. Figure 16 indicates the relationship between road density and the log of total value of tourism receipts in dollars per capita in 2013. There exists a positive but weak relationship between road density and total tourism revenues. The size of effect is smaller, 0.033, than that of previously observed LPI value.

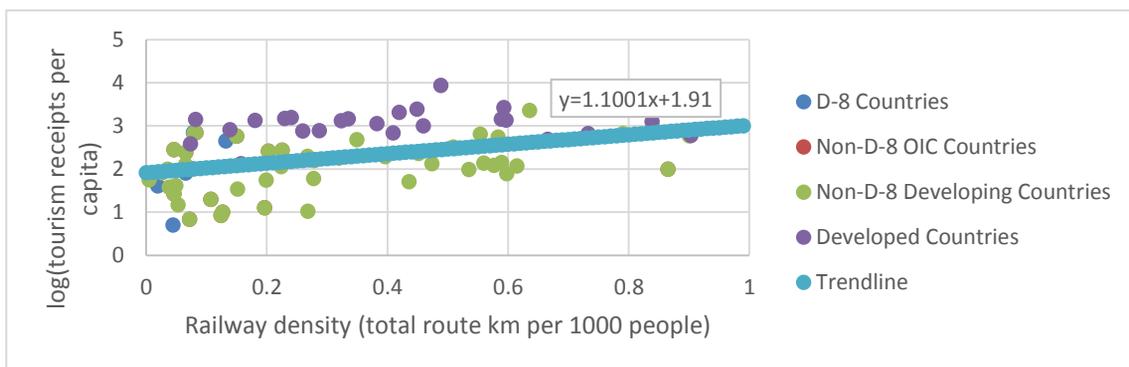
**Figure 16: Road density index and per capita tourism receipts for selected country groups, 2013**



Source: World Bank

However, when comparing both forms of transportation, it appears that road transportation density has a smaller effect on tourism expenditures than railway transportation density. Figure 17 summarizes the impact of railway transportation on tourism receipts. This figure suggests that one unit increase in railway transportation density increases log of total receipts per capita by 1.101. Overall, both land transportation density measures are positively linked to tourism receipts in 2013.

**Figure 17: Railway density index and per capita tourism receipts for selected country groups, 2013**

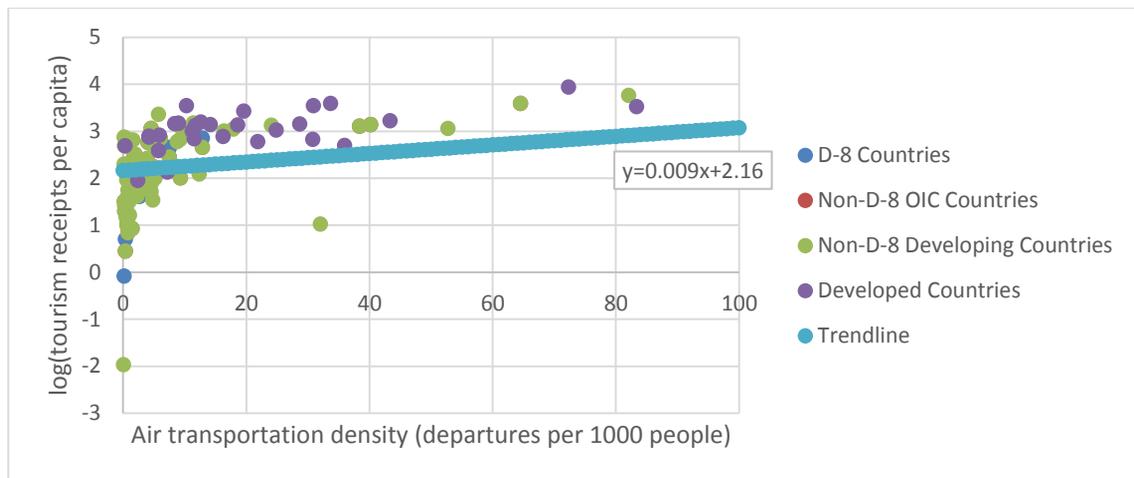


Source: World Bank

### 5.3 Air Transportation Density and Tourism Receipts

The size of the air transportation network affects the tourism sector directly since the ease of access to a country is positively correlated with the number of visitors it receives. Figure 18 draws our attention to the relationship between air transportation network and tourism receipts in 2013. A few outlier countries that have very high air transportation density value are omitted. Air transportation density has a weak positive effect on tourism receipts, 0.009. This effect is smaller than the previously measured land transportation densities. D-8 countries are mostly situated below the trend line while developed countries are mostly situated above the trend line, suggesting that D-8 countries are underperforming in terms of tourism receipts according to their air transportation network density values.

**Figure 18: Airway density index and per capita tourism receipts for selected country groups, 2013**



Source: World Bank



## 6 TRANSPORTATION AND POPULATION GROWTH

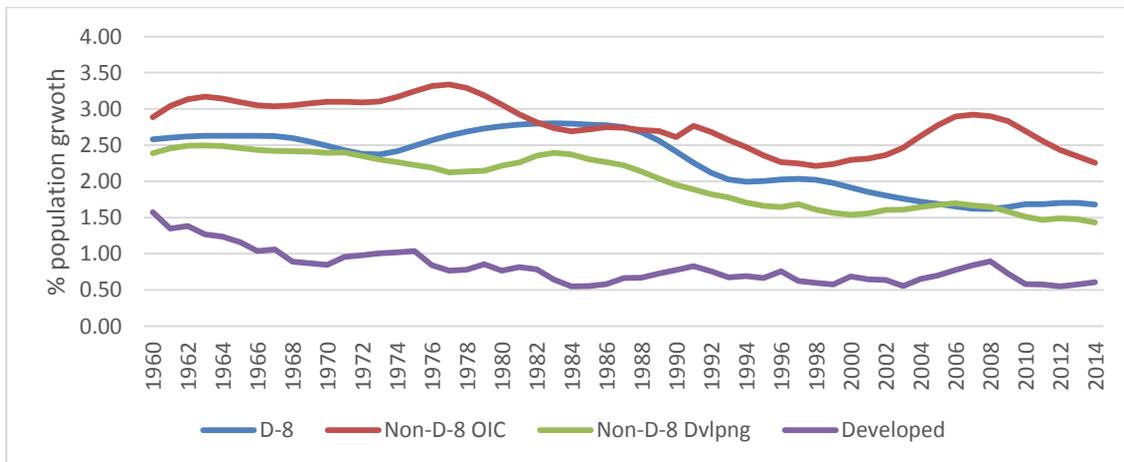
The current world population is around 7.4 billion. According to the projections of the United Nations, it is expected to exceed 9 billion by 2050, a 30 percent increase from today. In fact, this increase will mostly result from an increase in urban population in developing countries. The report of United Nations states that Africa is the fastest urbanizing continent in the world. As the population around the world continues to grow at a fast pace, the policymakers will need to match that with a growth in the transportation sector in order to meet the increase in demand.

This section will give a brief overview of the population change over the years and discuss its possible implications on the transportation sector. Further analysis will focus on impacts of population growth on demand for air transportation in D-8 countries.

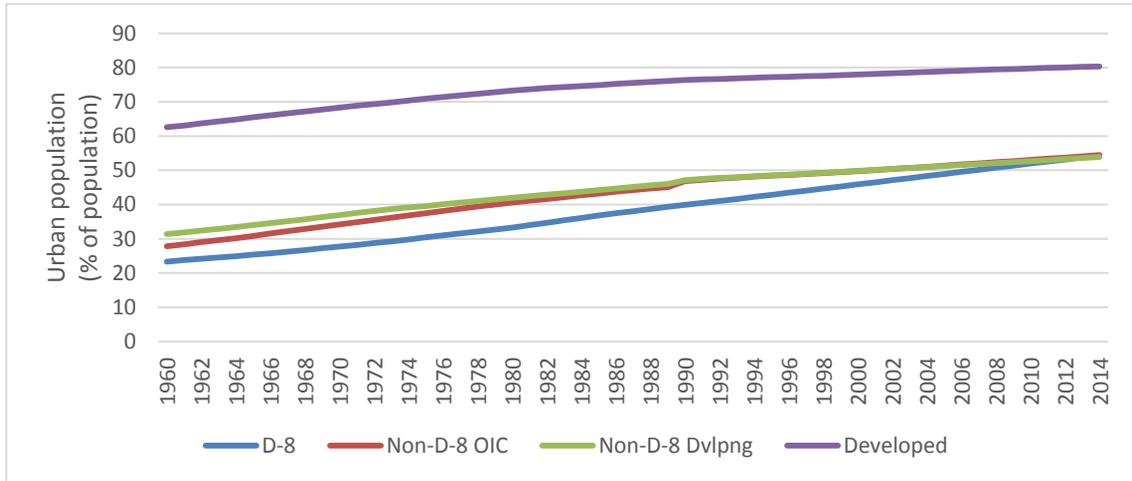
### 6.1 Overall Trends in Population Growth

Population growth has been constantly positive over the last 50 years and across regions. Population growth as percentage change for selected country groups between 1960 and 2014 is depicted in Figure 19. There are several results that can be gathered from this figure. First, there has been a downward trend in the population growth rate. Second, developed countries have a smaller population growth rate compared to developing countries and this has been the case for our sample years consistently. Third, among developing countries, D-8 countries are not the fastest growing countries. In 2014, the growth rate of population in D-8 countries was 1.68 percent on average while the growth rate of population in non-D-8 OIC was 2.24 percent. Finally, the growth rate of population in D-8 countries has been higher than the population growth rate in non-D-8 developing countries.

**Figure 19: The growth rate of population for selected country groups, 1960-2014**



Source: World Bank

**Figure 20: The share of urban population in total for selected country groups, 1960-2014**

Source: World Bank

It is also important to analyze the urban population growth rate as this would have implications on transportation demand. To this end, Figure 20 represents the change in the share of urban population in total population between 1960 and 2014 for selected country groups. A time series analysis would suggest that the concentration of population in urban areas have increased drastically and this increase has been uniform across country groups. In 2014, developed countries have the biggest share of urban population by 80.3 percent. D-8 countries have a share of 54.3 percent, so more than half of the population of the D-8 countries lives in urban areas. This is also the case in other developing countries including OIC countries. This result has a direct implication on the transportation sector. With a higher share of population residing in urban areas, the demand for transport-related investments would be higher.

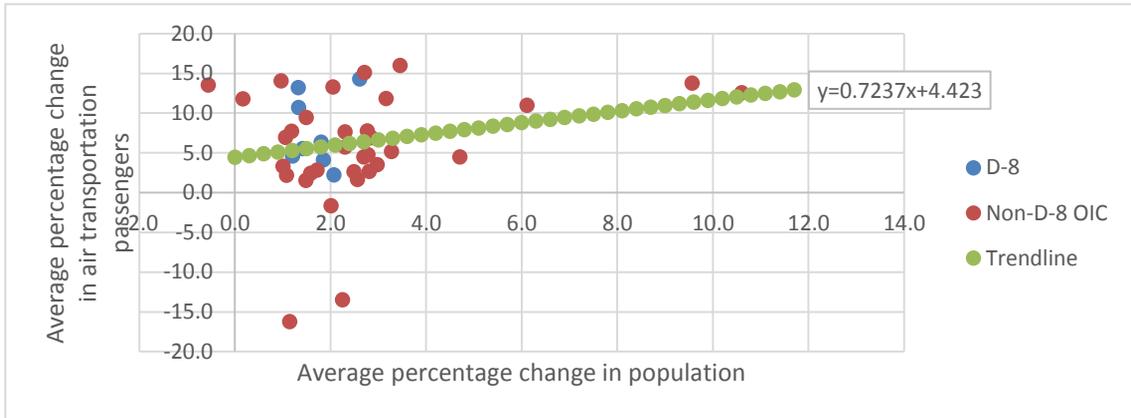
## 6.2 Population Growth and Transportation

The relationship between population growth and transportation is expected to be positive. Once you have higher number of agents living in an economy, the demand for transportation would be greater. In order to check the validity of this analytical result, Figure 21 plots population change versus transportation demand change between 1960 and 2014 for D-8 countries and the remaining OIC countries. Transportation demand change is reported as the average percentage change in passengers carried by air transportation per year. These statistics are obtained from SESRIC BASEIND database. Given data availability, transportation demand is only calculated for air transportation but the results are expected to be robust qualitatively.

The overall trend represented by trend line has a slope of 0.72. So, one percent increase in population increases passengers carried by airways by 0.72 percent on average. Put differently, higher population growth leads to a higher demand for air transportation. Population growth rate in some non-D-8 OIC countries is significant. This change, by contrast, did not cause any discernible increase in the percentage change of passengers carried by air transportation. Thus, compared to

non-D-8 OIC countries, air transportation demand has increased at higher rates than population growth in some D-8 countries.

**Figure 21: Population change vs. air transportation demand change, 1960-2014**



Source: World Bank



## 7 TRANSPORTATION AND ENVIRONMENT

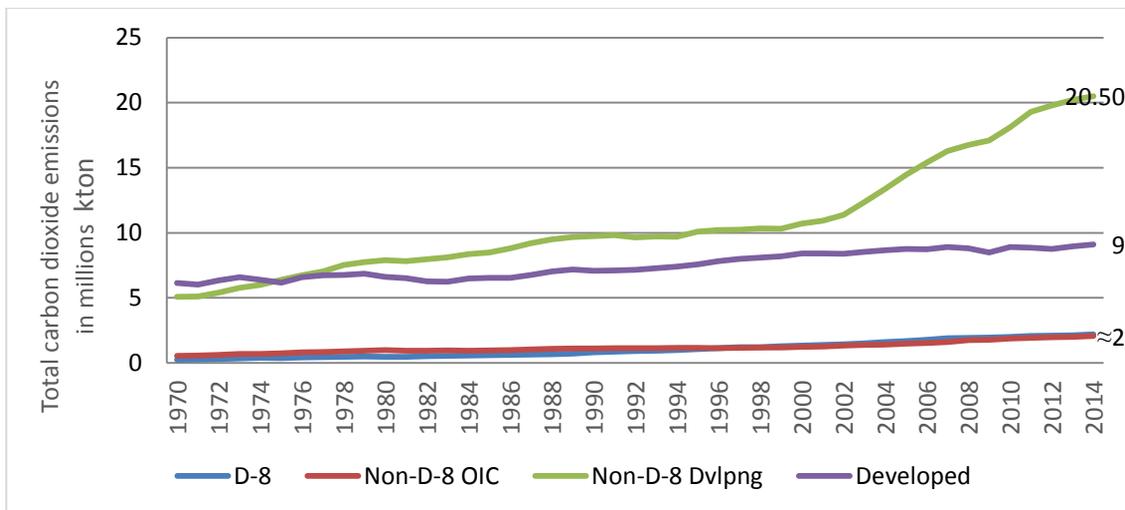
Carbon dioxide emissions have been steadily rising. After a decade of annual increases of 4 percent per capita emissions, on average, and two years (2012 and 2013) of slowing down to about 1 percent, the growth in global CO<sub>2</sub> emissions almost stalled, increasing by only 0.5% in 2014 compared to the record level in 2013 (EDGAR, 2015). Furthermore, transportation sector is the second largest source of CO<sub>2</sub> emissions with 22 percent following electricity and heat generation, 41 percent, in 2010 (IEA, 2012).

This section will aim to highlight the impact of the transportation sector on the environment by focusing on the effects of different sizes from different modes of transportation. Country-based analysis for selected D-8 and OIC countries will be provided to deepen the analysis.

### 7.1 Overall Trends in Transportation and Environment

The largest human source of carbon dioxide emissions is from the combustion of fossil fuels. Figure 22 reports total CO<sub>2</sub> emissions from fossil fuel use and cement production between 1970 and 2014. At the beginning of this period, developed and non-D-8 developing countries produced almost equal amount of CO<sub>2</sub>. However, in 2014, non-D-8 developing countries were by far the world's biggest emitters. Conversely, D-8 and the remaining OIC countries were among the least contributors to CO<sub>2</sub> emissions with approximately 2 million kilotons. D-8 countries were responsible for producing nearly one-tenth of non-D-8 developing countries' CO<sub>2</sub> emissions in 2014. In fact, the increase in total CO<sub>2</sub> emissions in the world has been driven by the rapid increase in population in developing countries.

**Figure 22: Total carbon dioxide emission for selected country groups, 1970-2014**

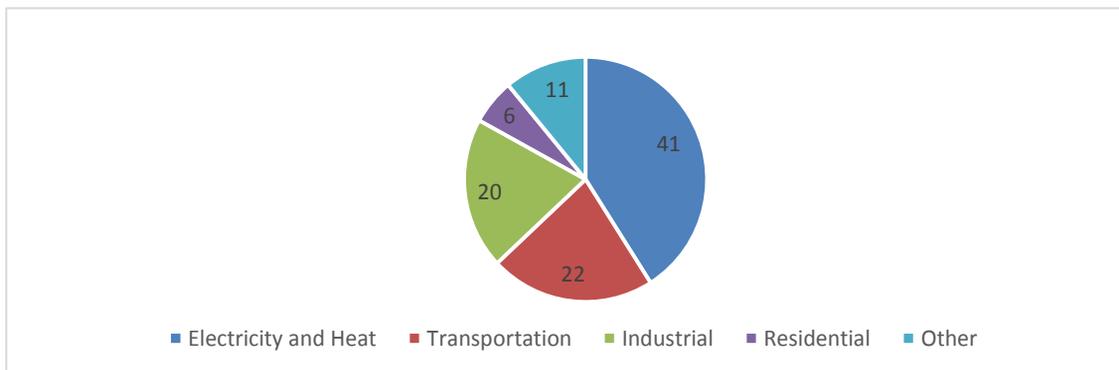


Source: International Transport Forum

There are three main sources of carbon dioxide emissions: transportation, industrial, electricity and heat generation. Each sector produces significant amounts of CO<sub>2</sub> emissions, and among them the transportation sector is the second largest source of emissions. Figure 23 demonstrates the distribution of CO<sub>2</sub> emissions into different areas of use. In 2010, the electricity and heat generation

is the largest source of CO<sub>2</sub> emissions, accounting for 41 percent, followed by transportation sector with 22 percent of CO<sub>2</sub> emissions. This is because of the fact that the transportation sector is very energy-intensive.

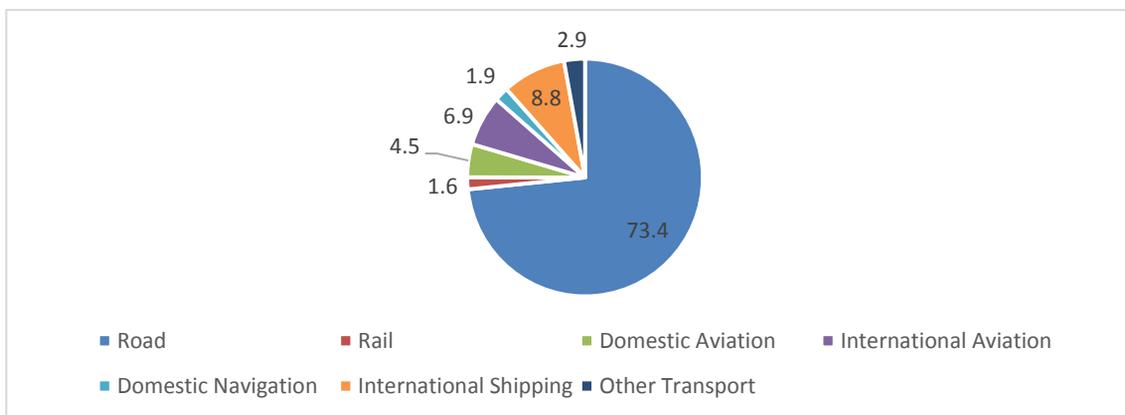
**Figure 23: The shares of end-use sectors in total CO<sub>2</sub> emissions, 2010**



Source: International Energy Agency

Figure 24 summarizes the shares of CO<sub>2</sub> emissions of different modes of transportation in 2008. The biggest part of CO<sub>2</sub> emissions in the transportation sector is caused by road transportation since this mode of transportation mostly uses petroleum based fuels. In fact, road transport, with 73.4 percent, accounts for a significant proportion of this sector's CO<sub>2</sub> emissions according to International Energy Agency reports. In descending order, international shipping (8.8 percent), international aviation (6.9 percent), and domestic aviation (4.5 percent) were other contributors to total CO<sub>2</sub> emissions in the transportation sector. Rail, by contrast, was the least contributor with 1.6 percent.

**Figure 24: The shares of modes of transportation in total transportation sector CO<sub>2</sub> emissions, 2008**

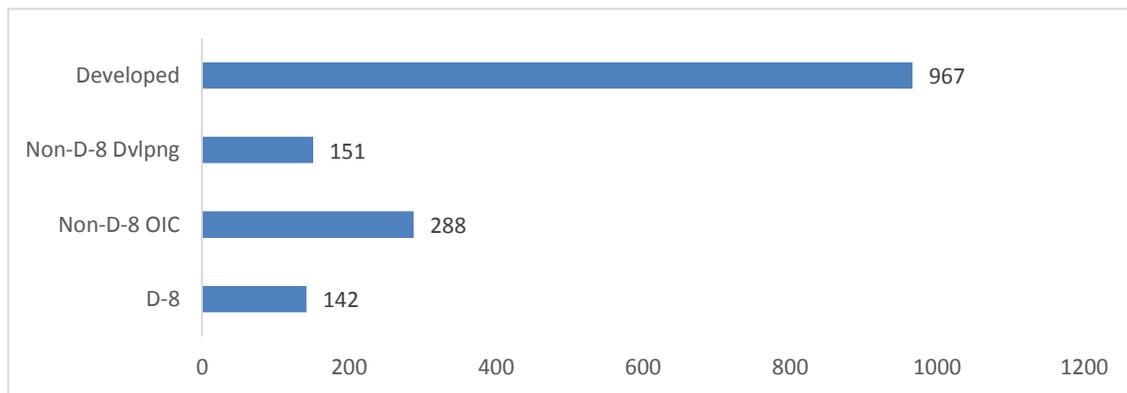


Source: International Energy Agency

Energy consumption in road transportation also differs among different country groups. Figure 25 represents per capita energy consumption in road transportation in 2011 and reflects measured energy consumption levels as kilogram of oil equivalent. Clearly, developed countries have by far the highest per capita energy consumption in 2011 with 967 kilograms of oil equivalent. D-8

countries, however, have the lowest per capita energy consumption, with 142 kilogram of oil equivalent. The opposite situation is found in terms of CO<sub>2</sub> emission totals in Figure 22. Thus, from these two figures, it can be concluded that while D-8 countries are consuming the lowest level of per capita energy in road transportation, they appear to be producing the highest level of CO<sub>2</sub> emissions. This would suggest that there needs to be fundamental adjustments in the transportation sectors of D-8 countries in order to minimize the negative impacts of transportation on environment.

**Figure 25: Per capita energy consumption in road transportation for selected country groups in kilogram of oil eq., 2011**

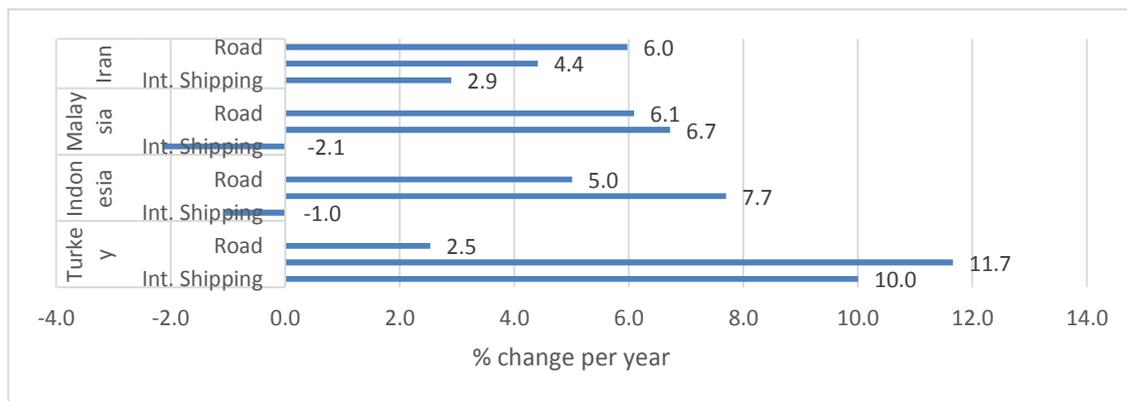


Source: Energy Information Administration

## 7.2 Country-Level Analysis of Transportation and Environment

This part of the report will focus on energy consumption of the various transportation modes in some D-8 countries, namely Indonesia, Iran, Malaysia, and Turkey. As shown in Figure 26, the share of total energy consumption in road transportation and international aviation appears to have increased in every reported country, between 1990 and 2008.

**Figure 26: Total energy consumption levels for selected country groups in kilogram of oil eq., 1990-2008**



Source: International Transport Forum

Country-level analysis suggests that the biggest percentage increase in road transportation has occurred in Malaysia (6.1 percent) while the smallest percentage change has occurred in Turkey (2.5 percent) in the same period. Turkey is the biggest energy consumer in international aviation with 11.7 percent per year on average, followed by Indonesia with 7.7 and Malaysia with 6.7 percent per year increase. Iran, however, remained behind these countries with 4.4 percent change. Lastly, there have been decreases in energy consumption levels in international shipping in Indonesia (1 percent) and Malaysia (2.1 percent) while Turkey increased its energy consumption by 10 percent during the same period of time. Therefore, international aviation experienced the highest growth in energy consumption of all transportation modes in every reported country, except Iran.

## 8 CONCLUSION AND POLICY RECOMMENDATIONS

This report analyses the state of transportation sector in D-8 countries to reflect the current situation, identify major challenges, obstacles, and opportunities with respect to the other country groups. With that being the main objective, this report also highlights a number of related socio-economic factors such as global competitiveness, transportation, network size, population growth, urbanization and pollution levels.

The effect of transportation on trade and tourism is found to be different for D-8 countries than the rest of the world. Although transportation increases the value of tourism receipts and the value of traded products all around the world, this increase is at much lower rates in D-8 countries than in developed countries and the remaining developing countries. Among all forms of transport, railway transportation appears to have the greatest positive impacts on tourism and trade.

Even though the length of paved roads in D-8 countries surpasses the length of paved roads in the remaining OIC countries, when this is adjusted by the size of the population, it appears that D-8 countries need to build more roads. This is also the case when railway network length is compared. As land transportation is the base of the transportation system of a country, the improvements in D-8 countries in this area is a must. Moreover, air transportation activity in D-8 countries both in terms of passengers carried and number of departures are below the level in the remaining developing countries. High level of air transportation activity is the key in increasing tourism and trade revenues. Policymakers in D-8 countries need to take the initiatives to improve these numbers.

Population growth and the demand for transportation are positively linked. Given the fact that the population has been growing in D-8 countries, policymakers should increase the transport infrastructure in order to meet the demand or encourage citizens to use public transport. The provision of public transportation may reduce the number of vehicle as well as carbon dioxide emissions, which is a problem that developing countries face. Total carbon dioxide emissions in non-D-8 developing countries have been increasing faster than the rest of the world. The most recent data on carbon dioxide emissions shows that non-D-8 developing countries were the largest emitters of carbon dioxide and developed countries were the second-largest emitters while D-8 and the remaining OIC countries were among the least contributors to the world's carbon dioxide emissions.

Developed countries are in an advantageous position compared to D-8 countries in the transportation sector, based on the LPI scores. In an attempt to improve their score, the primary objective of policymakers in D-8 countries needs to be improving the provision of transport-related infrastructure and services. To that end, a set policy recommendations, at the national and D-8 cooperation level are provided below.

## Policy Recommendations

### At the National Level

1. **Encouraging** Public-Private Partnership (PPP) schemes in the transport industry. PPPs help build better transportation and management services. For example, modernization of facilities, maintenance and repair services of highways as well as rail networks can be mostly delivered by private sector. Thus, the burden of public sector will be reduced to sustainable level.
2. **Using** technologies, such as fuel-efficient technologies, clean fuel and environment- friendly vehicles as well as high-speed train,
3. **Gathering** transportation-related institutions under a single body for better control and coordination. For example, in Bangladesh these institutions are under separate bodies while in Turkey these are under a single body,
4. **Providing** some key transport services that are characterised by on-time delivery, low cost, comfort, and security,
5. **Improving** computer-based management system, which will in turn increases the efficiency of transportation,
6. **Constructing** new ports and expending the existing airports,
7. Ever-increasing emission of carbon dioxide is a major problem that D-8 countries face thus **providing** public transportation may reduce the number of vehicle as well as CO<sub>2</sub> emissions. In this regard, Marmaray and the Metrobus are two examples of “best practices” implemented in Turkey,
8. **Increasing** total trade volume through air cargo,
9. Ensuring a quality-based competition environment to increase the sector’s value-added,
10. **Reducing** barriers to entry for private airlines.

### At the D-8 Cooperation Level

1. **Developing** and implementing special bilateral and multilateral agreements between member countries of the D-8 and the OIC, such as: facilitating custom clearance procedures, improving efficiency of custom operations as well as reducing tax burdens,
2. **Improving** the environment for international trade by strengthening the cooperation and coordination among ports of member countries,
3. **Reducing** barriers to trade,
4. **Enhancing** maritime safety,
5. **Sharing** data and knowledge about the requirement of the sector,
6. **Sharing** best practices and organizing effective training programmes to improve capacity.

## REFERENCES

COMCEC (2014), Transport Outlook 2014,

EDGAR (2015), Trends in Global CO<sub>2</sub> Emissions,

Hummels, D., (2007), Transportation Costs and International Trade in the Second Era of Globalization, *Journal of Economic Perspectives*, 21(3): 131-154,

IEA (2012), World Energy Outlook

Rodrigue, J-P., (2013), The Geography of Transport Systems, Third Edition, London: Routledge,

SESRIC (2011), Transportation Networks in the OIC Member Countries: Impact on Trade and Tourism

## APPENDIX

### Country Classifications:

#### *D-8 Countries:*

Bangladesh	Iran	Pakistan
Egypt	Malaysia	Turkey
Indonesia	Nigeria	

#### *Non-D-8 OIC Countries:*

Afghanistan	Gabon	Morocco	Tunisia
Albania	Gambia	Mozambique	Turkmenistan
Algeria	Guinea	Niger	Uganda
Azerbaijan	Guinea-Bissau	Oman	United Arab Emirates
Bahrain	Guyana	Palestine	Uzbekistan
Benin	Iraq	Qatar	Yemen
Brunei Darussalam	Jordan	Saudi Arabia	
Burkina Faso	Kazakhstan	Senegal	
Cameroon	Kuwait	Sierra Leone	
Chad	Kyrgyz Republic	Somalia	
Comoros	Lebanon	Sudan	
Cote d'Ivoire	Libya	Suriname	
Djibouti	Maldives	Syrian Arab Republic	
Gabon	Mali	Tajikistan	
Gambia	Mauritania	Togo	

**Non-D-8 Developing Countries:**

Afghanistan	Belarus	Cambodia	Croatia
Albania	Belize	Cameroon	Cuba
Algeria	Benin	Cayman Islands	Curacao
American Samoa	Bermuda	Cent. African Republic	Djibouti
Andorra	Bhutan	Chad	Dominica
Angola	Bolivia	Channel Islands	Dominican Republic
Antigua and Barbuda	Bosnia and Herz.	Chile	Ecuador
Argentina	Botswana	China	El Salvador
Armenia	Brazil	Colombia	Equatorial Guinea
Aruba	Brunei Darussalam	Comoros	Eritrea
Azerbaijan	Bulgaria	Congo, Dem. Rep.	Ethiopia
Bahamas	Burkina Faso	Congo, Rep.	Faeroe Islands
Bahrain	Burundi	Costa Rica	Fiji
Barbados	Cabo Verde	Cote d'Ivoire	French Polynesia
Gabon	Liberia	Palau	Sudan
Gambia	Libya	Palestine	Suriname
Georgia	Liechtenstein	Panama	Swaziland
Ghana	Lithuania	Papua New Guinea	Syrian Arab Republic
Greenland	Macao SAR, China	Paraguay	Tajikistan
Grenada	Macedonia, FYR	Peru	Tanzania
Guam	Madagascar	Philippines	Thailand
Guatemala	Malawi	Poland	Timor-Leste
Guinea	Maldives	Puerto Rico	Togo
Guinea-Bissau	Mali	Qatar	Tonga
Guyana	Marshall Islands	Romania	Trinidad and Tobago
Haiti	Mauritania	Russian Federation	Tunisia
Honduras	Mauritius	Rwanda	Turkmenistan
Hungary	Mexico	Samoa	Turks and Caicos Islands
India	Micronesia	Sao Tome and Principe	Tuvalu
Iraq	Moldova	Saudi Arabia	Uganda
Isle of Man	Monaco	Senegal	Ukraine
Jamaica	Mongolia	Serbia	United Arab Emirates
Jordan	Montenegro	Seychelles	Uruguay
Kazakhstan	Morocco	Sierra Leone	Uzbekistan
Kenya	Mozambique	Somalia	Vanuatu
Kiribati	Myanmar	South Africa	Venezuela
Korea, Dem. Rep.	Namibia	South Sudan	Vietnam
Kosovo	Nepal	Sri Lanka	Virgin Islands
Kuwait	New Caledonia	St. Kitts and Nevis	Zambia
Kyrgyz Republic	Nicaragua	St. Lucia	Yemen
			Zimbabwe
Lao PDR	Niger	St. Maarten Solomon Islands	
Lebanon	North. Mariana Islands	St. Martin	
Lesotho	Oman	St. Vincent and the Grenadines	

***Developed Countries:***

Australia	France	Korea, Rep.	Singapore
Austria	Germany	Latvia	Slovak Republic
Belgium	Greece	Luxembourg	Slovenia
Canada	Hong Kong	Malta	Spain
Cyprus	Iceland	Netherlands	Sweden
Czech Republic	Ireland	New Zealand	Switzerland
Denmark	Israel	Norway	United Kingdom
Estonia	Italy	Portugal	United States
Finland	Japan	San Marino	