

EVALUATION OF TURKEY'S FREIGHT TRANSPORTATION

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Abstract — *In this paper freight transportation of Turkey was evaluated according to transport modes. The transport modes analyzed include road, railway and waterway. The objective is to guide policy makers to correctly formulate strategies and make logical investment decisions about freight transportation system. There are freight transportation problems in Turkey because of unbalanced transport mode use resulting from lack of long-run strategic planning and accordingly incorrect investment decisions. The freight transportation of Turkey was evaluated by analyzing the past data. The freight transport data between years 1983 and 2005 for road and railway modes were used to obtain forecasts. The freight transport data of Turkey and European countries as of 2005 were analyzed based on cluster analysis. The suggestions were made in order to get a more balanced freight transportation system in a near future in Turkey.*

Keywords — *freight transportation, transport modes*

INTRODUCTION

The volume of freight transportation has been growing significantly over the past few decades in Turkey. The amount of freight transport in year 2005 in million tones / km is about 3.56 times more than that of year 1983. When the distribution by transport modes is analyzed at the same time period, it can be seen that use of roads has increased 3.95 times, while use of railway has only increased 1.48 times.

The portion of highway, railway, waterway (maritime and inland waterways) and air transport differs in each country according to the geographical conditions, technologies, etc. of that country. In Turkey, highway use for both passenger and freight transportation has increased much more quickly than the other transport modes. As a result of this unbalanced development, the portion of highway has increased over 90%. During this development the number and freight capacities of transportation firms has also increased and idle capacities has formed, which results in fierce competition that makes an efficient and safe transportation difficult. In this medium, while traffic accidents increased, at the same time the physical structures of highways damaged quicker than expected because of the high ratio of heavy vehicle and excess loading of considerable amount of vehicles [1].

In order to maintain and improve the highway system in Turkey, billions of Turkish Liras are spent annually [5]. Although railway technology has shown a rapid improvement in the world, Turkey could not shown a parallel improvement in this area because of unbalanced financial distribution between transport modes. Also maritime is the transportation system that has the biggest portion (about 95%) in World's transportation system. It is 3.5 times more inexpensive than railway and 7 times more inexpensive than highway. Today, the burden of that situation on country's economy is discussed and studies to shift freight transport to other modes are conducted [1].

In the literature, studies were made to guide the transportation policy makers in their strategic decisions on transportation planning [2]-[4]. In this study freight transportation of Turkey was evaluated according to transport modes for the same objective as well.

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EVALUATION

The freight transport data of Turkey by road, railway, maritime, and air transport modes between years 1983 and 2005 [6] are given in Table 1. Data do not include transport to or from foreign countries. The forecasting models are selected based on error measure MSE and diagnostic check. The forecasting method used for the road data is Box-Jenkin's ARIMA with parameters ($p=0$, $d=2$, $q=1$). The forecasting method used for the railway data is Double Exponential Smoothing with smoothing constants $\alpha=0.52$ and $\beta=0.124$. Because of the privatizations of Turkish Maritime Cargo Lines there are missing data in maritime transport, therefore forecasting could not be made for this mode. Also air transport was not forecasted because the portion of use of this mode is very low. As forecasts indicate, the increasing trends are expected to continue in the future (Figures 1 and 2). Therefore, energy use in freight transportation is also expected to increase. It is obvious that there is unbalanced transport mode use in Turkey in favor of road by 90.8% when total freight transport is considered by modes between years 1999 and 2003 (Figure 3). Road is the most energy consuming and environmentally harmful transport mode among all transport modes. Balancing mode share by railway and maritime for long-haul and by road for short-haul is the best way to achieve the most energy-efficient and environmentally sustainable way for freight transportation. Transportation planning and investment decisions should be made based on research on selection of optimal routes and optimal connections among modes according to a set of criteria such as cost, time, distance, safety, energy, and environment.

TABLE 1
Turkey Freight Transport by Transport Modes (million tone-km) [6]

Years	Road	Railway	Maritime	Air Transport
1983	42189	6124	2934	57
1984	43878	7532	7719	63
1985	45634	7747	4504	59
1986	54018	7219	4682	64
1987	58832	7259	4541	79
1988	65459	8006	9454	88
1989	68239	7571	7152	95
1990	65710	7915	7234	107
1991	61969	7995	2780	76
1992	67704	8246	1756	102
1993	97843	8410	901	152
1994	95020	8215	587	198
1995	112515	8516	276	231
1996	135781	8914		240
1997	139789	9614		263
1998	152210	8376		274
1999	150974	8237	8200	286
2000	161552	9761	7900	310
2001	151421	7486	8100	285
2002	150912	7169	5738	275
2003	152163	8615	5400	276
2004	156853	9334		321
2005	166831	9078	6158	392

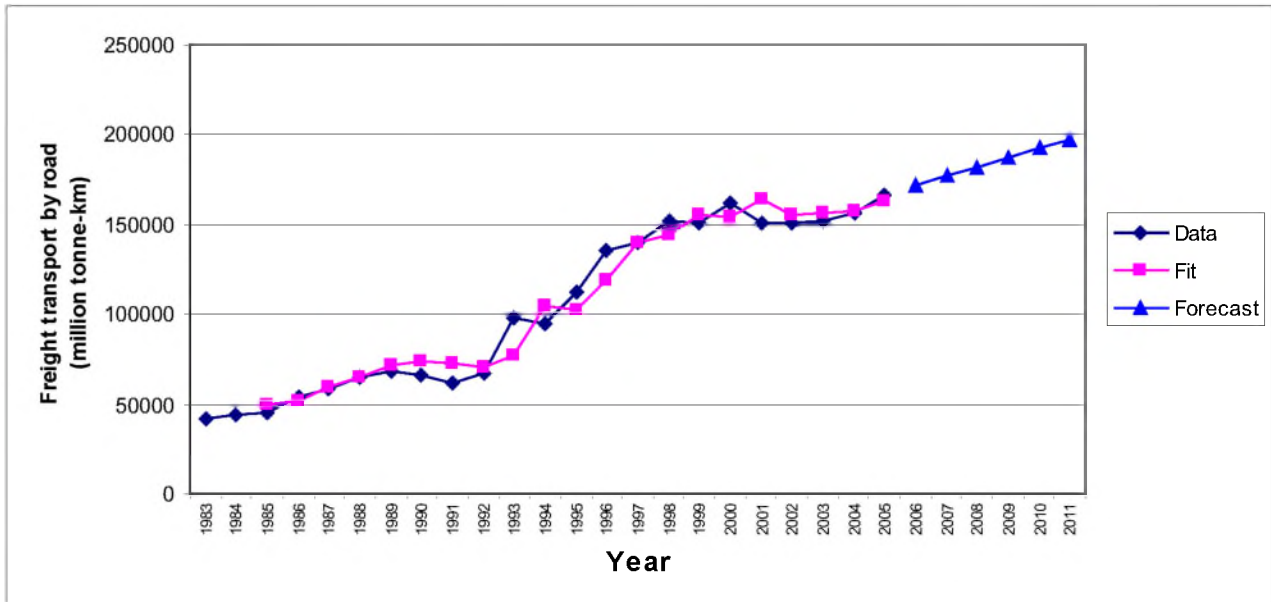


FIGURE. 1
Forecasts for Freight Transport by Road

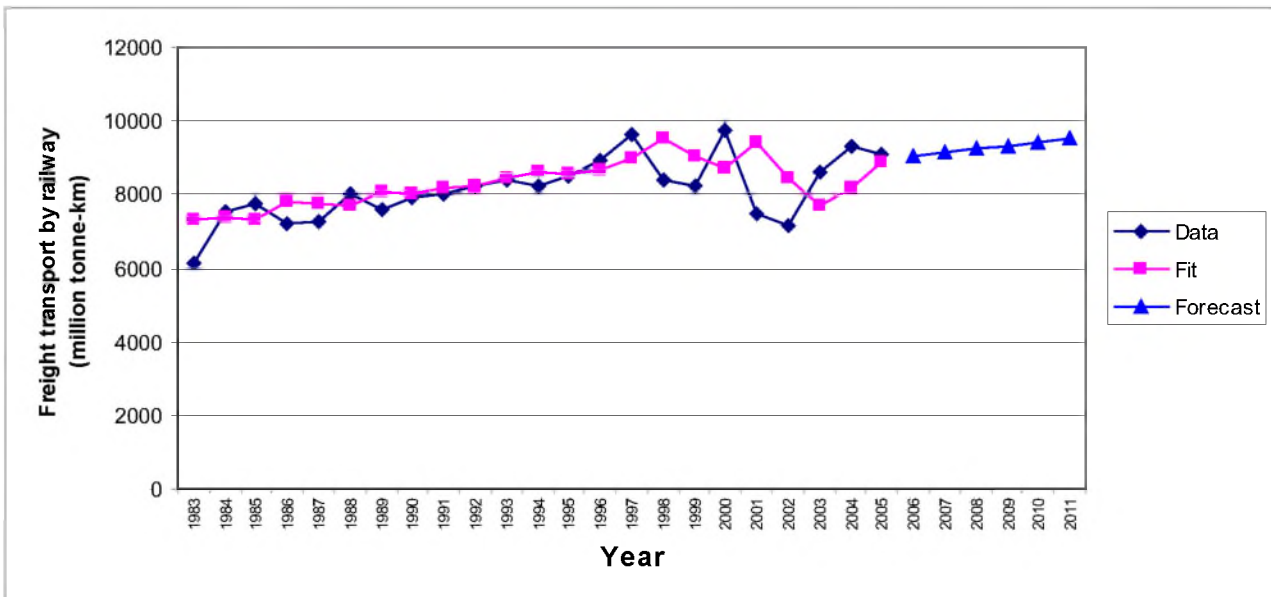


FIGURE. 2
Forecasts for Freight Transport by Railway

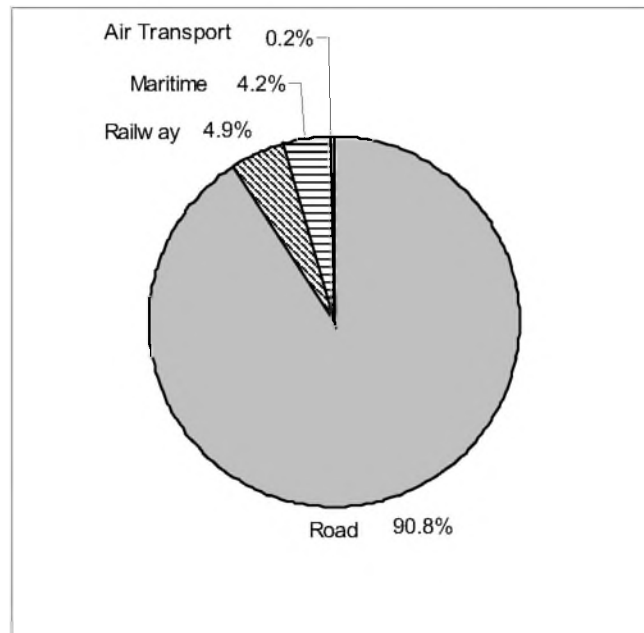


FIGURE. 3

Use of Modes for Total Freight Transport between 1999 and 2003

Freight transport data of European Countries for 2005 [6] are used to group countries into clusters such that each cluster is as homogeneous as possible with respect to the clustering variables which are freight transport by railway, road, and inland waterways. In cluster analysis we select Euclidean Distance as a measure of similarity and the hierarchical clustering technique with single-linkage method. Agglomerative algorithm used to develop clusters is the single-linkage method which is based on minimum distance. The data and the result of the analysis are given in Table 2. The cut shown by the dotted line in the dendrogram (Figure 4) gives the composition of a four-cluster solution. Cluster 1 contains Turkey, England, Italy, Spain, and France, all of which have high amount of freight transport. Among them Turkey is the one that use railway least. Cluster 2 contains Germany which has the highest amount of freight transport and balanced mode share. Cluster 3 contains Netherlands which has lower amount of freight transport and the largest share in using inland waterways. Cluster 4 contains the remaining countries which have lowest amounts of freight transport when compared with the countries in the other clusters.

TABLE 2

Freight Transport by Countries and Transport Modes in 2005 (billion tone-km)

Observation	Country	Railway	Road	Inland Waterways	Cluster
1	Turkey	9.1	166.8	0	1
2	England	22.1	154.4	0.2	1
3	Luxembourg	0.4	0.5	0.3	2
4	Greece	0.6	18	0	2
5	Ireland	0	14	0	2
6	Portugal	2.8	17.4	0	2
7	Germany	81.7	237.6	64.1	3
8	Denmark	2	11.1	0	2
9	Italy	23.1	171.6	0.1	1
10	Netherlands	4.3	31.8	42.2	4
11	Spain	11.6	166.4	0	1
12	Belgium	9.2	19.3	8.6	2
13	France	41.9	177.3	8.9	1
14	Switzerland	11.4	0	0	2
15	Norway	2.1	15.4	0	2

16	Austria	18	12.5	1.8	2
17	Sweden	13.1	34.7	0	2
18	Finland	9.7	27.8	0.1	2
19	Czech Republic	15.9	15.5	0.1	2
20	Slovak Republic	9.3	5.6	0.1	2
21	Hungary	9	11.4	2.1	2
22	Bulgaria	5.2	5.1	0.8	2
23	Croatia	3.1	4.4	0.1	2
24	Romania	14.9	19.4	8.4	2

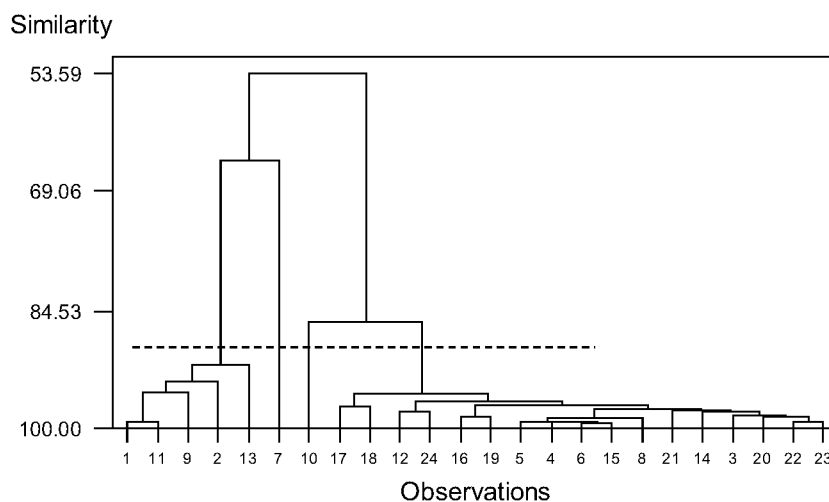


FIGURE. 4
Dendrogram for Freight Transport Data

Policy makers in Turkey made investments for many years only in road transport and neglected railways. To obtain a balanced transportation system like Germany investments should be made not only roads but also railways and maritime. Turkey geographically is very suitable country to integrate all transport modes to develop a single and balanced system of transportation.

CONCLUSION

There are freight transportation problems in Turkey because of unbalanced transport mode use resulting from lack of long-run strategic planning and accordingly incorrect investment decisions. In order to overcome the problems, all transport modes (road, railway, maritime, and air transport) should be integrated into a single system of transportation. The transport mode share should be balanced by using railway and maritime for long-haul and using road for short-haul in order to achieve the most energy-efficient and environmentally sustainable way for freight transportation. This requires detailed research on the selection of optimal routes and optimal connections among transport modes according to a set of criteria such as cost, time, distance, safety, energy, and environment. Policy makers should develop long-run strategic plans and make investment decisions for transportation using the results of that research in order to get a more balanced freight transportation system in a near future in Turkey.

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