

# **A multiple variables data analysis on the relationship between Turkey's socio-economic and transportation indicators**

**Murat Darcin, Adnan Sozen<sup>\*</sup>, Fatih Cipil, Baris Kurt**

*Gazi University, Faculty of Technology, Department of Energy Systems Engineering, 06500, Ankara, Turkey*

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## **Abstract**

As a candidate country to EU for development of transportation strategy, determination where Turkey is between EU countries is as important as know about measurable and comparable communications infrastructure circumstances with one another of provinces and regions, to build a healthy communication transportation policy at the country level. Present capacity must be fixing, depends on these fixed capacity the new investments must arrange and provide balanced transportation potentiality all around the country. Fundamental aim of this study is detection of relation's transportation with one another, to find similar provinces groups, to show become-dissimilar provinces, to order provinces by development situation, exposure transportation of Turkey by using analectic social and economical indicators and transportation situations which belong to 81 provinces according to present managerial essential situation of Turkey. In addition, as a candidate country has been mentioned about the needed development policy with determination of where Turkey is in the other EU countries. At this study multi-variable categorical data analyses and cluster-analysis methods have been used.

*Keywords:* Transportation policy; Healthy communication; Social and economical indicator; Turkey  
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## **1. Introduction**

Natural sources, geographical factors, historical, demographical and cultural factors Such as lots of factors cause the differences between consideration sections and provinces. An impressive development policy must be used in the generic of country for providing equivalent foster of provinces those located in the different parts of our country. Transportation is the indispensable development engine of futuristic economies' foster as it is the key factor of commercial and cultural evolution.

To know about measurable and comparable communications infrastructure circumstances with one another of provinces and regions, to build a healthy transportation policy at the country level. Exposures conclusion of these kinds of studies, admitting of evaluation of

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<sup>\*</sup>Corresponding author. Tel.: +90-  
*E-mail address:* (A. Sozen).

present policies sufficiency and/or insufficiency, by that way provide test of success also that provide facility of produce new policies which are available present's reservation, consistent in the local dimension.

Fundamental aims of this study are:

1. Exposure which one of the main development constituent is transportation infrastructure situations of Turkey by comparing with to other countries (especially European countries)
2. Determine if there is a relation or not between social and economical improvement with transportation infrastructure according to provinces by means of through socioeconomic indicators set (q variable) and transportation indicators set (p variable)
3. Chosen variables, based on associated-with social, economical and transportation determine transportation ministration level of provinces and arrange in order at this direction.
4. Fixation of similarity of provinces.
5. Fixation of effectiveness of provinces' geographic location for separation.

Present capacity must be fixing, depends on fixed capacity the new investments must produce and provide balanced transportation potentiality all around the country instead of unplanned, independent from each other, short timed solutions for the complementary subsystem development at the transportation establishment. To provide all these, main plans must be produce that will be able to fix up transportation infrastructure. This study aimed to reach the conclusions which will enlighten to that kind of studies, exposition of Turkey's transportation infrastructure. In addition this study aimed solves the traffic problems of similar provinces those fixed up by using the data and use this solution as a model for the other similar provinces.

Study, exposures according to the present managerial essential situation of Turkey by using reflecting development 81 provinces' analectic social and economical indicators and reflecting transportation situations those used as if these found trust and consistent data. Variables; these reflects present situation in definite period not the improvement. Canonical correlation analysis study has been done to exposure if there is a connection between socioeconomic indicators sets of provinces and transportation indicators sets. By means of through Principal Component Analysis the provinces have been put in an order by transportation and socioeconomic variables, by means of through to assemble the similar characteristic provinces to constitute different provinces amount k have been used Cluster Analysis and if the grouping is available to analyze for any group quantity or not have been used (MANOVA) Multivariate Analysis of Variance. Which variable or variables were differentia for detection of separation of provinces in different groups and detection role of location variables of provinces those located different sections have been detected by means of through Discriminate Analysis.

At this study the improvement level of provinces that were detected by means of through data sets which included transportation indicators, concerned with study of State Planning Corporation is aimed to plan and special aimed other's studies were existent have been exposed the transportation ministry infrastructure level of provinces and the differences by more often use of transportation indicators. That is comparatively important to produce for providing the proportional healthy development between sections and provinces and between transportation modes. Provinces must be enumerated, ordered in groups and the differences-similarities must be exposed in respect of transportation ministry infrastructure. Provinces show important concession these effect increasing performance and generic development trends of their. During determination of improvement strategy in respect of economic and social indicators, with the perform they have showed, to know the situation of transportation infrastructure, predication of potentiality emphasis of provinces will able to help to built of a quite well subsystem.

## 2. Transportation

Transportation has central role to facilitate economic activity between districts and sectors (Fig. 1) [1, 2].

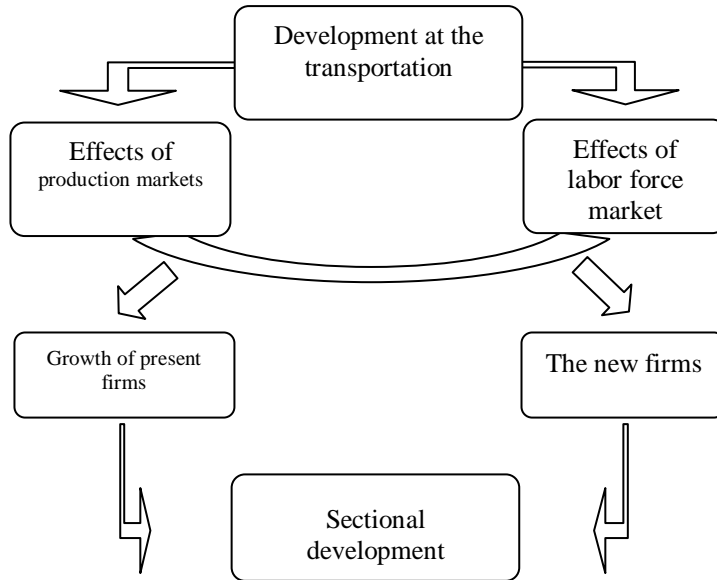


Fig. 1. Impressions of transportation improvement on the sectional improvement.

Connection between transportation and economy is difficult to understand and very involved. Naturally economical growth and development [3] that depends on transportation factors [4] is very important sector with its direct and indirect effects on the development is also involved [5]. Discussion about the connection between transportation and economy is emerges from necessary factor conception for economical development. Difficulty of connection between economical improvement and transportation, originate there are lots of effectible factors. Therefore besides transportation, other factors those contributed on economical development process must have an important place [6] at the conception of relation between transportation and economy. When if think about the effects economy on the transportation: economy affects the type and size of transportation.

Some variables such as local production, local income, and/or job supply are exterior sourced variables that reflect effects of transportation models on economy [6,7]. Some variables are existent on manifested equality with transportation petition fiction based approximation, cargo and passenger transportation [6-10].

Development or increase at the transportation subsystem means low cost transportation and it provides much more expedition with some amount of labor force, vehicle and fuel also business travel and cargo carriage provides more expedition and more production. More local production means more income [6]. As is seen the development of transportation sector causes economical development. The types of models these elicit the effects of transportation foreground on the economy can predicate like these [6];

*Models of Production Function:* Production function of these model, labor force and capital which are classical production factors also contain production infrastructure factor as an explanatory variable [10-17].

*Models of Location:* That explains investment and job with one of the location factor which contains subsystem [17]. However omits the effects of macroeconomic variables.

*Models of Generic Librations:* These are comparable models that specify the effects of

transportation on subsystem [18-20].

Connection between transportation infrastructure economical improvements occupies quite important place for of underdeveloped states' improvement plans all the time [21]. Transportation (especially mass transportation) has an important position such as provide living/life quality [22]. Transportation has a critic effect that depends on competition and for the maintenance of importance [23, 24] at the beginning of cities [25, 26]. Rapidly, permanent and simultaneously continued (economic) improvement, urbanization, increase of motor vehicle get burden and cause strong urban transportation problems [27]. Exertions of solving the problems have been emphasized on raising of way subsystem capacity by means of through improve the existential and built more way in 1960's, 1970's and some part of 1980's. This kind of strategies which is one of the most important reasons of turbid transportation causes serious problems on environmental, financial, social such as other sections those have been transpired from 1990s [27]. Continuously increase of population and use of personal cars turning into city of great field, freeway investments can't catch increase of density of traffic and car ownership ratio. Corporate alternative transportation modes and alternative urbanization models were used as solution methods commonly in 1990's, but orient of people from automobiles to the alternative sorts and transport them more closer to their work area is strong because present habits increase use of automobile consistently. So that even present policies success is still contentious about decrease of automobile use and improving alternative transportation systems. From the beginning of era vehicle till present as good as all policies those concerned with urban transportation got invitation to increase of car use advantages. Enterprisers are afraid of have investments with alternative transportation systems because satisfaction can't be as level as expected about carried customer [27].

### **3. Material and method**

#### *3.1. Material*

Study material has been constitute by means of through study of state planning organization, statistics of statistics institution of Turkey, General directorate of highways of Turkey, General directorate of rural service, state railways of Turkish Republic, state airport authority, undersecretary of seamanship. 34 variables those belong to 81 provinces have been used at this study.

The number of variance has been reserved a place as large as possible dimension. Transportation variances those consist of as good as all indicators which acquired the result of long range studies scale factor of province with 81 provinces' analectic socioeconomic variables have been used and called socioeconomic variables, socioeconomic indicators, transportation variables and transportation indicators at this study. The indicators have been standardized by means of through divide such as population or public square bigness to put faced effect of bigness of provinces' population public square away.

An obtained analectic social and economic indicator which used at this study from state statistic institute that reflect developed levels of provinces and reputed has an effect on transportation are these:

E-1: Density of population: Are the ratio of per person on kilometer square which obtained by ratio of public square to population.

E-2: Rapid increase of Population: increased annual population for each 1,000 population between the periods of 2 census date.

E-3: Ratio of city population: Centre of city and boroughs' ratio in the total population I respect of 2,000.

E-4: Age ratio: Expression percentage proportion of 0-14, 65 and over 65 years to the 15-64 and over.

E-5: Ratio of graduates of 22+ years old population: Proportion of graduate in the province of over 22 years population.

E-6: Ratio of labor force: Is the number of labor force of 12 years and over in per each 100 bodies.

E-7: Contribution proportion of provinces on gross national product: Is the contribution proportion of provinces on gross national product is one of the most important variables that use to compare economical developed levels.

E-8: Gross domestic product of income per capita: Proportion of gross domestic product per person in the province

E-9: Ratio of literate female of female population: Number of literate female who 6 and over in per each 100 bodies.

E-10: Ratio of province's labor force to find job: Number of workers in per each 100 bodies.

U-1: The length of state provinces ways in the public square (meter/km<sup>2</sup>): Is the portion of province roads in kilometer square of province are priority state main roads which connect important section and city center, sea, air and rail ways, station, catwalk, harbor, and areas same connect country the neighborhood and connect secondarily important certain definite sections such as parish, borough with each other, city center and state ways.

U-2: The length of village ways in the public square (meter/km<sup>2</sup>): Proportion of per km<sup>2</sup> of province in the length of total village ways.

U-3: Ratio of asphalt in the village (%): State of percentage proportion of asphalt in the village ways.

U-4: Ratio of state and province asphalt ways (&): State of percentage proportion of asphalt in total of province and state ways.

U-5: Ratio of carried passenger by expressway province to province, province to town, town to town (person/population): State of ratio of carried passenger of the population.

U-6: Number of personal car (number/10,000 population): States the number of motor vehicle per capita in each 10000 body in province those produced for passenger transportation and have maximum 7 seats.

U-7: Number of minibus (number/10,000 population): States the number of motor vehicle per capita in each 10,000 body in province those produced for passenger transportation and have maximum 8-14 seats.

U-8: Number of bus (number/10,000 population): States the number of motor vehicle per capita in each 10,000 body in province those produced for passenger transportation and have minimum 15 seats.

U-9: Number of pickup (number/10,000 population): States the number of motor vehicle per capita in each 10000 body in province those produced to carry the freight maximum permissible on load capacity is not over 3500 kilogram.

U-10: Number of lorry (number/10,000 population): States the number of motor vehicle per capita in each 10,000 body in province those produced to carry the freight maximum permissible on load capacity is over 3,500 kilogram.

U-11: Total length of railways in the public square (meter/km<sup>2</sup>): Proportion of current line length that is total of normal, secondary, third and fourth line in the kilometer square of province.

U-12: The load sent by the railway from the stations (ton/6 months): States total tonnage of loaded goods in 6 months.

U-13: The load comes by railway to the stations(ton/6 months): States total tonnage of comer goods in 6 months.

U-14: Annual loading and excretion capacity (1,000 tones/year): Is the capacity of loading and excretion, expression of annual loading and excretion as tonnage of harbor. Capacity of loading and excretion of harbors changes over depends on amount of personnel, dock and length, amount of cranes and capacity.

U-15: Capacity of sailing ship acceptance (sailing ship/year): Amount of sailing ship that harbor will be able to accept for a year in respect of section and location.

U-16: Length of dock (meter): Is expression of total length of places that is built for loading and excretion via by way of fill of available sections by seaside.

U-17: Amount of carried passenger (body/year): Total amount of comer and outgoing passenger based on harbor.

U-18: Total loading based on harbor (ton/year): Total amount of exportation that Turkish and foreign flagged ships by sea.

U-19: Total excretion based on harbor (ton/year): Total amount of importation that Turkish and foreign flagged ships by sea.

U-20: Passenger capacity of airport (10000person/year): Expression of annual passenger capacity of airports in province.

U-21: Airport passenger density (body/year): Expression of total amount of passengers at the airports (comer and outgoing) in province.

U-22: Airport load density (ton/year): Expression of annual total amount of load at the airports as ton in province.

U-23: Aircraft capacity of airport (aircraft/year): Expression of annual possible airplane capacity of airport (aired and landed airplane) in province.

U-24: Aircraft density of airport (aircraft/year): Expression of total amount of airplane (aired and landed airplane) through the year in province.

### *3. 2. Method*

At the observed happenings analyses of recent years' treatise has been deduced constraint conjectural valid

single variable analyses are not satisfactory. The most important constraint of single variable analyses is always examine effect of one factor and keep down lots of factors as deduce at the happening. At the multivariate statistic analyses method, Canonical Correlation Analyses, Principal Component Analyses, Cluster Analyses, (MANOVA) Multivariate Analyses of Variance and Discriminant Analyses and Multidimensional Scaling methods have been used at this study.

In this study by using place of provinces in 3 dimensional space, provinces' transportation structure were construed. Proximity matrix which includes dissimilarity value were calculated as Euclid distance and MSD analysis were used by XLSTAT program.

## 4. Result and discussion

### 4.1. Canonical correlation analysis

A canonical correlation is the correlation of two or more canonical (latent) variables, one representing a set of independent variables, the other a set of dependent variables. Each set may be considered a latent variable based on measured indicator variables in its set. The canonical correlation is optimized such that the linear correlation between the two latent variables is maximized. Whereas multiple regressions are used for many-to-one relationships, canonical correlation is used for many-to-many relationships. There may be more than one such linear correlation relating the two sets of variables, with each such correlation representing a different dimension by which the independent set of variables is related to the dependent set. The purpose of canonical correlation is to explain the relation of the two sets of variables, not to model the individual variables.

For each canonical variety we can also assess how strongly it is related to measured variables in its own set, or the set for the other canonical variety.

At this study observed the relation between economic variance sets those consist of 10 variables and transportation sets that consist of 24 articles. For the analyses NCSS (Number Cruncher Statistical System) packaged-software has been used. Up to obtained results, most of Correlation coefficients are important ( $p < 0.05$ ) also medium averages of variances are pointed. When internal correlation coefficients are obtained correlations between private car population and pickup, total excretion based on harbor and Population of carried passenger by expressway province to province, province to town, town to town, annual loading and excretion capacity, capacity of sailing ship acceptance, length of dock, total loading based on harbor; Aircraft density of airport, airport load density and aircraft capacity of airport, proportion of literate female of female population, proportion of labor force, population intensiveness and contribution proportion of provinces on gross national product. As canonical correlation those counted between canonical mutable couples and first–sixth canonical mutable couples' correlation coefficients are important as statistic ( $p < 0.001$ ) the others are not.

It is possible to exposure relation between transportation and economic variables as proportion of 99.16%. When the correlation of transportation1 canonic variable with transportation variation that located in x variable set has observed and the results of values are detected as airport load traffic is 0.906; aircraft traffic of airport is 0.9; length of dock 0.662. Relation of number of lorry is 0.109 and the length of village ways in total public square, number of minibus is so less proportion of negative relation is topic. Population intensiveness and the contribution proportion of provinces on gross national product those located in economic variables of Y mutable set is show the highest correlation with economic1 canonic variety; also proportion of labor force and proportion of province's labor force to find job are in negative relation with economic1 canonic mutable with all varieties those are located in x variety set (transportation variable) and transportation canonic variety is mostly similar. Same as all varieties in Y are mostly similar. Same as most varieties in Y are mostly similar for

high. For extract of dominant economic canonical variables, population intensiveness and contribution proportion of province's on gross national product must be dominant level ; proportion of participate labor force and province's labor force to find job must be low.

These qualifications are attention getting to show the dimension of unbooked work in Turkey. To raise population intensiveness and contribution proportion of provinces on gross national product, airport loading intensiveness, aircraft intensiveness of airport and length of dock are firstly important, then air and sea transportation must be raised up. Province and state asphalt ways must be raised up, number of lorry, length of village ways and minibus numbers must be lower.

These results show us to necessity of use of sea and air ways for transportation instead of highways for economical improvement also for highway transportation minibuses and similar small vehicles are not available for development. Economical improvement is directly connected with healthy policy and present ways are not enough, village ways must be high standardized.

#### 4. 2. Ordering of provinces by factor and principal component analysis

The research has been started by using 34 variables those have been expected show the made character of provinces by respect of socio economic and transportation situation. Therefore data matrix consist of 34 variables set's of 81 provinces also 81x34 dimension.

$$X = \begin{pmatrix} x_{1,1} & x_{1,2} & x_{1,3} & \dots & x_{1,34} \\ x_{2,1} & x_{2,2} & x_{2,3} & \dots & x_{2,34} \\ \vdots & \vdots & \vdots & & \vdots \\ \vdots & \vdots & \vdots & & \vdots \\ x_{81,1} & x_{81,2} & x_{81,3} & \dots & x_{81,34} \end{pmatrix}$$

The choppers of matrix show variables and columns are provinces.  
 $x_{i,j}$  = Value of "i" in "j" province.

Because of variance are different unit and bigness have been standardized to protect much more and less weigh. At the factor analyses causes of collective variance or communality factors on each variable have been aimed to multiprocessing. This value depends on load value of items on each factor and its equal with the total of item's important factors loading value squares. Factor loading is a coefficient that explains relation between items and factors [28].

There are lots of technique that used for factorized principle axes, maximum likelihood and multiple grouping techniques are three of techniques those spaced in classical factor analyses. Principle component analyses (PCA) is another multivariate statistic technique that used more often [28]. Factor analyses can't be available for all data make. Availability of data for factor analyses can be observed by means of through Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's Sphericity test. KMO's over 0.60 and Bartlett test's meaningful determination show that data are suitable for factor analyses.

At this research SPSS 12.0 windows packaged program has been used for factor analyses (Converted Principle Component Analyses).

KMO coefficient, Bartlett' Sphericity test and anti image correlation coefficient's matrix has been observed for test availability of factor analyses. KMO extracted as 0.729 and defined well. Bartlett' Sphericity test value is high value such as 3,654,832 and importance level is 0.000. By this way has been decided that correlation matrix is different than unit matrix tan concluded use of factor analyses on data. E-8 variable has high loading value relatively first

and third factors. Load value of that item for first factor is 0.649 and third factor is 0.576. U5 variable has high loading value relatively 6<sup>th</sup> and 8<sup>th</sup> factors. Load value of that item for 6<sup>th</sup> factor is 0.427 and third factor is 0.514. U11 variables have high loading value relatively third, 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> factors. Load value of that item for third factor is 0.315, 6<sup>th</sup> factor is 0.301, 7<sup>th</sup> factor is 0.387. U23 variables have high loading value relatively second and 4<sup>th</sup> factors. Load value of that item for second factor is 0.637, 4<sup>th</sup> factor is 0.666.

These four factors have been refused from analysis because of 0,10 difference criterion and high loads more than one factor. As result of used factor analyses on the rest 30 items; communalities those consist with items have been changed between 0.985 with 0.617 that results show good combination of variables' factor solution.

There are 8 factors determined end of the analyses. Results has been explained as in total variance of first factor 18.38%, 2<sup>nd</sup> factor 15.76%, 3<sup>rd</sup> factor 14.12%, 4<sup>th</sup> factor 10.06%, 5<sup>th</sup> factor 9.75%, 6<sup>th</sup> factor 6.4%, 7<sup>th</sup> factor 5.7% and 8<sup>th</sup> factor is 3.89%.

Total variance of these 8 factors is 83.9%. Covariance of these 8 factors on items is changes almost between percent 61.7 with 98.5%. Factor scores matrix which used for put provinces in order has been obtained by means of through standardized data matrix's multiplication with Bartlett method score's coefficient. The result of all factors' total variance explanation has been found with the method of following;

$$\text{General factor} = [F1*(\text{variance}\%)+F2*(\text{variance}\%)+ \dots + F8*(\text{variance}\%)] / (\text{Total variance}\%)$$

$$\text{General factor} = [(F1*0,18378) + (F2*0,15601) + (F3*0,14115) + (F4*0,10058) + (F5*0,09747) + (F6*0,064) + (F7*0,05712) + (F8*0,03891)] / 0,839$$

Principal component analyses has been used with the XLSTAT program and because of E8, U1, U5, U11, U13 items gave high loading value except of these result items gave high loading value an more than one factor also it did not meet expected load value of less 0.10, items have been moved from the analyses. Analyses has been kept going with the rest of 29 items.

At the end of Bartlett Sphericity test have been decided that correlation matrix is different than unit matrix and concluded of exercises of data factor analyses. Total variance of 8 factors has been detected as 82.21% at the end of the analyses.

Converted factor matrix that obtained by means of through varimax method has been used for easier construe of factors (Tables 1 and 2). As it seen Istanbul has huge differences than the other provinces after observation of provinces' convention (Fig. 2).

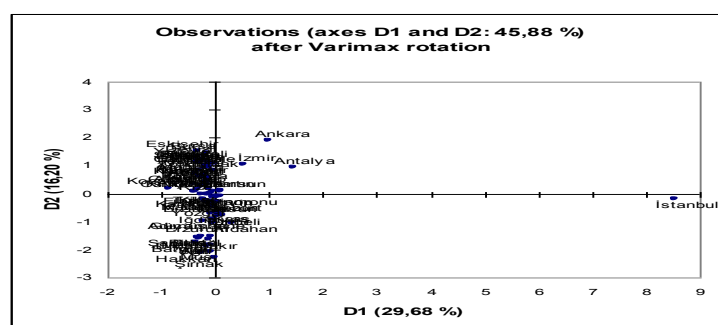


Fig. 2. Observations after Varimax rotation.

#### 4. 3. Cluster and discriminant analysis

To produce different province groups, cluster analysis  $k = 2,3,4, \dots, m$  has been used from XLSTAT program also MANOVA analyses is used to determine if the groups are available



**Table 1. Ordering of provinces depends on general factor score is as following;**

Rank	Provinces	Score	Rank	Provinces	Score
1	Istanbul	1.570897	42	Usak	-0.04885
2	Izmir	1.149187	43	Ordu	-0.07005
3	Kocaeli	0.996263	44	Giresun	-0.07576
4	Ankara	0.904320	45	Karaman	-0.11253
5	Antalya	0.853929	46	Kirsehir	-0.11522
6	Mugla	0.707768	47	Duzce	-0.12470
7	Bursa	0.522641	48	Kastamonu	-0.15110
8	Icel	0.402374	49	Bartın	-0.15757
9	Zonguldak	0.396812	50	Erzincan	-0.16225
10	Balikesir	0.374473	51	Sivas	-0.16230
11	Adana	0.363220	52	Sinop	-0.16807
12	Hatay	0.325690	53	Sirnak	-0.19801
13	Trabzon	0.325203	54	Afyon	-0.20648
14	Eskisehir	0.312254	55	Kilis	-0.22248
15	Yalova	0.273632	56	Igdir	-0.22299
16	Kayseri	0.245353	57	K.Maras	-0.23553
17	Sakarya	0.178243	58	Corum	-0.23786
18	Karabuk	0.148913	59	Aksaray	-0.24111
19	Samsun	0.148538	60	Tokat	-0.24348
20	Tekirdag	0.140849	61	Nigde	-0.25018
21	Aydin	0.120641	62	Mardin	-0.25419
22	Rize	0.117756	63	Batman	-0.26305
23	Bolu	0.089535	64	Adiyaman	-0.26309
24	Denizli	0.084970	65	Erzurum	-0.26507
25	Canakkale	0.077599	66	Gumushane	-0.30034
26	Bilecik	0.068643	67	Tunceli	-0.30814
27	Edirne	0.067651	68	Diyarbakir	-0.31077
28	Gaziantep	0.054070	69	Sanliurfa	-0.31284
29	Isparta	0.043342	70	Cankiri	-0.32609
30	Burdur	0.030613	71	Kars	-0.35804
31	Konya	0.016164	72	Yozgat	-0.36150
32	Nevsehir	0.015658	73	Siirt	-0.38014
33	Manisa	0.013735	74	Bayburt	-0.39724
34	Artvin	0.005636	75	Bitlis	-0.40222
35	Elazig	-0.00462	76	Van	-0.40261
36	Kutahya	-0.00912	77	Bingol	-0.43590
37	Osmaniye	-0.01192	78	Hakkâri	-0.43810
38	Kırkkale	-0.01349	79	Agri	-0.58542
39	Malatya	-0.02575	80	Mus	-0.60606
40	Kirklareli	-0.03048	81	Ardahan	-0.64188
41	Amasya	-0.03202			

or not. Group member is determined as 6 depend on Wilks Lambda value and p possibility that gives the most high F value. Cluster of 6 provinces is also follows in Table 3.

Observed provinces at the research have been tested by means of through discriminant analyses those consist of all provinces grouping.

For determination of availability of discriminant analyses, importance test of grouping average that belongs to variables has been tested. When the importance of grouping average equality test is observed E-6 (Proportion of labor force) and U-5 (Population of carried passenger by expressway province to province, province to town, town to town (person/population) variables are 0.05 importance value level U-13 (The load comes by railway to the stations (ton/6 months) is 0.1 and U-10 (Number of lorry (number/10,000 population) is 0.01.

In the other word there is a difference between grouping average depends on this variables but importance level of U-10 (Number of pickup) is 0.0826 also Ho hypothesis has been accepted. Therefore U-10 variable has been moved from the group and Discriminant analyses applied again. At the end of Discriminant analyses 5 Discriminant functions have been found that were linear composition of x variable factors. For meaning test of these functions separator factors criterion and Wilks' Lambda value have been counted and factor axis those separate groups best has obtained.

Eigen value that is ratio of group squares total of group interior squares total bigness of Eigen value shows good definite of function. As the explanation percentage of separator factors on total variance, first separator factor is explained 50.8% of total variance, second separator factor is explained 42% of total variance, third separator factor is explained 6.1%

**Table 2. Order of provinces as generic factor score in XLSTAT program is obtained as following**

Rank	Provinces	Score	Rank	Provinces	Score
1	Istanbul	1.5812	42	Osmaniye	-0.058
2	Izmir	1.1470	43	Usak	-0.069
3	Ankara	0.9856	44	Duzce	-0.101
4	Kocaeli	0.9519	45	Karaman	-0.103
5	Antalya	0.8605	46	Kirsehir	-0.107
6	Mugla	0.7247	47	Ordu	-0.110
7	Bursa	0.5019	48	Sivas	-0.125
8	Icel	0.3998	49	Erzincan	-0.137
9	Balikesir	0.3994	50	Kastamonu	-0.151
10	Adana	0.3982	51	Sinop	-0.167
11	Zonguldak	0.3715	52	Bartın	-0.202
12	Eskisehir	0.3598	53	Afyon	-0.215
13	Trabzon	0.3487	54	Igdir	-0.217
14	Hatay	0.3032	55	K.Maras	-0.221
15	Kayseri	0.2820	56	Sirnak	-0.222
16	Karabuk	0.2072	57	Corum	-0.239
17	Samsun	0.1935	58	Erzurum	-0.250
18	Rize	0.1844	59	Aksaray	-0.251
19	Yalova	0.1682	60	Kilis	-0.254
20	Bolu	0.1661	61	Tokat	-0.256
21	Aydin	0.1312	62	Nigde	-0.260
22	Sakarya	0.1150	63	Tunceli	-0.271
23	Denizli	0.1128	64	Gumushane	-0.276
24	Artvin	0.0859	65	Batman	-0.278
25	Tekirdag	0.0786	66	Mardin	-0.285
26	Bilecik	0.0406	67	Diyarbakir	-0.298
27	Canakkale	0.0383	68	Adiyaman	-0.316
28	Edirne	0.0293	69	Sanliurfa	-0.319
29	Gaziantep	0.0293	70	Kars	-0.345
30	Burdur	0.0276	71	Cankiri	-0.353
31	Isparta	0.0242	72	Bayburt	-0.369
32	Konya	0.0189	73	Yozgat	-0.372
33	Manisa	0.0030	74	Van	-0.381
34	Giresun	0.0004	75	Bitlis	-0.403
35	Kutahya	-0.003	76	Siirt	-0.406
36	Elazig	-0.009	77	Bingol	-0.437
37	Nevsehir	-0.010	78	Hakkari	-0.448
38	Kirikkale	-0.025	79	Agri	-0.575
39	Amasya	-0.026	80	Ardahan	-0.628
40	Malatya	-0.032	81	Mus	-0.636
41	Kirklareli	-0.057			

**Table 3. Cluster results**

1st Cluster	2nd Cluster	3rd Cluster	4th Cluster	5th Cluster	6th Cluster
Adana	Adiyaman	Antalya	Artvin	Istanbul	Izmir
Afyon	Agri	Mugla	Cankiri		Kocaeli
Amasya	Bingol		Corum		
Ankara	Bitlis		Erzincan		
Aydin	Diyarbakir		Giresun		
Balikesir	Erzurum		Gumushane		
Bilecik	Hakkari		Kars		
Bolu	Mardin		Kastamonu		
Burdur	Mus		Kirsehir		
Bursa	Siirt		K.Maras		
Canakkale	Sanliurfa		Ordu		
Denizli	Van		Rize		
Edirne	Batman		Samsun		
Elazig	Sirnak		Sinop		
Eskisehir	Igdir		Tokat		
Gaziantep			Trabzon		
Hatay			Tunceli		
Isparta			Yozgat		
Icel			Aksaray		
Kayseri			Bayburt		
Kirklareli			Bartın		
Konya			Ardahan		
Kutahya			Kilis		
Malatya			Duzce		
Manisa					
Nevsehir					
Nigde					
Sakarya					
Sivas					
Tekirdag					
Usak					
Zonguldak					
Karaman					
Kirikkale					
Yalova					
Karabuk					
Osmaniye					

of total variance, fourth separator factor is explained 0.8% of total variance, fifth separator factor is explained 0.3% of total variance.

As it seen fourth and fifth separator factors have very low separator importance to explain to total variance. In this case 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> discriminant functions kept out of analysis. When looked at canonical correlation coefficient that has seen there is a pretty high correlation between all separator factors with variables set. When mean fully test is observed, lowness then 1 of Willks' lambda value that obtained from the analyses shows to there is a separator force for a function.

In the situation of no function is moved with function 1 and function 2 are moved is seen there is no changes with Willks' Lambda value is still the most small. When the 3<sup>rd</sup> function is moved from the function, value increases so less. When the 4<sup>th</sup> function is moved from the function, value increases some. When the Willks' lambda value is rise up separator force of Discriminant function decreases also as increase of willks's lambda value is ki-square value's decrease shows there is still separator information. As a result of mean fully test all functions are mean full than 0.01 importance value. Therefore Ho hypothesis is refused. So group average is different than each other.

Variable that has first degree separator force is E-1 (Density of population), second degree separator forces are U-21 (passenger density of Airport), U-22 (Airport load Density traffic), U-24 (Aircraft Density of airport), U-20 (Passenger capacity of airport), U-17 (Amount of carried passenger) third degree separator factors are U-18 (Total loading based on harbor), U-19 (Total excretion based on harbor ), U-14 (Annual loading and excretion capacity), U-15 (Capacity of sailing ship acceptance), U-16 (Length of dock), fourth degree separator forces are E-9 (Proportion of literate female of female population), E-4 (Age Proportion), U-3 (Proportion of asphalt in the village (%), U-6 (Number of personal car), U-9 (Number of pickup), U-4 (Proportion of state and province asphalt ways), U-8 (Number of bus), E-8 (Gross domestic product of income per capita), E-5 (Proportion of graduates of 22+ years old population), U-12 (The load sent by the railway from the stations), U-1 (length of state provinces ways in the public square) and last of all fifth degree separator factors are the other variables.

In the province grouping at the 5<sup>th</sup> cluster (Istanbul) and 3<sup>rd</sup> cluster (antalya and mugla); as on 1<sup>st</sup> separator function that has the most separator effect with population density, 2<sup>nd</sup> separator function that has the most separator effect with air transportation has seen average value so separator coefficient is effectiveness. In the 6<sup>th</sup> cluster (Izmir and Kocaeli); 3<sup>rd</sup> separator function that has the most separator effect with sea transportation and 2<sup>nd</sup> separator function that has the most separator effect with air transportation has affects on grouping. Depend on 1<sup>st</sup> and 2<sup>nd</sup> function those have the most separator force, the highest values are placed at the 5<sup>th</sup> cluster (Istanbul) then 3<sup>rd</sup> and 6<sup>th</sup> cluster. That shows Istanbul is the most developed city by transportation. Then respectively Antalya and Mugla which consist of 3<sup>rd</sup> group, Izmir and Kocaeli which consist of 6<sup>th</sup> group, provinces which consist of 4<sup>th</sup> group and provinces which consist of 2<sup>nd</sup> group took place in the grouping. 5<sup>th</sup>, 3<sup>rd</sup> and 6<sup>th</sup> provinces show more separation and have much more differences than the others.

At the 1<sup>st</sup> and 2<sup>nd</sup> functions which have an effect on separation on 1<sup>st</sup>, 5<sup>th</sup> and 6<sup>th</sup> groups. At the 3<sup>rd</sup> function 6<sup>th</sup> group shows different effects than the others. Such that at the formation of groups' population density, air and sea transportation values of Istanbul, antalya, mugla, izmir and kocaeli is separated from the other cities. When values are the most separator factor those consist with air and sea transportation in more valued scale factor. If given the most contributed cities for produce of turkey and development cities that will be seen it is possible to say to be an improved province only by state way transportation is impossible.

When we looked at the results of ordering that known as also bewilderment matrix ratio of

correct ordering of original groups' is 98.8% , as the results of cross-validated evaluation 69 of 81 provinces are such that 85.2% is grouped correctly has been detected.

When Istanbul is kept out of analyses and gruped again; the cities seperated as available groups and that grouping accepted as "piori" classing and seperator factors also meanfully is tested. 34 variables' grouping average equality has been tested at the analyses and E-3 (Ratio of city population), E-6 (Proportion of labor force), U-2(The length of village ways in the public square), U-10 (Number of lorry), U-13 (The load comes by railway to the stations) variables are kept out of the group because of their grouping avarage is equal and kept going analyses with the rest 28 variables. At the end of the analyses 3 seperator function has been determined. 1<sup>st</sup> function 71.6%, 2<sup>nd</sup> function 25.32%, 3<sup>rd</sup> function 3% explains of total of vaiance.

All functions are 0.01 meanfully level. When made matrix is observed is seen at the first seperator function on any variable had no effect, at the second function U-18 (Total loading based on harbor), U-24 (Aircraft density of airport), U-23 (Aircraft capacity of airport), U-21 (Airport passenger density), U-14 (Annual loading and excretion capacity), U-22 (Airport load density), U-20 (Passenger capacity of airport), U-17 (Amount of carried passenger), U-11 (Total length of railways in the public square) variables had mainly effects on seperation. When the 1<sup>st</sup> function which has the most seperator is observed 4<sup>th</sup> cluster (Izmir and Kocaeli) and 3<sup>rd</sup> cluster (Ankara, Antalya and Mugla) had much more value than the others and get extreamly different. The groups by development of transportation level could be ordered as respectly 4<sup>th</sup> group, 3<sup>rd</sup> group 1<sup>st</sup> group and 2<sup>nd</sup> group.

When the information of grouping at the beggining is observed, Ardahan which placed at the second group and Yalova which placed in the first group has seen they have been ordered wrongly. At the end of the analyses Ardahan have put in 2<sup>nd</sup> cluster and Yalova is in 1<sup>st</sup> cluster. 97.5% of original grouped cases correctly classified and 88.8% of cross-validated grouped cases correctly classified.

After Istanbul, Ankara, Antalya, Izmir, Kocaeli and Mugla are kept out of tha analyses cities has put in 3 groups as available cluster and accepted "piori" classing. Meanfull and the seperator factor of the groups have been tested. 34 variables' equality of grouping average has been tested and E-2 (Rapid increase of Population), E-3 (Ratio of city population), E-6 (Proportion of labor force) and U-10 (Number of lorry) variables are kept out the analyses because of they are equal with group average and kept going analyses with the rest 30 variables. There are 2 seperator factors have been determined. The 1<sup>st</sup> function explained 88.6% and 2<sup>nd</sup> function explained 11.4% of total variance. All functions are meanfull as 0.01 value level.

When make matrix is observed is seen U-16 (Length of dock), U-19 (Total excretion based on harbor), U-14 (Annual loading and excretion capacity), U-18 (Total loading based on harbor), U-15 (Capacity of sailing ship acceptance), E-1 (Density of population), E-7 (Contribution proportion of provinces on gross national product), U-23(Aircraft capacity of airport), U-24(Aircraft density of airport), U-17(Amount of carried passenger), U-22(Airport load density), U-13(The load comes by railway to the stations), U-2 (The length of village ways in the public square)variables have affects on 1<sup>st</sup> seperator function and at the 2<sup>nd</sup> function there is no effect of the other variables. When the 1<sup>st</sup> function which has the most seperator force, inm respect of transportation development situation could be ordered in such as 1<sup>st</sup>, 3<sup>rd</sup> and 2<sup>nd</sup> cluster.when ordering information is observed is seen Manisa that placed at the 3<sup>rd</sup> group is ordered wrongly. At the end of the analys Manisa moved from 3<sup>rd</sup> cluster to 2<sup>nd</sup> cluster. 98.7% of original grouped cases correctly classified and 89.3% of cross-validated grouped cases correctly classified.

When Istanbul, Ankara, Antalya, Izmir, Kocaeli and Mugla are kept out of the analyses

have put in 3 groups as available cluster and equality of these 34 variables tested and U-10 variable has been moved because of its grouping average is equal and kept going analyses. At the 3 separation functions the 1<sup>st</sup> function explained 70.1%, 2<sup>nd</sup> function is 21% and 3<sup>rd</sup> function is explained 8.9% of total variance. All functions are meaningful as 0.01 level.

When the distances from group center is observed is seen the 1<sup>st</sup> group is more development in respect of transportation than the others. 3rd group is more developed than 2<sup>nd</sup> and 4<sup>th</sup> and 2<sup>nd</sup> group is very similar with 4<sup>th</sup>. when ordering information is observed all provinces ordered correctly is seen. Depends on clustering result 100% of original grouped cases correctly classified and 80% of cross-validated grouped cases correctly classified. To determine effects of geographic position of provinces are separated 12 sections and this ordering accepted as "priori". Separator factors and meanfull of group is tested. To detect availability for discriminant analyses use, equality of group average's importance is tested.

When the result of test is observed U-10 (Number of lorry), U-12 (The load sent by the railway from the stations), U-13 (The load comes by railway to the stations), U-14 (Annual loading and excretion capacity), U-15 (Capacity of sailing ship acceptance), U-17 (Amount of carried passenger), U-18 (Total loading based on harbor), U-20 (Passenger capacity of airport) and U-21 (Airport passenger density) variables accepted  $H_0$  hypothesis where is the proof of no difference between group average.

There are 11 discriminant function that is the linear combination of x variable vektor's is determined at the end of the separation analyses for the mean full test of this function. Separator factor measures and willks' lambda value is in respect of explanation percentage of total variance, 1<sup>st</sup> separator function explained 90.2% and 2<sup>nd</sup> separator factor explained 3% of total variance. Explanation force of the other discriminant function is so less. When canonical coefficient is observed there is a huge correlation has seen between 1<sup>st</sup> separator factor and variable set.

There aren't any variables got foreground which has 1<sup>st</sup> degree separator force variables which have 2<sup>nd</sup> degree separator force are E-9 (Ratio of literate female of female population), E-4 (Age ratio), U-3 (Ratio of asphalt in the village), U-6 (Number of personal car), U-9 (Number of pickup), E-8 (Gross domestic product of income per capita), U-4 (Ratio of state and province asphalt ways).

When original grouping information is observed whereas Bitlis was in the 11th group (middleeast anatolia) at the beginning then moved to 12th group (South East Anatolia) during the discriminant analyses. Kahramanmaras was in the 6th group (mediterian) at the beginning then moved to 7th group (Middle Anatolia), Nevsehir was in the 7th group (Middle Anatolia) at the beginning then moved to 3rd group (Aegean), Tokat was in the 8th group (west blacksea) at the beginning then moved to 7th group (Middle Anatolia), Yozgat was in the 7th group (Middle Anatolia) at the beginning then moved to 10th group (northeast anatolia), Karaman was in the 5th group (West Anatolia) at the beginning then moved to 7th group (Middle Anatolia) during the discriminant analyses. 92.6% of original grouped cases correctly classified and 39.5% of cross-validated grouped cases correctly classified.

#### 4. 4. Multidimensional scaling, MDS

As the first dimension is seen; Kocaeli, Istanbul, Mugla, Izmir, Sırnak, Trabzon provinces; as second dimension, İstanbul, Mugla, Antalya, İzmir, Ankara provinces are in different shape than the others. As it seen Agri, Bingol, Bitlis, Diyarbakır, Hakkâri, Mardin, Mus, Siirt, Sanliurfa, Van, Batman provinces are put in the same cluster. Same as, Afyon, Amasya, Bilecik, Burdur, Cankiri, Corum, Kirklareli, Kirsehir, Konya, Manisa, Kahramanmaras, Nigde, Tokat, Usak, Karaman provinces are put in the same group (Fig. 3). When this case is

observed, is seen multidimensional scaling can result in same as cluster analyses technique. When comparison is made in consideration of dissimilarity values, the most similar provinces with each other are; K.Maras-Tokat, Bitlis-Diyarbakir, Diyarbakir- S.Urfa, Cankiri-Tokat, Tokat-Yozgat, Kastamonu-Sinop, Corum-Kirsehir, Afyon-Nigde, Konya-Karaman and Bitlis-Siirt. The most dissimilar provinces are İstanbul-Sirnak, İstanbul-Ardahan and İstanbul-Mus.

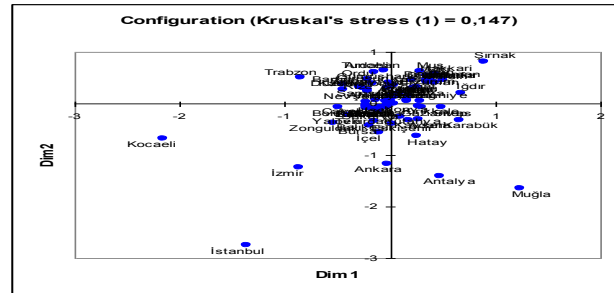


Fig.3.Situation cities.

## 5. Conclusion

Development plans' poised progress aim is important as development speed. For this reason, precaution and policy for development aim must be consistent with human and physical sources [29, 30]. For dispersion of public-sector' investment, economic geography, sectional development and social use also be considered, shortly, to provide connection between locality and social-structure is very important aim [31-35].

In this study position of provinces was researched by using multivariate statistic analyses method, Canonical Correlation Analyses, Principal Component Analyses, Cluster Analyses, (MANOVA) Multivariate Analyses of Variance and Discriminant Analyses and Multidimensional Scaling methods have been used by application to variable sets which are represent or effect transportation structure.

At this study relationship between economic development and transportation was researched by using canonical correlation to economic and transportation variable sets that consist of 24 articles. For the analyses NCSS (Number Cruncher Statistical System) packaged-software has been used. At the end of the study thaat is find that there is very strongly positive correlation between development level and transportation structure.

According to result of discriminant analysis, in cluster of all provinces 98.8% of original grouped cases correctly classified, in cluster of provinces except Istanbul 97.5% of original grouped cases correctly classified, in cluster (3 group) of provinces except Istanbul, Izmir, Ankara, Kocaeli, Antalya, Mugla 98.7% of original grouped cases correctly classified, in cluster (4 group) of provinces except Istanbul, Izmir, Ankara, Kocaeli, Antalya, Mugla 100% of original grouped cases correctly classified. At the result of discriminant analysis which applied to determine effects of geographic position of provinces 92.6% of original grouped cases (12 geographic district) correctly classified.

To construe by using place of provinces in 3 dimensional space, about provinces' transportation structures multidimensional scaling analysis was applied. Provinces come down to 2 dimensions in space according to relationship between variables. For first dimension Kocaeli, Mugla, Izmir, Sirnak and Trabzon; for second dimension, Istanbul, Mugla, Antalya, Izmir and Ankara apart from others. The most similar provinces by transportation situation; K. Maras-Tokat, Bitlis-Diyarbakir, Diyarbakir-S.Urfa, Cankiri-Tokat, Tokat-Yozgat, Kastamonu-Sinop, Corum-Kirsehir, Afyon-Nigde, Konya-Karaman, Bitlis-Siirt; the most dissimilar provinces are, İstanbul-Sirnak, İstanbul-Ardahan ve İstanbul-Mus.

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