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Impacts of Transportation Projects on Urban Trends in İzmir†

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ABSTRACT

The effects of major transportation projects on urban trends in Izmir were analyzed using the Delphi method. Once convergence was maintained in expert opinions, the Delphi results were re-evaluated according to the suggested method of total evaluation for obtaining much concise and general results. Accordingly, Absolute Total Impacts (ATI), Net Total Impacts (NTI) and the impact levels in broader terms were defined. The most effective projects were found to be: Integrated Rail Transportation System, Enhancement of Existing İzmir Port. The most impacted trends were: Development in Tourism Sector, Economic Development, Air Pollution and the Ratio of Private Car Ownership.
Keywords: *Delphi method, transportation projects, urban trends, İzmir*

1. INTRODUCTION

The purpose of the study is to estimate the impacts of transportation projects that are planned, or are expected to be implemented for İzmir city, or its vicinity, in the near future, over the region's major socio-economic and environmental trends by using the Delphi method. The outcome might be helpful in guiding efforts of various administrative/planning and investment bodies. Another contribution of the study would be revealing the extent to which and in what way the experts joining the project from various institutions and agencies (academic, private sector, public, etc.) can merge and diverge in perceiving and evaluating the impacts of the projects on the trends.

In the study, first of all, the effects of transportation investments onto the environment and urban development trends will be analyzed, then the method proposed and the results that it produced will be discussed. Transportation is an integral part and a common denominator of all economic activities. It plays an important role in economic development through its impact of synergy on all activities. Although the major goal of transportation is accessibility, transport investments carry along with this, such positive effects as economic viability and support of employment [1]. The transport sector which is responsible for the supply of goods and services to right places and in the right time for economic efficiency,

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carries onto localisations affected together with some other effects (positive and negative) due to the technical infrastructure that is acquired to provide these mobility and accessibility services. Besides the positive economic effects, presence of social/environmental negative effects is also unavoidable. In general, such effects have an indirect and intangible nature. The effects appear both as project/construction stage (temporary) and after-construction (in-use, permanent) effects. The focus, here in this study, is on the after-construction, permanent effects.

When evaluated as a sector, transport comprises an important aspect of all economy. 7% of all Gross National Domestic Product (GNDP) is contributed by the transportation sector in the EU [2]. A sizable portion of all non-renewable resources and mineral production is devoted to the development of transport activities and production of transport vehicles. Transport is also an area enhancing employment in great amounts and variety: It additionally supports co-existence of dependent auxilliary sectors and economic activities. The fact that 20% of all manpower in the U.S. is employed in automobile production is an important indicator for its input into the economy [3].

Transportation is also one of the forthcoming income resources of the state and the local governments (fuel consumption tax, carbon tax, etc.): Road taxes comprise 7.8% of all taxes in Switzerland, 7% in Australia, and 6.3% in Sweden. According to the statistics, significantly the motor carrier (or, highway-based transportation) systems before other transportation modes. The volume of motor carriers over land has increased substantially between the years 1970 and 1990: up to 80% in France, 85% in Italy, 50% in the U.S. and 82% in the UK [2]. Cargo carriage has also recorded significant increases: Up to 93% in France 50% in the U.S., and 45% in the UK on vehicle/km. basis. Towards the recent years, in Turkey, too, highway-based transportation attained the largest share up to 94% over the national road network amounting 63,000 km [4]. As can be seen in Table 1, that share in Turkey is even higher than that in the U.S., which country is assumed to be totally highway-dependent.

The largely accepted concept of rapid and door-to-door service in transportation has finally lead to the priority assigned to the highway-based transport in Turkey, together with the Eastern European countries. That also lead to the continuous expansion of the highway infrastructure in order to meet the increasing demand for more highways. The governments have allocated significant sums of money for these investments from their budgets. Yet, such infrastructure investments to meet the mentioned transportation demands do not increase in the same rate. Lately, rather the budget allocations to maintenance and more effective use of the existing infrastructure are preferred instead of new investments.

Table 1. Transportation Demand Distribution of Several Countries [Aybar, 1996]

Countries	Railways %	Highways %	Airways %
Japan	35	60	4
Germany	6	92	2
England	6	93	1
France	8.7	90	13
USA	1	82	17
Turkey	4	94	2

The number of motor vehicles on the roads in Turkey exceeds eight million, according to 2005 figures. The existing infrastructure is insufficient to meet this demand, which causes an excessive traffic density imposed on the system. Such agglomeration can be expected to cause various and tremendous effects on the socio-economic life and the environment. Fortunately efficient use of the existing railway systems, and especially as observed in the last 10 years, a trend of "rehabilitation and re-structuring" the railways over all the world has been started [5].

One of the forthcoming negative development is the increase in traffic accidents paralleling with the increasing trends of vehicle ownership and number of trips. Remembering that approximately 500,000 people were killed in traffic accidents in the world every year in average, transportation can be said to be responsible for one of the major causes of death. Also, transportation is responsible for the 60-90% of all air pollution all over the world, of which a non-negligible portion (40%) of the air pollution is created by the use of private cars. Due to the encouragement of private car use and the ever-increasing trip rate per person, the air pollution is expected to rise again, albeit the much wider use of clean fuel and catalytic technologies have decrased the pollution in significant amounts (up to 90%).

Today, transportation has been assigned great importance among international investment fundings. Not only for economic benefit, but also for sustainability projects, for alleviating the problems it created, World Bank allocated 12% of its total budget to the transportation related projects [2]. Supporting some major projects (TEN, TEM, etc.) in the EU countries, through a centralized system (such as the European Investment Bank) has been given special emphasis. Especially the projects about the enhancement of environmental quality in urban areas have been the core interest in recent years. For the local projects, most of the time, access to the above mentioned financial resources is provided through the state's and local governments' efforts. Some local governments have worked through to access such funds in Turkey, too. To understand the content, and pros and cons of important transportation projects that were solely launched for economic benefit on the cities that we planners try to plan is a challenging issue to search, and thus, forms the basis of this study.

2. ENVIRONMENTAL IMPACT ASSESSMENT TECHNIQUES

A brief literature review on the basic impact assessment approaches will be helpful before beginning the work on the trend analysis using the Delphi method.

2.1. Cost-based Impact Assessment

Basically cost/benefit analysis (CBA) is used for socio-economic valuation, and for configuring the costs in public investments, within the framework of a feasibility work using a certain set of criteria for finding out the clear returns from the application of the project [6]. Usually, social and environmental effects that spread over long term are ignored in this method. In finding of the material values of the impacts, the market valuation, willingness to pay, or compensation valuation can be used. In most projects, multi-criteria CBA is executed. Among those:

- individual impact; means only considering the single impact without taking other impacts into account,
- weighed multi-impacts; means calculating each impact one-by-one separately, and then weighing these in order to get single value and/or single unit,
- economic valuation; means assigning money values to each impact concerned in order to sum and come up with single meaningful value later on,
- multi-criteria analysis; means using sort of a non-monetory rank-ordering system for each impact in most cases, which, though sometimes can be summed up to a single value.

In the calculation, the principle is to evaluate those impacts calculable in terms of money value in the first place, and then comes the incalculables ones in terms of money. When the multi-criteria analysis is used, sort of a non-monetory evaluation system needs to be defined for the impacts that can vary among various criteria by ordering the positive and negative effects. Usually, the impacts are measured somehow in a unitless evaluation system by applying such impact measuring techniques: money values (for the impacts measurable in economic terms), expert judgment, or voting (by questionnaires when especially in the cases of high uncertainty, high costs and political concerns), and energy values (based on the physical characteristics). In the cross-impact analyses, the net benefits (or impacts) can be found, in principle, considering all impact relations between each impact items (or between the project alternatives). Instead of calculation in economic terms, another impact assessment method, however, utilizing the same measurement logic performs estimations adopting the Delphi (asking the expert view) method.

Consequently, decison-makers evaluate choices through an objective and rationalized filtering process. The quality of choice also depends on the information levels about the alternatives. In some cases, there will be no clear alternatives. In this case, the solution should be sought in linear or non-linear mathematical models for the data in determinist nature [7]. If quantitative data exist, then the method will be much neater. Sometimes, using differential values from a previously defined ideal value (defined for each criterion) can be the basis of measurement (called discrepancy analysis technique). The evaluation can be made according to the deviations of the alternatives' values from the ideal value.

2.2. Cross Impact Analysis

Cross impact analysis method investigates interdependencies between the projects and these interdependencies define the impacts. Along with the impact of projects on to each other interdependencies between the project variables could also be investigated. This study aims to analyse the Delphi results. Delphi method and survey process are defined and aggregated results are interpreted. [8, 9]

3. METHOD

Following steps are carried out to analyze the impact of transportation projects on urban development trends:

1. Transportation projects and urban development trend for İzmir are defined
2. An expert panel is formed to evaluate these projects and trends
3. Experts supplied the data for impact analysis
4. Model is run and data is analyzed, results are interpreted.

Since the model solely depends on expert judgment, expert selection and data gathering processes are most important for the health of the results. Experts are selected among professionals who provide important services for the development of İzmir. At the beginning 35 experts are listed and communicated. Finally 19 of them volunteered for the study, and 15 of them successfully completed the Delphi process.

Experts are especially selected from academic environments related to transportation and urban development. Delphi questionnaires are conducted via internet in order to decrease the costs and enhance ease of participation for experts (one of them is participating from Australia). 3 rounds of Delphi are carried out until the convergence among experts is reached. At the end of each round, median, mode and standard deviation for each answer are analyzed and experts are informed about the results. Once the convergence is achieved for an answer, that question is omitted from the following rounds.

In order to get expert opinion five tables are prepared: First one is about impact of projects on trends; second one is about impacts of projects on the other projects probability of occurrences; and third one for impacts of trends on trends. Fourth and fifth tables are related to time dimension of the study. Probability of occurrences for each project in given time frames and their level of potential changes are questioned.

3.1. The Projects Concerned

The projects that will be covered by the study are defined based on the requirements below, also by taking the opinions of the expert group:

- The projects that are likely to be realized but not yet implemented.
- The project application site should be within or around İzmir to affect the city (i.e, even if far, some macro level projects can have its impacts on the urban trends of İzmir)
- Also the projects that were already launched

With these requirements, these projects are taken into consideration:

P1: Izmir and Surrounding Expressways: covers all the road systems around İzmir including; Çeşme motorway that was completed in 1998, Izmir Peripheral Expressway (the Karşıyaka section is still under construction), İzmir-Denizli motorway up to Aydın, İzmir-Çanakkale highway up to Aliağa (the divided rural highway) and Izmir-Manisa highway

(which is partially divided). The total impact of all these highway segments mentioned should be evaluated.

P2: Integrated Rail Transit Systems: The new metro system, of which the first stage was accomplished, and the 'Aliaga-Cumovasi' suburban line, which is still under construction, are the major parts of the Integrated Transportation System that the Greater City Municipality of Izmir had started since 2000. They are, in fact, a complementary systems (Fig. 1). The construction of the second stage of the metro called 'Ucyol-Uckuyular Line', started in 2005 and had been targeted to be completed in 2007. The third stage comprises the 'Aliaga-Cumaovası' light rail system, of which the construction is still underway, and targeted to be finished by the end of 2008.

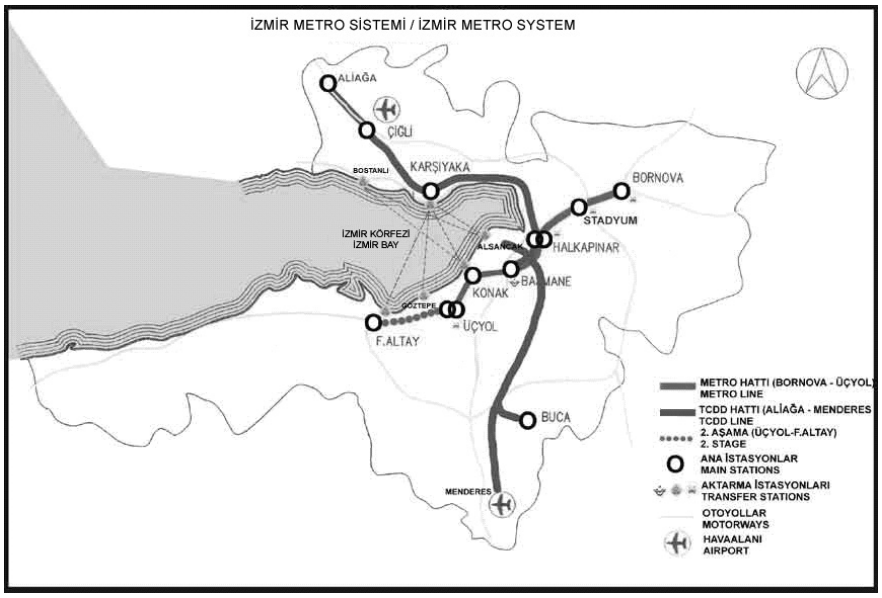

Fig. 1. Integrated Rail Transit System (Municipality of Izmir)

P3: Rehabilitation of the Existing Izmir Sea Port: Rehabilitation of both the freight and passenger sea ports is in the agenda. The possible solutions to overcome its existing insufficiency can be through capacity increase and expropriations from the surrounding lands used for usually storage, etc., enlarging premises. But, as some authorities advocated, its alleged negative impacts to its environment and rental pressures for the central urban activities around the port allow also for consideration for an alternative site possibility for the port.

P4: Modernization of the Izmir Airport: The enhancement and modernization of the airport are proposed by the authors of this paper to cope with the increased passenger demands.

P5: Istanbul-Izmir Motorway: Based on the increased traffic accidents in the last 10 years and insufficient capacity (for especially cargo carriage) of the existing infrastructure, some believed that building of such a motorway is already much neglected.

P6: Bursa-Izmir Railway: Bursa is not connected to other cities by railroad. There was only Mudanya connection in the past. The concerned Izmir-Bursa railroad here is rather a conception than a planned project. For the time being, there is already a railroad connection up to Bandirma, but actually the railroad connection to Bursa should have been over the township of Mustafa Kemalpasa (a more direct line), but not through Bandirma for effective service.

P7: Candarli Freight Port Project: There is already a project in progress to develop only a freight port in Candarli, as an alternative for the Enhancement of the Existing Izmir Port (for only freight) mentioned above. However, the problems such as environmental impacts on the Candarli project are discussed, especially in relation to the local archeological sites in close vicinity.

3.2. The Trends Concerned and the Existing Situation in Izmir

Trend is a graphical expression of a phenomenon to indicate whether it increases or decreases, based on the obtained regular (time series) data in time about the researched issue. It explains the slope and the momentum on the development of the phenomenon in time. In case the information is not healthy, it is best to assume the slope of the trend to be linear. When the information is healthy and detailed, it is possible to assume the relationship as non-linear, or semi-linear (or NSRR- Nonlinear Semi parametric Route Regression).

In our study, the concerned trends for the Izmir urban region (coastal Aegean region) are quite major ones (the number of trends that had been defined to be eleven, and then reduced to nine due to the non-significance recorded in the results of the first round surveys). In the surveys, providing information to the expert group about the current situation of the trend, and giving the base trend values as reference points are necessary. But, especially in the case where insufficient data and fuzziness exists, the base value is to be assumed as 50 units (over 100), and the rate of change asked from the respondent is expected to be in regard of this reference base value.

T1: Urban Density: As known, urban transportation systems have mutual relationships with the urban development pattern, in form and in density. For example, mass transportation systems can only serve in the dense, and “corridor” style developments effectively [10]. Though Izmir city involves many settlement areas that are much denser than world standards, it has also many low density areas as well within the urban metropolitan region but outside residential areas. Using the most recent data of the year 2002, the base trend value was found to be 120 person/ha (gross) for all Izmir, according to our calculations.

T2: Air pollution: Air pollution is one of the most important urban trends in terms of environmental pollution. Air pollution happens at global and local levels. Local level air pollution is usually urban and influenced by the aerial movements in the low levels of the atmosphere (tropospheric). It is known that all passenger carrying vehicles makes up to

13% of all carbondioxide (CO_2) pollution in the world. Again, 20% of all compounds that create greenhouse effect is transportation-borne [5,11]. According to the year 2010 projection, that value will rise up to 23% with the 75% annual rate of increase. The 80% of the NO_x (Nitrogenoxide) pollution, the 37% of the volatile compounds (VOC or HC), and the 90% of CO, that occur in our urban areas are caused by the transportation activities [5, 12]. In general, transportation is responsible for the 60-70% of all the air pollution in urban areas. In particular, the contribution of the highway-based transportation is beyond all other types.

In Izmir city, today, a serious air pollution situation (above critical values) is observed by experts, which extends from Aliaga to the Bornova basin, in particular, and the Alsancak district, following dominant wind direction all through the northern skirts, even though there is the all-year wind (imbat) advantage [13]. This pollution is usually from industrial activities, and mostly made up of Sulphurdioxide (SO_2) and particulate matter. Yet, also another serious pollution heavily composed of NO_x from the traffic occurs over all major transportation corridors and on the city center. Being due largely to transportation, the amount of NO_x pollution can be assumed as an indicator [14].

T3: Economic Development: It is known that transportation projects can have significant influences on the economic indicators. The basic economic development indicators can be GNDP, average income level per person, volume of transactions, expenditures, consumption indices, etc. Besides, general economic optimism and satisfaction observed all throughout the city, stockmarket high values, private sector investments and developments, and other indicators of a vibrant economy can be used. Especially, the unemployment rate is an important indicator.

T4: Private Car Use Ratio: From the 70's to the 80's, a slight decrease could be observed in the average rate of increase in annual vehicle ownership both in the developed and developing countries: from 5% to 3% in the developed, and from 9% to 5% in the developing countries [5]. While, a period of 10 years is required to double up the ratio before, now it takes 20 years. A 19 million units add to the number of vehicles each year. While the number of registered motor vehicles was 664.986 in 2001, it became 694.895 by the end of the year 2002, which is the latest record high known, for the Izmir city. In addition, the number of "private cars" is known to be around 400.000 for the 2002.

T5: Growth of the City in Compliance with the Planned Macroform: Urban form, or the growth shape and direction defined as shortly 'macroform', is about the geographical spread, shape and development directions of a city, and it concerns the definition of the city as to which defined macroform models in the planning terminology it fits. These models characterize the concerned city through the evaluations on the basis of geography, urban functionality and historical development. For example; an urban form describing historically a typical European city is the "compact" one with condensed urban uses originating from the denser city center with almost no vacancies (Madrid, Munich, Cologne). Contrarily, as seen in the U.S. and Australia, a typical "sprawled" city (spread over geography with irregular form) presents a from with the low density suburban residential settlements quite far from the business center that is to satisfy the needs of the capitalist and individualistic life-style of the society and that requires the auto mobilization (Los Angeles, Chicago, Houston, Melbourne).

City planners have agreed previously that the Izmir city's macroform should be a linear one through North-South axis (Menemen-Cumaovasi).

T6: Traffic Congestion: Today, we observe that the traffic congestion is a prevailing and insistant urban problem due to the insufficient infrastructure and inefficient traffic management methods especially in developing countries such as Turkey. The duration of peak-hour periods at which the congestions occur increase up to 10-14 hours in some metropolitan cities of the world. Such important losses happen when congestions prolong [5]:

- Not delivering the commodities timely and the related cost increases,
- Shortened work durations / work efficiency / punctuality / morale loss,
- Increased ratio of pollutant gas emissions from the transportation,

New shopping centers and office uses, etc. outside the cities foster traffic congestion and the related air pollution by causing additional traffic and private car usage. The congestion that especially occurs at the peak-hours on the major corridors in the CBD area of Izmir exists to be one of the most urgent problems that necessitates urgent solution due to its other negative consequences to the city.

T7: Development of the Tourism Sector: The basic indicators are the number of hotels, number of 5-star hotels and other touristic facilities, the number of beds, increases in service quality and the number of tourists visiting, the increases in the reservations, and a significant feel of the developments in activities in general. Similarly, in particular, the development in tourism sector is of a different significance from other economic development.

T8: Urban Trip Rate: Trip rate, which is one of the most important trends in transportation planning, can be a clear-cut definable indicator showing the average number of travels per day. Simply, it can be calculated by dividing the all average total number of daily vehicle travels in Izmir city by the total number of the city population. Daily number of trips was 2.490.700 in 1997, which was the latest data (when this study started). Yet, it is expected that this amount has been reduced to around 2 million recently, due to economic recession. Thus, for the year 2002, the trip rate is found to be 0,90. This value is assumed acceptable, though the uncertainty prevails due to the probable inaccuracies in the population census studies.

T9: Traffic Accidents: In Turkey, 233.803 persons were exposed to traffic accidents according to the data in 1994, of those 5.942 were killed and 104.717 were injured. In terms of the number of vehicles involved in crashes, a total of 428.903 vehicles were affected, of which 67% were automobiles, 5% were buses, 9% were Lorry/truck, and 19% were other types [4].

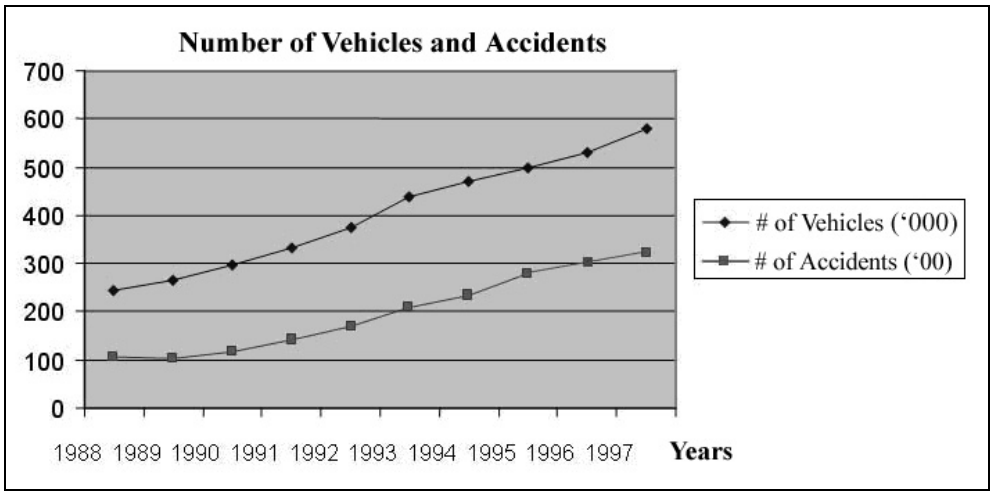

Fig. 2. Increase in the number of accidents and the vehicles in Izmir

Especially the accidents resulting in deaths, and also injuries are important indicators. Total annual accident number, or the ratio of the accidents with deaths to this total can also be used as the trend base value. In Turkey, the proportion of accidents with deaths to all accidents is lower than 1% according to the Police and Gendarme Department's reports (0.8% in 1999). For the Izmir urban area, the number of accidents is 28.979 (4% of all registered vehicles) and the number of accidents with deaths is 29 in 2002 (Fig. 2) [8]. As shown in Fig. 2, the rate of increase in the number of accidents increases with the rate of vehicle number. To begin with, (assuming base trend year as 2002), the most reliable and the precise data would be the number of accidents with deaths as an indicator.

3.3. Delphi Method

The objective of most Delphi applications is the reliable and creative exploration of ideas or the production of suitable information for decision making [8]. The Delphi Method is based on a structured process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires interspersed with controlled opinion feedback. According to Helmer Delphi represents a useful communication device among a group of experts and thus facilitates the formation of a group judgment. Wissema underlines the importance of the Delphi Method as a monovariable exploration technique for technology forecasting. He further states that the Delphi method has been developed in order to make discussion between experts possible without permitting a certain social interactive behavior as happens during a normal group discussion and hampers opinion forming. Baldwin [9] asserts that lacking full scientific knowledge, decision-makers have

to rely on their own intuition or on expert opinion. The Delphi method has been widely used to generate forecasts in technology, education, and other fields.

Fowles asserts that the word Delphi refers to the hallowed site of the most revered oracle in ancient Greece. Forecasts and advices from gods were sought through intermediaries at this oracle. However Dalkey states that the name "Delphi" was never a term with which either Helmer or Dalkey (the founders of the method) were particularly happy [1]. Dalkey acknowledged that it was rather unfortunate that the set of procedures developed at the RAND Corporation, and designed to improve methods of forecasting, came to be known as "Delphi". He argued that the term implies "something oracular, something smacking a little of the occult", whereas, as a matter of fact, precisely the opposite is involved; it is primarily concerned with making the best you can of a less than perfect kind of information.

The Delphi method is an exercise in group communication among a panel of geographically dispersed experts. The technique allows experts to deal systematically with a complex problem or task [8]. The essence of the technique is fairly straightforward. It comprises a series of questionnaires sent either by mail or via computerized systems, to a pre-selected group of experts. These questionnaires are designed to elicit and develop individual responses to the problems posed and to enable the experts to refine their views as the group's work progresses in accordance with the assigned task. The main point behind the Delphi method is to overcome the disadvantages of conventional committee action. According to Fowles anonymity, controlled feedback, and statistical response characterize Delphi. The group interaction in Delphi is anonymous, in the sense that comments, forecasts, and the like are not identified as to their originator but are presented to the group in such a way as to suppress any identification.

The Delphi method is also sometimes used for a normal inquiry among a number of experts. Delphi has found its way into industry, government, and finally, academe. It has simultaneously expanded beyond technological forecasting. Since the 1950s several research studies have used the Delphi method, particularly in public health issues (such as, policies for drug use reduction and prevention of AIDS/HIV) and education areas.

4. DELPHI SURVEY RESULTS

As the results of the convergence sufficiently obtained (accepted standard deviation: 15%) as outcome of the three-round repetitive surveys, the "agreed-on" values are shown in Table 2.

In addition to the impact matrices, the rate of changes in the trends over time and the probabilities of project realization in the same period intervals were asked to the experts again with three-round repetitive surveying. The results are shown in Table 5 and Table 6.

Table 2. Impacts of the Projects onto Trends

IMPACTS of PROJECTS ONTO TRENDS	**T1**-Urban Density	**T2**-Air Pollution	**T3**-Economic Development	**T4**-Private Car Use Ratio	**T5**-City Growth in Com. to Planned Macroform	**T6**-Traffic Congestion	**T7**-Developm. of Tourism Sector	**T8**-Urban Trip Rate	**T9**-Traffic Accidents
P1-Izmir & Surround. Exprways	**-1**	**-1**	**+1**	**-2**	**0**	**[+1]**	**+2**	**0**	**-1**
P2-Integr. Rail Mass Trsp. Syst.	**-1**	**+2**	**+2**	**+2**	**+2**	**+3**	**+2**	**-2**	**+2**
P3-Enhanc. of Exist. Izmir Port	**-1**	**-2**	**+1**	**-1**	**-1**	**-2**	**+1**	**-1**	**-1**
P4-Moderniz. of Izmir Airport	**0**	**0**	**+1**	**-1**	**0**	**0**	**+3**	**0**	**0**
P5-Istanbul - Izmir Motorway	**0**	**-1**	**+1**	**-1**	**0**	**0**	**+2**	**0**	**-1**
P6-Bursa - Izmir Railway	**0**	**+1**	**+2**	**+1**	**0**	**+1**	**+2**	**-1**	**+1**
P7-Candarli Freight Port Proj.	**0**	**+1**	**+1**	**0**	**+1**	**+1**	**+1**	**0**	**0**

P# : Projects **T# :** Trends

The meanings of the symbols in the cells:

#	**:** Agreed on areas by the Experts	(Standard Deviation: less than 15%)
#	**:** Not so agreed	(St. Deviat.: between 15% – 30%)
[#]	**:** Completely not agreed areas	(St. Deviat.: more than 30%)

Note: Median value is used instead of mean averages.

Table 3. Impacts of the Projects onto Projects

IMPACTS of PROJECTS ONTO PROJECTS	**P1**-Izmir & Surround. Exprways	**P2**-Integr. Rail Transit Syst.	**P3**-Enhanc. of Exist. Izmir Port	**P4**-Moderniz. of Izmir Airport	**P5**-Istanbul - Izmir Motorway	**P6**-Bursa - Izmir Railway	**P7**-Candarli Freight Port Proj.
P1-Izmir & Surround. Exprways		**0**	**+1**	**+2**	**+2**	**-1**	**+2**
P2-Integr. Rail Transit Syst.	**0**		**+1**	**+2**	**0**	**+1**	**0**
P3-Enhanc. of Exist. Izmir Port	**+1**	**0**		**+1**	**+1**	**+1**	**-3**
P4-Moderniz. of Izmir Airport	**+1**	**+2**	**+1**		**0**	**0**	**0**
P5-Istanbul - Izmir Motorway	**+2**	**0**	**+1**	**0**		**-2**	**+1**
P6-Bursa - Izmir Railway	**0**	**+1**	**+1**	**+1**	**-2**		**+1**
P7-Candarli Freight Port Proj.	**+2**	**+1**	**-2**	**+1**	**+1**	**+1**	

Table 4. Impacts of the Trends onto Projects

IMPACTS of TRENDS ONTO TRENDS	**T1**-Urban Density	**T2**-Air Pollution	**T3**-Economic Development	**T4**-Private Car Use Ratio	**T5**-City Growth in Com. with Planned Macroform	**T6**-Traffic Congestion	**T7**-Developm. Of Tourism Sector	**T8**-Urban Trip Rate	**T9**-Traffic Accidents
T1-Urban Density		**-2**	**+1**	**-2**	**[+1]**	**-2**	**0**	**-2**	**-2**
T2-Air Pollution	**+1**		**0**	**0**	**0**	**0**	**-2**	**0**	**-1**
T3-Economic Development	**-1**	**-1**		**-2**	**0**	**-1**	**+2**	**-2**	**-1**
T4-Private Car Use Ratio	**0**	**-2**	**+1**		**0**	**-3**	**+1**	**-2**	**-3**
T5-City Growth in Com. with Planned Macroform	**+1**	**+2**	**+1**	**0**		**+1**	**+2**	**-1**	**+1**
T6-Traffic Congestion	**+1**	**-3**	**-1**	**+1**	**0**		**-2**	**+2**	**-1**
T7-Developm. of Tourism Sector	**-1**	**0**	**+2**	**-1**	**+1**	**-1**		**-2**	**-1**
T8-Urban Trip Rate	**-1**	**-1**	**+1**	**-2**	**0**	**-2**	**+1**		**-1**
T9-Traffic Accidents	**0**	**0**	**0**	**0**	**-1**	**-1**	**-1**	**+1**	

Table 5. Trend – Time graph

TRENDS	**Sample Indicators**	**Today**	**Future**		
		2002 *	**2005 – 2010**	**2010 – 2015**	**2015 – 2020**
T1-Urban Density	Gross density (person / ha)	**120**	135	137	144
T2-Air Pollution	NO_x, CO, HC, SO_2, …	50	59	57	[60]
T3-Economic Development	GNDP, Stockmarket index, Consumption indices, etc.	50	57	64	[70]
T4-Private Car Use Ratio	No. of registered cars (x 1000)	**400**	492	559	[600]
T5-City Growth in Com. with Planned Macroform	Comprehensive Plan decisions	50	49	[55]	[62]
T6-Traffic Congestion	Traffic volume on peak hours	50	57	62	65
T7-Development of Tourism Sector	Bed capacity	50	56	64	70
T8-Urban Trip Rate	Trip rate (population/daily trips)	**0,90**	1,01	1,15	1,3
T9-Traffic Accidents	No. of fatal accidents in a year	**29**	32	34	[39]

* Base value for the year 2002 is assumed to be 50 because of the lack of the data for that year.

The meanings of the symbols in the cells:

**:** Agreed on areas by the Experts (Standart Deviation: less than 15%)

**:** Not so aggreed (St. Deviat.: between 15% – 30%)

[#] **:** Completely not aggreed areas (St. Deviat.: more than 30%)

Note: Median value is used instead of mean averages.

Table 6. Probability of realization of Projects – Time graph

PROJECTS	Future Projections		
	2005-2010	**2010-2015**	**2015-2020**
P1-Izmir & Surround. Expressways	% 60	% 40	% 50
P2-Integrated Rail Transit System	% 40	% 40	% 40
P3-Enhancement of Existing Izmir Port	% 20	% [20]	% [10]
P4-Moderniz. of Izmir Airport	% 20	% 40	% 50
P5-Istanbul - Izmir Motorway	% 20	% 40	% [30]
P6-Bursa - Izmir Railway	% [0]	% [10]	% 20
P7-Candarli Freight Port Project	% 20	% 30	% 40

5. EVALUATION OF THE DELPHI RESULTS

It was observed that there are non-converged results in few areas (response cells in the matrices) as the result of the three-round surveying, meaning non-agreed results by the experts. This may be due to fact that these areas might be open to political influence, or that the expert might not be sufficiently informed on the situation.

When we examine the matrix of impacts of the projects on the trends (Table 2), two non-converged impact cells were observed, of which one is totally non-agreed area. This area is the "the impact of the project of Izmir and Surrounding Expressways onto the Traffic Congestion" (P1xT6).

When we examine the matrix of impacts of the projects on the projects (Table 3), there is only one non-agreed area: "the impact of the project of Izmir and Surrounding Expressways onto the project of Integrated Railed Mass Transportation System", which is assumed to be of negligible result. On this subject, most probably, the "highway" advocator experts' worldview clashed with the "railway" advocator experts' worldview, that are fond of mass transportation solutions.

When we examine the matrix of impacts of the trends on the trends (Table 4), there are three areas of non-convergence, one of which is totally non-agreeable: The totally non-agreed area is between the "trend of Urban Density onto the trend of City Growth in Compliance with Planned Macroform" (probably due to the misunderstanding of the concepts that the interpretations "density" and "planned macroform" change from one expert to another). According to Table 5 and Table 6, it is clear that the experts could not agree on time estimations. In these last tables, especially the last two period intervals (last 10 years) (2010-2015 and 2015-2020), either the falling short of prediction capability or the non-convergence to agree on the same result between the experts is observed.

5.1. The Impact Assessment Method

By the aforementioned Cross Impact Analysis techniques, the results are obtained on the basis of matrices through the analyses of the interactions between the trends and major events. But, in the next stage, these matrices need to be evaluated in an objective manner. The proposed method is the aggregate evaluation of the impacts in a form of totality. To rectify the increases in the negative-character trends into correct values, such values are converted to negative values in the evaluation, while the decreases are converted to the positive values if these mean something positive. For instance, the project of Izmir and Surrounding Expressways seems to have an effect to increase the Rate of Private Car Use (+1). Since this is presumably a negative development, the value needs to be multiplied by (-) sign, by which actually, the positive sign that means increase for the negative-character trend will be converted to negative sign. The conversion process has already been done for the concerned trends in the abovementioned matrices.

Whereas obtaining detailed evaluations on the basis of matrices is possible, producing the aggregated results for general evaluations can be more meaningful. Hence, aggregated results can either be expressed in terms of averages or the summation of all individual results. These calculation methods below are applied in order to get such results:

Absolute Total Impacts (ATI): The absolute impact of all positive (+) and negative (-) impacts obtained shows how far a project may have a general influence, and how far a trend, in general, may be prone (sensitive) to be impacted. Here, the direction (i.e., positive or negative) of impact is not important and only the total amount of influence is measured.

An "i" project's total absolute impact upon all other (j) trends: $P_i = \sum_j | \mathbf{x}_{ij} |$ (1)

All projects' (i) total absolute impact upon one "j" trend: $T_j = \sum_i | x_{ij} |$ (2)

Positive and Negative Impact Level (PNIL): Different from the above, not the absolute total score of impacts, but whether the positive impacts or the negative impacts are dominant is reckoned separately. This especially is a necessary step for the calculation of net impact levels, which is the next stage. Therefore, the positive or negative impacts are separately evaluated and summed up as separate entities for the concern projects and trends.

Positive impact of an "i" project on all trends in total: $P_{i(pos)} = \sum_j x_{ij\,(pos)}$ (3)

Being impacted positively of a "j" trend in total from others: $T_{j(pos)} = \sum_i x_{ij\,(pos)}$ (4)

Negative impact of an "i" project on all trends in total: $P_{i(neg)} = \sum_j x_{ij\,(neg)}$ (5)

Being impacted negatively of a "j" trend in total from others: $T_{j(neg)} = \sum_i x_{ij\,(neg)}$ (6)

Total positive impact of all projects onto all trends: $PNIL_{P(pos)} = \sum_i P_{i(pos)}$ (7)

Level of being impacted positively of all trends in total: $PNIL_{T(pos)} = \sum_j T_{j(pos)}$ (8)

Total negative impact of all projects onto all trends: $PNIL_{P(neg)} = \sum_i P_{i(neg)}$ (9)

Level of being impacted negatively of all trends in total: $PNIL_{T(neg)} = \sum_j T_{j(neg)}$ (10)

Net Total Impacts (NTI): Additionally, whether a project has overwhelmingly a positive or negative impact or a trend is overwhelmingly affected positively or negatively must be

found out. This is basically the subtraction operation of the positive impact values from the negatives ones that are determined at PNIL stage.

Net impact score of an "i" project: $P_{i(net)} = \sum_j (x_{ij\,(pos)} + x_{ij\,(neg)})$ (11)

Net score of being impacted of a "j" trend: $T_{j(net)} = \sum_i (x_{ij\,(pos)} + x_{ij\,(neg)})$ (12)

Total net impact score of all projects on the trends: $NTI_P = \sum_i (P_{i(net)})$ (13)

Total net impact score of all trends being impacted from the projects: $NTI_T = \sum_j (T_{j(net)})$ (14)

All the score results from impacting project and from the impacted trends should be equal in total. Thus; $NTI_P = NTI_T = NTI$ (15)

Similarly, these conditions should be maintained;

$$PNIL_{P(pos)} = PNIL_{T(pos)} = PNIL_{(pos)} \quad (16)$$

$$PNIL_{P(neg)} = PNIL_{T(neg)} = PNIL_{(neg)} \quad (17)$$

The total score of impact of all these impacts can be found by the ratio of all scores obtained in total to the "maximum possible total score.

Those equations are used in finding the impact scores;

$$ATI = \sum_j | x_{ij} | \quad (18)$$

$$X = \text{Max} \sum_i \sum_j |(x_{ij})_{max}| \quad (19)$$

(X = Maximum total possible impact score potential +/- value)

$I_{ATI} = ATI / X$ (Absolute Total Impacts) (20)

$I_{POS} = PNIL_{(pos)} / X$ (Positive Impact Score) (21)

$I_{NEG} = PNIL_{(neg)} / X$ (Negative Impact Score) (22)

$I_{NET} = NTI / X$ (Net Total Impact) (23)

Additionally, to get a more meaningful result, the most general result definition can be through the General Impact Ratio:

$$GIR = \left| I_{POS} / I_{NEG} \right| \quad \text{(Global Impact Ratio)} \quad (24)$$

This ratio (GIR) yields the most conclusive results about the general degree of impacts: Is there overwhelmingly a positive or negative impacting in the relationship of effecting-effected? How far the score is above 1, so far the power of impacting relationship is positive in direction. A similar evaluation process can be used for other impact matrices. In the analysis of project-trend, the affecting are the projects and the affected are the trends. However, in the other matrices (project-project and trend-trend), since the subject and object are the same, the expressions used in the above mentioned equations are handled as "Impacting" and "Impacted" for convenience. Using the techniques explained above, the formulas for General Impact evaluation are provided in Table 7 for each impact category.

Table 7. Summary results of the impact level calculations

Calculated value	Formulation	Abbreviation
Maximum total possible impact	X = (# of cells) x 3	X
Absolute Total Impact (total impact of positive/negative scores)	$ATI = \sum_j \left\| \mathbf{x}_{ij} \right\|$	ATI
Total Positive Impact Score	$PNIL_{(pos)} = PNIL_{P(pos)} = PNIL_{T(pos)}$	$PNIL_{(pos)}$
Total Negative Impact Score	$PNIL_{(neg)} = PNIL_{P(neg)} = PNIL_{T(neg)}$	$PNIL_{(neg)}$
Net Total Impact	$NTI_P = NTI_T = NTI$	NIE
Absolute Impact Score	$I_{ATI} = AIE / X$	I_{ATI}
Positive Impact Score	$I_{POS} = PNIL_{(pos)} / X$	I_{POS}
Negative Impact Score	$I_{NEG} = PNIL_{(neg)} / X$	I_{NEG}
Net Impact Score	$I_{NET} = NTI / X$	I_{NET}
Global Impact Ratio (positive impact / negative impact ratio)	$GIR = \left\| I_{(pos)} / I_{(neg)} \right\|$	GIR

5.2. Evaluation on the Impacts of the Projects on the Trends

The expert agreement is obtained about the impacts of the projects on the trends in general. The projects that the trends would be most affected are;

- Integrated Railed Mass transportation System (the Integrated Metro and the Light Rail System) will definitely reduce the Traffic Congestion (-3),
- Modernization of Izmir Airport will have the most positive influence in the development of the Tourism Sector (+3).

Together with the development of the railed mass transportation system, many citizens were expected to quit riding their private cars, and rather use the mass transportation, and finally the more relieved urban traffic. Similarly, revitalization in the tourism sector by such capacity increase projects such as the renovation of the airport is an expected impact. Even if not in full agreement, the expert group decided conclusively that the new Izmir and Surrounding Expressways projects will have a relieving impact in the urban traffic jams (+1) (even though the final tour standard deviation value is 1,8).

The trends that are thought not to be impacted at all in case of the project applications;

- the contribution of the new Izmir and Surrounding Expressways projects on the City Growth in Compliance with Planned Macroform,
- the impact of the new Izmir and Surrounding Expressways projects onto the Urban Trip rate,

- Izmir Airport and Istanbul-Izmir Motorway projects have no effect on the trends of Traffic Congestion and Urban Trip rate,
- The projects such as Izmir Airport, Istanbul-Izmir Motorway, and Bursa-Izmir Railway are similarly believed to have no effect on the trends of Urban Density and the City Growth in Compliance with Planned Macroform.

Nevertheless, interpreting these results requires caution that negligence of some impacts would be due to the insufficient information provided to the expert group about the existing situation of the impacts.

5.3. Absolute Impact Evaluation, Positive ve Negative Impact Level and Net Impact results

When Table 2 is examined, the strong positive impacts of both Modernization of Izmir Airport onto the tourism (+3) and of the Integrated Railed Mass Transportation System onto the traffic congestion had been recorded. When the total impact scores of projects onto the trends are measured, these aggregated results were observed (Table 8):

Table 8. Total impacts of Projects onto Trends

Impacting Projects	ATI	PNIL		NTI
		+ score	- score	
P1	9	4	-5	-1
P2	18	15	-3	12
P3	11	2	-9	-7
P4	5	4	-1	3
P5	6	3	-3	0
P6	9	8	-1	7
P7	5	5	-	5
Total	62	41	- 22	19

As seen in the Table, a net impact score of 19 (NTI), with 41 positive impact and 22 negative impact, meant that the application of the projects will generate positive impacts in general. More specified results show that the most influential projects are found to be the P2 (Integrated Railed Mass Transportation System) and P3 (Enhancement of the Izmir Port). P3 is strongly agreed to have negative impact in general, which is one of the Izmir's most debated topic (For the summary results, refer to Table 17 at the end of this section) In Table 9, the levels of being impacted of the trends were analyzed.

Table 9.Impact scores of Trends by Projects

Impacted Trends		T1	T2	T3	T4	T5	T6	T7	T8	T9	Total
ATI		3	8	9	8	4	8	13	4	6	62
PNIL	+ score	0	4	9	3	3	6	13	0	3	41
	- score	-3	-4	0	-5	-1	-2	0	-4	-3	-22
NTI		-3	0	9	-2	-2	4	13	-4	0	19

The trends that are expected to be the most influenced in total are T7 (Development of Tourism Sector), T3 (Economic Development), T2 (Air Pollution), and T4 (Private Car Use ratio), and the trends that are to be the least influenced are T1 (Urban Density), T5 (City Growth in Compliance with Planned Macroform), and T8 (Urban Trip Rate). Among those, the most positively effected trends are T7 (Development of Tourism Sector), T3 (Economic Development) and T6 (reduction in the Traffic Congestion), and the most negatively effected trends are significantly the T8 (increase in the Urban Trip Rate), T1 (Urban Density), and T4 (increase in the Ratio of Private Car Use).

In a sense, such a situation is forecasted: "Whereas the realization of the projects has a positive effect on the economic and touristic developments, in the meantime, it will bring together accelerating impacts on the traffic congestion and car ownership trend". Due to one impact area (P1xT6: Izmir and Surrounding Expressways and the Traffic Congestion) is not converged, which is not taken into account for its uncertainty, instead of 63 total number of impacts, 62 impacts were taken into calculations. The level of both positive and negative impacts of the projects onto the trends, the net impact score and the general impact score are provided in Table 10.

Table 10. Projects-Trends impact ratio

X	ATI	NTI	I_{ATI}	I_{POS}	I_{NEG}	I_{NET}	GIR
189	62	19	0,33	0,22	-0,12	0,10	1,86

5.4. Impacts of Projects onto Trends

On the Projects-to-Projects (PxP) impact assessment, experts agreed on in general; the impacts will be evaluated as similar as the preceeding assessment methods. In general, the highest value in Table 3 is observed in the area that the Enhancement of the Existing Izmir Port will prevent the realization of the project of Candarli Port (-3). When the impacts of the projects, as "impacting", onto the projects were analyzed, the results in the Table 11 were obtained:

Table 11. Impacts of Projects onto Projects

Impacting Projects	ATI	PNIL		NTI
		+ score	- score	
P1	8	7	-1	6
P2	4	4	0	4
P3	7	4	-3	1
P4	4	4	0	4
P5	6	4	-2	2
P6	6	4	-2	2
P7	8	6	-2	4
Total	43	33	-10	23

According to the results in Table 11, the most impacting projects absolutely (ie, either positive or negative) onto the realization probability of the other projects were P1 (the construction of the Izmir and Surrounding Expressways), P7 (the Candarli Freight Port), and P3 (the Enhancement of the Existing Izmir Port). In a sense, the fate of other projects (the realization probability) depends on the completion of the mentioned projects. For example, it was foreseen that the Enhancement of the Existing Izmir Port (P3) may prevent the realization of some projects. While the completion of the Izmir and Surrounding Expressways will bring about the most benefit to all, the Enhancement of the Existing Izmir Port seems to produce the least benefit.

When we look at the general results in Table 12 as of "impacted" projects, the realization of the projects that are the most dependable to others (ie, to the realization of other projects) are P3 (the Enhancement of the Existing Izmir Port) and P7 (the project of Candarli Freight Port). The Modernization of the Airport (P4) and the Izmir and Surrounding Expressways (P1) are the projects to be most positively impacted (benefitted) from the realizations of other projects, while the Bursa-Izmir Railway (P6), the Candarli Freight Port and the Istanbul-Izmir Motorway projects seems to be affected negatively.

Table 12. Impact scores of Projects by Projects

Impacted Projects		P1	P2	P3	P4	P5	P6	P7	Total
ATI		6	4	7	7	6	6	7	43
PNIL	**+ score**	6	4	5	7	4	3	4	33
	- score	0	0	-2	0	-2	-3	-3	-10
NTI		6	4	3	7	2	0	1	23

The positive and negative impact scores of projects onto projects, net impact score and the general impact ratio are given in Table 13.

Table 13. Impact ratio of Projects onto Projects

X	ATI	NTI	I_{ATI}	I_{POS}	I_{NEG}	I_{NET}	GIR
126	43	23	0,34	0,26	-0,08	0,18	3,25

5.5. Impacts of the Trends onto Trends

Regarding Table 4 about the impacts of the Trends onto Trends (TxT), we had already mentioned the non-agreement of experts on some impact areas. Before the evaluation process by the method we followed, the highest impacts were seen in the areas that the increase in Traffic Congestion will strongly (and negatively) increase the Air Pollution trend (-3), and that the increase in Private Car Use will again strongly increase (-3) both the Traffic Congestion and the Traffic accidents. Accordingly, the results in Table 14 were obtained:

Table 14. Impacts of Trends onto Trends

Impacting Trends	ATI	PNIL		NTI
		+ score	- score	
T1	11	1	-10	-9
T2	4	1	-3	-2
T3	10	2	-8	-6
T4	12	2	-10	-8
T5	9	8	-1	7
T6	11	4	-7	-3
T7	9	3	-6	-3
T8	9	2	-7	-5
T9	4	1	-3	-2
Total	79	24	-55	-31

As can be followed from the Table above, The Private Car Use rate (T4), Urban Density (T1), Traffic Congestion (T6) and the Economic Development (T3) trends have the most absolute impact power compared to others; any change in these (increase or decrease) will play a determinant role in the development levels of other trends. T2 (Air pollution) and T9

(Traffic Accidents) stand rather as the consequences of other trends. In terms of causing positive impacts, especially the City Growth in Compliance with Planned Macroform (T5) and the Traffic Congestion, to some extent, (T6) came affront. Increases in the trends of Urban Density, Private Car Use Ratio, and the Economic Development can in general have a trigger effect on the other trends negatively. We see that the increases in almost all of the above mentioned trends will not produce positive impacts around. The net impact results, too, tell a similar conclusion; particularly Urban Density, Private Car Use and the Economic Development have dominantly negative impacts in general, and a general result that these trends will cause delaying impacts onto others. Neatly, almost the unique trend that has the positive impacts is the City Growth in Compliance with Planned Macroform. The total impact scores of the trend-trend evaluation can be clearly seen in Table 15 below:

Table 15. Total Impacts of Trends by Trends

Impacted Trends		**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**Total**
ATI		6	11	7	8	2	11	11	12	11	79
PNIL	**+ score**	3	2	6	1	1	1	6	3	1	24
	- score	-3	-9	-1	-7	-1	-10	-5	-9	-10	-55
NTI		0	-7	5	-6	0	-9	1	-6	-9	-31

When the Net Impact Scores are checked, we can say that the trends are in general negatively impacted from each other: In particular, significant increases are expected in the trends of Traffic Congestion, Accidents and in the Air Pollution. In the meantime, the experts also expected some considerable increases in the Private Car Use Ratio and Urban Trip Rate, which are said to be negative developments. The total positive and negative impact scores, net impact level and the general impact ratio are given in Table 16.

Table 16. Trends-Trends impact levels

X	**ATI**	**NTI**	**I_{ATI}**	**I_{POS}**	**I_{NEG}**	**I_{NET}**	**GIR**
216	79	-31	0,37	0,11	0,25	-0,14	0,44

As a result of all evaluations, a summary impact levels were found as shown in table 17. These are important results in terms of their comparability since they are normalized values.

Table 17. Summary results of impact levels

impact	I_{ATI}	I_{POS}	I_{NEG}	I_{NET}	GIR
P x T	0,33	0,22	0,12	0,10	1,86
P x P	0,34	0,26	0,08	0,18	3,25
T x T	0,37	0,11	0,25	- 0,14	0,44

When the general impact ratios are compared, that the potential for positive impact is quite high for the impact relations between projects was observed. This situation may explain the fact that how much important transportation projects and investments in urban areas can have triggering impact onto each other. Another important point, here, inversely the trends can in general have a potential to impact each other in negative direction. The general results are explained in the Conclusions section.

5.6. The Trend Values in Time

Although the standard deviation values are high (i.e., high degree of non-convergence in the expert views), an evaluation is made to estimate the direction of development that the trends would take according to the mean averages of the expert responses (Fig. 3). The Trend-Time (intervals) data are normalized and converted into ratio (%) values for comparability due to their different ceiling (maximum) values. Respectively, experts agreed that the Air Pollution and Urban Density would not continuously increase over time while the others would increase in a linear trajectory. Particularly, the Private Car Use Ratio, Urban trip Rate, and the Economic Development are expected to increase in time.

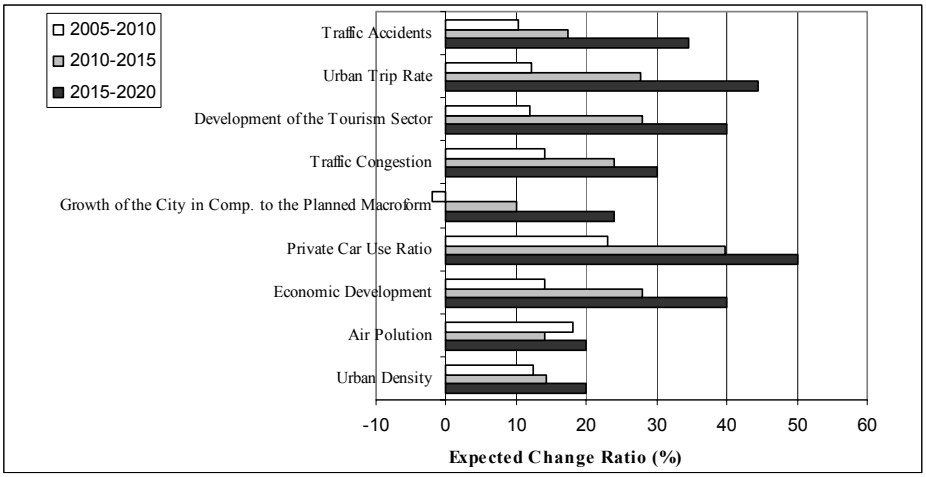

Fig. 3. Expected change ratio of Trends in time

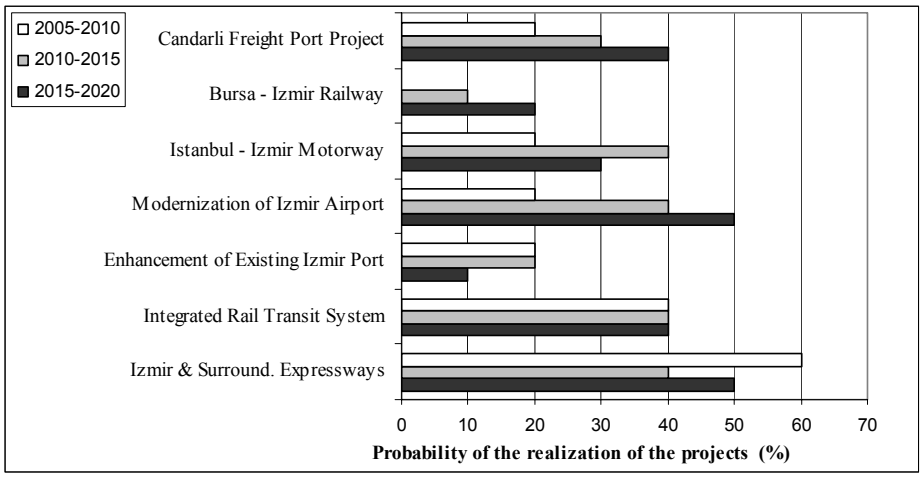

Fig. 4. Probability of the realization of the projects in time

According to the realization probability of the projects in time (results in Table 6), the realization of the projects such as Candarli Freight Port and Modernization of the Airport, Bursa-Izmir Railway are foreseen to extent over longer periods of time (2015-2020), while the Istanbul-Izmir Motorway would be realized in the second interval of time (2010-2015), and the completion of the Izmir and Surrounding Expressway would be within the first five-year period. But, more equal chance is foreseen for the realization periods for the other projects (Fig.4).

When we analyze the Trend-Time and the Project-Time tables, which are the last two tables, it was observed that the experts could not provide clearly foreseeable and agreed-on results about the future of trends and projects. This situation can be explained by a general uncertainty resulted from non-planned development tradition in our country.

6. CONCLUSION

How the experts interpret the impacts of major transportation projects that have already been launched or will begin soon in and around Izmir metropolitan city and the probability of impacts on the major urban trends are evaluated within the framework of a method by the experts' common view (Delphi method), and then the singular impact results were aggregately evaluated as the raw (impacting) and column (impacted) summary results within a methodology framework of matrice evaluation. Without going into the detailed results of the research, especially the total absolute impact type results and some other interesting results will be outlined here.

As the basic results of this study, the evaluations are made on the aforementioned three impact tables as below:

- On the reliability of the produced matrices with respect to the convergence criterion (whether impact values are being agreed) by the experts,
- Total evaluations on the basis of the total impacts that were defined by the raw (impacting) and column (impacted) summations of the matrices (ATI, PNIL, NTI),
- On the most general impact results (scores) as General impact rates for all matrices.

As the simple methods developed, the impacts were measured as in the separation of "impacting" and "impacted" in the second item above; Absolute (as either positive and negative) impacts (ATI), as the positive and negative impacts separately (PNIL), and finally the net impact as the difference between the positive and negative impacts (NTI). The emphasis is on the absolute type impacts (plus or minus) (ATI) within the context of this research. Especially, for the next study of the modeling based on the cross-impact analysis, which is intended to be the continuation of the current one, where the impacts will be more accurately and precisely defined, the subject of to what degree the project and trends might have impacts upon each is more important than the determination of net impacts (ratio of the positive onto negative).

When the impacts of the transportation projects onto the urban trends are analyzed, the projects of the Integrated Railed Mass Transportation System and the Enhancement of the Existing Izmir Port have the highest absolute impacts (ATI), or in other words, these projects are said to be the most influential (positive or negative) ones on the trends. However, of those, the impacts of the Enhancement of the Existing Izmir Port will be overwhelmingly in negative direction; yet, the modernization of the Airport, Bursa-Izmir Railway and the Candarli Freight Port proposals will significantly have positive impacts. The Development of Tourism Sector is one of the trends that are the most prone to be impacted. The other most impacted trends are consecutively; the Economic Development, the Air pollution and the Ratio of Private Car Use. Those remarkably positively effected trends are the Development of Tourism Sector, the Economic Development and the reductions in Traffic Congestion. Beyond such evaluations, the general impact level (score) for the Project-Trend (PxT) impact analysis is 0.3, the general impact ratio is 1,8, namely the positive impact level is almost twice compared to the negative impact level.

For the impacts of the transportation projects onto other transportation projects, Izmir and Surrounding Expressways, Candarli Freight Port and the Enhancement of Existing Izmir Port are the ones with the most impact power (positive or negative) on the realization of the projects. Those projects, except the Existing Izmir Port, are in the same time the positively impacting projects in general. The Enhancement of the Existing Izmir Port is evaluated as the least affecting project on the others positively, while being the most impacted one from the others. The Modernization of the Airport and the Candarli Freight Port are also the ones that are the most open to be imapcted. Whereas the impact level is 0.3 in total, the general positive impact ratio for the projects is 3.1. Projects impact each other positively in general.

For the impacts of Urban Trends onto other Urban Trends, the Ratio of Private Car Use, the Urban Density, the Traffic Congestion and the Economic development have significant impacts on the other trends. Whereas the City Growth in Compliance with Planned Macroform creates positive impacts, it is, in the meantime, the least affected trend from the

others. Generally, the negative impacts occur largely on the Urban Trip Rate, the Development of Tourism Sector, the Air Pollution, Traffic Congestion, and the Traffic Accidents. The General Score of being impacted is 0.36 and the General Ratio of being positively impacted is very low: 0.44. In short, the trends affect each other negatively.

These results, however, are only the initial outcomes of the expert view, which comprised the first stage, and will be utilized to be initial forecast inputs to the second stage, later, which is the Cross-impact Analysis. Thus, in a sense, they are not really matured results to be accepted as accurate. In the next stage, more realistic results are expected by the method of cross-impact analysis (i.e., the impacts from five matrices will interact simultaneously).

Abbreviations

$\mathbf{x}_{ij}$: Impact value of an "i" project on the "j" trend

P_i : Total absolute impact value of an "i" project onto all trends

T_j : Absolute impact of all projects onto a "j" trend

PNIL : Total impact of all projects onto all trends (separate positive and negative impacts)

NTI : Net Total Impacts of the projects onto the trends

ATI : Absolute Total Impact Score of the projects onto the trends

X : Maximum absolute potential impact value that can be gained from all impact totals

I : Impact level (score)

GIR : General Impact Ratio; the absolute value obtained from ratio of positive impact over the negative

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