Impacts of High Speed Trains on Tourism Development: A Case Study of Ankara Konya High Speed Rail Lines

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Abstract
Regional and urban transportation systems have a key role in developments in tourism activities. While people prefer air and maritime transportation in cross-country travels, they may prefer rail and road transportation in domestic travels. In domestic travels, alternatives related to transportation play an important role in terms of increasing tourism demand. On the other hand, passenger transportation alternatives such as high speed rail systems, light rail systems, subways and trams in urban areas can play an important role in customer behaviors related to tourism demands. In the past, some factors, such as history, entertainment, food and beverage had an importance; nowadays factors related to transportation have begun to gain importance for customers for comfortable, safe, cheap, speedy and safe travels. If available, high speed trains are mostly preferred by passengers because of these advantages. High speed trains can help reduce the economic and external costs of transportation. International and domestic tourism demands may increase thanks to high speed trains (HST). This paper analyses the impacts of High Speed Trains (HST) on regional and urban tourism development. On the other hand, HST can provide unusual tourism alternatives, passengers may travel to places of interest which are not included in their original itinerary using HST. However, HST can increase tourism demand. Before and after the opening of the high-speed train services, occurred changes related to tourism demand, including customers’ behaviors were taken into consideration and they were analyzed as variables. In this study, the high speed rail line between Ankara and Konya cities is selected as a case study. Impacts of HST on tourism demand are evaluated with the data obtained in the surveys.

Keywords: High speed trains; Tourism; Regional development; Transportation

Introduction
The travel and tourism sector is very important for the economic well-being of both developed and developing countries. Even in the current economic crisis several international organizations argue that the tourist industry is a key driver for leading economies out of the crisis [1]. Nevertheless, a debate exists about the impact of the travel and tourism sectors on the environment. Tourism is one of the main sources of wealth for numerous destinations [2]. Tourism transportation represents one of the essential parts of the tourism system [3]. The high speed rail system is an important part of domestic and international passenger transportation systems. Also, it can provide a successful connection between the passenger transportation modes. With globalization, technological developments have caused dramatic changes in social and economic life. One of these changes has been seen in tourism behaviors. Any new technological applications to revolutionize transportation will also exert a substantial influence on tourism [4]. Technological improvements in transportation have led to the diversification of passenger transportation alternatives. In the past, while people had to choose unimodal transportation between departure and arrival points, nowadays they can choose multiple transport types in the same journey. The time–space effects of HST travel have significantly altered economic geography, shrinking continents [5]. Tourists have the opportunity to choose from different passenger transport types, taking into account the different advantages of these transport alternatives. Short travelling times, low ticket fares, accessibility and safety are the main determinants of travel demands as well as comfortable journeys. The significance of these factors can vary for each user. Priority status of these factors can vary according to the customer’s expectations, income and other conditions. In addition to users, operators, governments, local authorities, international institutions and habitants are also affected by negative and positive effects of different types of transportation. Each party of transport has different expectations for transport operations. For example; while the expectations of users are fast, cheap, comfortable and safe journeys; local authorities, governments and international institutions aim to minimize environmental impacts. Tourists arriving at international cities need mobility and few decide (or can afford) to hire private transport. Because of this, the public transport system is an essential service for this population, especially in cities large enough to need bus, metro and train systems [6].

According to passenger behaviors and instant situations, the significance of these parameters can vary for each travel and passenger. Nevertheless, because they are focused on optimizing transport alternatives, users’ choices are mostly rational. As a result, within the framework of their needs and present situations, passengers can prefer the most appropriate transport type from all of the alternatives. As a result, if the transport alternatives can be increased, preference of passengers may be more rational. On the other hand, optimal transport solutions can also be possible as a result of an increase in transportation alternatives. When the commercial speed increases, other parameters related to travel behavior can also vary depending on the effects of the commercial speed. This study focuses on the impacts of commercial speed on the other parameters related to the passengers’ choice of transport. In addition to that, since there is a correlation between

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commercial speed and effectiveness and efficiency; this study proposes that, if other parameters are constant and commercial speed increases, productivity and effectiveness of transportation can also increase.

Methodology

This paper examines the factors that affect passengers’ choice of transport modes. The main aim of this study is to define the relationships between the factors and compare the advantages of transport modes within the framework of characteristics such as effectiveness, productivity, price and travel times. Particularly, impacts of high speed trains on regional developments are analyzed in comparison to conventional train, air and road transportation. All the parameters of passenger transportation alternatives are evaluated in terms of monetary values and they related to passenger transport alternatives are described as a constant value. In this study, a model of travel time cost is developed as a methodology to define travel demands related to tourism with the factors affecting it directly and indirectly. Travel time costs are modelled with parameters such as number of traveling passengers per transport operation, unit time costs, and travel times using that transport modes, occupancy rates of vehicles per operation. Travel time costs are evaluated for each transport mode: air, conventional rail, road and high speed rail. The methodology can be formulated as below;

\[ u_{it} = \frac{n_i \cdot p_i}{y_i \times d_i \times t} \]  
(1)

\[ t = \frac{d}{s} \]  
(2)

\[ t_{oc} = \frac{n_i \cdot u_{it} \times t \times o_{ci}}{n_p} \]  
(3)

While \( u_{it} \) represents unit cost of travel times, \( n_i \) is the national income per capita, \( y_i \) is the number of days in a year, \( d_i \) is the hours in a day, \( t \) is unit travel time for each transport mode, \( o_{ci} \) is occupancy rate for \( i \) type of transport modes, \( t \) is travel times, \( d \) is distance between the departure and the arrival points, \( s \) is speed for \( i \) modes of transport.

Passenger Transportation Indicators

In this study, travel time and cost of passenger transportation service in the tourism sector are analyzed within the framework of five passenger transportation alternatives: buses, automobiles, airways, conventional trains and high speed trains. Each alternative has different characteristics and a great number of specific conditions. In order to compare the different types of transport, parameters related to the cost of time are defined in terms of fixed value. To determine the total cost of travel time within the framework of passenger transport alternatives, national income per capita were considered as constant value and were converted to the monetary value per minute. On the other hand, distance is considered as a variable factor. When the distance increases, changes related to the cost of travel time are observed. While the number of days in a year, hours in a day, minutes in an hour and occupancy rates are fixed values; speed, distances, number of passengers per transport operation are variable factors. Variables can be seen below in Table 1.

According to Table 1, when the distance increases, cost of travel time is also increased for each passenger transport alternative. Whereas, the costs of travel time for each transport type is close to each other in short distances. When the distance increases, differences between travel time costs of transport modes gradually increase. Buses, automobiles and conventional trains cannot compete with airways and high speed trains (HST) in terms of these indicators. On the other hand, these transport modes are slow and their passenger carrying capacities, excluding conventional trains, are low compared with airways and HST (Figure 1).

Road transportation

Automobiles cannot be a good solution compared to other transport modes in terms of their passenger capacity. On the other hand, because of its individual characteristic, it cannot be used for public and tourism transport. When accidents, casualties and injuries are considered, buses cannot provide a safe transportation opportunity. On the other

| Buses | Automobiles | Airways | Conventional Train | HST |
|-------|-------------|---------|--------------------|-----|
| d     | si          | t       | np                 | tct |
| 20    | 93          | 13      | 45                 | 0.27 |
| 40    | 90          | 26      | 45                 | 0.55 |
| 60    | 90          | 40      | 45                 | 0.82 |
| 80    | 90          | 53      | 45                 | 1.09 |
| 100   | 90          | 67      | 45                 | 1.37 |
| 120   | 90          | 80      | 45                 | 1.64 |
| 140   | 90          | 93      | 45                 | 1.91 |
| 160   | 90          | 107     | 45                 | 2.19 |
| 180   | 90          | 120     | 45                 | 2.46 |
| 200   | 90          | 133     | 45                 | 2.74 |
| 220   | 90          | 147     | 45                 | 3.01 |
| 240   | 90          | 160     | 45                 | 3.28 |
| 260   | 90          | 173     | 45                 | 3.56 |
| 280   | 90          | 187     | 45                 | 3.83 |
| 300   | 90          | 200     | 45                 | 4.1  |
| 320   | 90          | 213     | 45                 | 4.38 |
| 340   | 90          | 227     | 45                 | 4.65 |
| 360   | 90          | 240     | 45                 | 4.92 |
| 380   | 90          | 253     | 45                 | 5.2  |
| 400   | 90          | 267     | 45                 | 5.47 |

Table 1: Indicators of passenger transportation alternatives.
hand, the number of transport operations is not enough to respond to the needs in terms of price and customer satisfactions. Especially in longer distances, number of expeditions carried out by buses may be low. Therefore, passenger transport operations cannot be productive and effective. More importantly, when the distance travelled by buses increases, the cost of travel time also increases. Cost of travel time and elapsed transport time between two points is extremely high in travelling by conventional trains compared to other types of passenger transportation since conventional train is the slowest transport mode among these alternatives. According to the figures related to the cost of travel times of transportation modes, the most advantageous types of transportation are air and high speed trains. Especially in longer distances; buses, automobiles and conventional trains cannot compete them. Buses and coaches can be operated more frequently in short distances and they may be used in short distances providing advantages for transfers between long distance transport modes.

**Air transportation**

While the low cost of travel time is low in airways, fares are high compared to other passenger transport alternatives. It should also be kept in mind that, the process before and after the flight, boarding and leaving the plane may take much time. The geographical and quantitative comparison of railway and air travel is a delicate matter, since the ways in which the two modes operate differs [7]. Airlines may be a success in long distance passenger transportation. This transportation type can create the best solution for very long distance transportation that cannot be equaled by other passenger transportation types. As a result, passengers can prefer air transport in long distance tourism transportation. When fares of airways are similar or close with other passenger transport types, air may be preferred. According to Froixh; for high-speed long-distance services of about one to three hours of train travelling time, or distances of 200-600 km, trains have gained travelers from cars, coaches and airlines [8]. In general, tourists can choose airways, if the distance is over 600 kilometers. High speed trains can be preferred at distances of up to six hundred kilometers by passengers in international or domestic tourism transport.

**Turkish domestic passenger transport and tourism**

In Turkey, both freight and passenger transportation have gained new perspectives at the beginning of the 2000s. A great number of structural changes have been observed in air, rail and road transportation. To global competition, organizational structure of the airline sector has changed. This sector has become more competitive and flexible in the global scale. Turkish airline industry continues its improvements year after year. Especially, it has grown a capacity and a capability in domestic flights compared to their competitors and alternative transport modes. In the past, Turkish transport system was completely dependent on road transportation.

Nowadays, passenger transportation is largely carried out by road transportation in Turkey. Although important improvements have been observed in the railway passenger transportation in the recent years, it has not yet reached a sufficient level. Road passenger transportation has negative impacts such as higher energy consumption, environmental and air pollution, noise, accidents and economic and social losses. On the other hand, road transportation cannot provide users’ expectations such as short travel times, cheap, comfortable and safe travel at the required level. In Turkey, buses are largely used in passenger transportation. They cause external costs of transportation such as environmental and air pollution, noise and economic losses. Buses are not an effective and productive transport alternative for sustainable transportation and tourism policies. They cannot be the single transportation option for the tourism sector but can only be a complementary type of transportation. Road transportation may provide integration between air and rail transport.

**High Speed Trains in Turkish Tourism Market**

High speed trains are the most important component of the tourism sector as well as of transport activities. Especially in domestic tourism activities, they can provide the best solution in the middle and long distances compared to other transportation alternatives. Beyond its direct impacts, HST will inevitably have longer-term indirect impacts on the geography of economic activities, simultaneously on regional (inter-regional), urban (intra-regional) and local (intra-urban) scales [9].

On the other hand, passengers can prefer this transport type when they consider advantages such as minimizing travel costs, high speed, low fares and safer transportation. In addition to that, high speed rail systems can affect the urban transport systems and tourism activities of the cities. Consequently, the analysis on how urban tourism destination choices may be affected by HSR systems needs to identify the elements affecting the choice of destination and the role played by transport [10]. HSR trains operating at a maximum speed of up to 350 km/h were reduced to 300 km/h; those trains with a maximum speed of up to 250 km/h were reduced to 200 km/h. and trains with a maximum speed of up to 200 km/h were reduced to 160 km/h [11]. In
2002, since road transportation is not a sustainable and safe transport mode, Turkey’s policy makers were seeking an effective solution to better transportation operations and to balance the use rates of transportation modes. They took a decision to improve the railway system in Turkey. Unlike the past, they focused on the high speed rail systems. According to Turkish policy makers, high speed rail systems might be the best solution for transportation problems. This policy has become a prioritized strategy. Compared with other successful examples around the world. High Speed Train operations are a fairly new in Turkey. TCDD started the construction of the high speed rail line between Ankara and Eskisehir in 2003. Its test driving was carried out on 23 April 2007 and the first operation began on 13 March 2009. Despite the use of HSR for a short time, TCDD has developed its own capabilities and capacity related to high speed rail operations within a very short period. Another important part of these systems is high speed rail lines located between the cities of Konya and Ankara. High speed trains have begun to run on 24 August 2009 between Ankara and Konya. In both directions high speed train operations are carried out 16 times a day. While the average number of passengers who travelled by conventional trains before the high speed trains was 572, this number reached to 7,500 after high speed trains were opened for service. Between 24 August 2011 and 31 December 2012, the total number of expeditions is 6705 and the number of passengers traveling by high-speed trains is observed as 1,778,148. In 2012, while the total number of passengers is 1,371,152; average number of passengers who were traveling by high speed trains are increased and it has reached to 114,293. The average occupancy rate of these trains is observed as 62% [12]. High speed trains which operated between Konya and Ankara were used by averagely 3,747 passengers per day in 2012 [13]. Between 1 December 2011 and 9 February 2012, the number of passengers went up depending on the increased number of daily HSR operations. In this period, the number of HSR expeditions has increased from 8 to 14. But due to severe winter conditions, the number of expeditions was reduced to 10, consequently, the number of passengers decreased. This situation shows that there is a correlation between travel demands and the number of expeditions. In addition, the number of passengers who prefer speed trains may vary depending on various factors such as enrollment period, festivals and special occasions. According to the statistical data of TCDD, the number of passengers is increasing at a very short period. Another important part of these systems is high speed rail operations within the same day with organized day tours. On the other hand, high speed trains can affect tourism activities in terms of economy, safety, speed and environmentally-friendly transport. There are no foreseeable technological revolutions in the short and medium terms in terms of fuel and therefore emissions; the potential for growth remains substantial [16]. Many factors are taken into consideration by tourists and passengers while they take a decision related to cities where they travel and transport types they use. Passenger transportation is affected by many factors such as environment, social

![Figure 2: Number of passenger in Konya – Ankara HST line.](image-url)
and cultural habits of passengers, safety and security, comfort and economy, low ticket prices.

Travel time and ticket fares are top priority factors in the decisions and behaviors of the passengers compared to other factors. While tourists and passengers decide the transport type, take into account ticket fares and travel times. If travel time is too long, this transport type may not be preferred by passengers even if the ticket price is low. At the same time, if ticket fares are too high and travel time is short, passengers may show the same behavior.

As seen in Figure 5, travel time is very long in travel by conventional
connections between tourist source markets [19]. If preferences of haul tourism, relies heavily on the availability of affordable transport. The reason for this uncertainty is that tourism, and in particular long-distance travel, cannot be possible by airlines. According to already Ivaldi and Vibes, due to high fixed costs in the airline industry, cheap transport compared to other alternatives; however, air is the fastest transport type. As a result of this analysis, when the distance increases, effectiveness and popularity of airlines decrease. The high speed rail system may be a successful transport type in short and middle distance travel. Especially, when all the transport modes compared to each other in terms of ticket fares, travel costs and travel times, high speed rail system have obvious superiority compared to other transport types. On the other hand, a high speed rail system can provide a systematic and orderly travel opportunity for passengers and tourists. As a result of its systematic and orderly structure, high speed rail system can provide more reliable, productive and effective passenger transportation system. The existence of a high speed rail system in a country also affects tourism demands and tourists behaviors. Passengers and tourists seek comfortable, safe, cheap and fast transport alternatives in travel and they can choose the touristic countries according to the advantages of transport alternatives.

Results

When passenger transport alternatives compared with each other in terms of parameters such as costs and travel times all of them were evaluated within the framework of a travel time cost model. As a result of this analysis, when the distance increases, effectiveness and productivity of passenger transportation by airline can also increase. Whereas, in distances less than 600 kilometers; productivity, effectiveness and popularity of airlines decrease. The high speed rail system is the most effective passenger transportation system in distances less than 600 kilometers. This system is a more economic, safe and fast type of passenger transport compared to other alternatives. It can provide fast, comfortable and low-price transport for passengers and tourists. When these advantages of high speed trains are taken into consideration, unit ticket fares can be possible in travels by high speed trains.

While the unit ticket fares are 0.090 €/kilometers in travel by high speed trains, this value is higher in other passenger transport alternatives. In airlines, this value reaches to 1.79 €/km and is very high compared to other alternatives; however, air is the fastest transport type. Due to high fixed costs in the airline industry, cheap transport cannot be possible by airlines. According to already Ivaldi and Vibes, high speed railway lines are a significant source of competition for the air transport sector (Figure 6) [17].

Conclusion

The high speed rail system may be a successful transport type in short and middle distance travel. Especially, when all the transport modes compared to each other in terms of ticket fares, travel costs and travel times, high speed rail system have obvious superiority compared to other transport types. On the other hand, a high speed rail system can provide a systematic and orderly travel opportunity for passengers and tourists. As a result of its systematic and orderly structure, high speed rail system can provide more reliable, productive and effective passenger transportation system. The existence of a high speed rail system in a country also affects tourism demands and tourists behaviors. Passengers and tourists seek comfortable, safe, cheap and fast transport alternatives in travel and they can choose the touristic countries according to the advantages of transport alternatives.

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