Investigating the Relation between Tehran Metro in Urban Traffic Domain to Increase Tehran Citizens’ Satisfaction

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A B S T R A C T

Metro is a rail rapid transit method. All or a part of metro has been constructed underground, transporting passengers within city through several certain routs with the accessible and constant stations on the earth. The purpose of the present study is to investigate the performance of Tehran metro in urban traffic domain to increase Tehran citizens’ satisfaction. However, due to residing and floating citizens in metropolis of Tehran, infinite population formula is used to determine statistical population. To determine the size of statistical sample, all people using credit tickets have been studied. Required data has been gathered using questionnaire. To analyze the obtained data, Cronbach’s alpha, Pearson correlation coefficient and Friedman test have been used through SPSS Software. According to the research findings, all the studied variables influence citizens’ satisfaction.

INTRODUCTION

Due to high population density, living and working in crowd cities is increasingly becoming difficult and the lack of ability to remove this population density to facilitate traffic is regarded as a threat for the development and preparation of cities’ economic growth. Currently, in many main streets of Tehran City, from 7 to 12 and around evening and night, especially in the beginning of schooling year, the traffic of vehicles is less than the number of pedestrians and a slight accident or problem in roads causes a long obstruction [17]. Therefore, the municipality of Tehran tries to decrease such problems through some actions such as increasing the number of urban metros and railways, buses, taxies, and BRT buses to convince citizens to use public transportation vehicles. The most important method of convincing citizens to use public transportation is to gain and maintain their satisfaction from the provided services and continuous opinion polling to improve the status quo [16]. Metro is one of the most important ways of solving traffic and air pollution in the world. Rapid development of metro lines is a vital and inevitable necessity of the city. Metro can also be justified in terms of economic, social, health, and urban traffic aspects [7] and [22]. As the qualitative advantages of using metro, it can be referred to the possibility of within city travels and the communication of the suburb with the center of Tehran with appropriate speed, safe and secure traffic with high technology, the decrease of bio-environmental pollutants, urban transportation optimization, the decrease of citizens’ time waste, and the decrease of driving accidents [16]. As the most clean, healthiest, rapidest, safest, and most efficient transportation network, metro has an ignorable role in solving economic-social and environmental problems due to traffic [21]. Accordingly, the present study attempts to evaluate the performance of Tehran metro in urban traffic domain to increase Tehran citizens’ satisfaction since as the most important capitals of this organization, citizens have a critical role to modify shortages and evaluate performances.

Theoretical Principles:

Introducing Metro Transportation System:

Urban train (metro) is one of urban transportation systems which have been widely used in big cities. As its advantages, it can be referred to the decrease of noise pollution, less energy consumption, less occupation of earth, and high security. Also, due to the guarded path, the number of accidents and death is obviously decreased [24]. With the capability of mass of cargo and passenger, railway transportation consumes one-seventh fuel used in road transportation. Therefore, such consumption allocates only 20% of Gasoline
consumption of the country. Decreasing the number of travels through personal vehicles is one of the most important bio-environmental benefits of metro transportation system [12].

**Introducing Traffic Factors:**
Traffic factors have four basic parts including human, vehicle, road, and rules such that human are pedestrians, passengers or driver and with the growth of population in central parts of city, they cause heavy traffic by unnecessary travels. Lack of observing traffic rules by pedestrians as well as the growth of personal and public vehicles without considering the capacity of streets and parking lots cause high traffic in cities; roads with irregular widths also causes traffic; sometimes, rules are temporarily and improperly executed leading to the intensification of traffic. In the present study, it has been attempted to find some strategies of controlling traffic through investigating traffic actions [10] and [23].

**The Efforts of Traffic Management Based on Traffic Purposes of Transportation and Traffic Organization:**
There are various methods to design and apply traffic management in cities. The most common method used in a comprehensive urban traffic management design involves the following [15] and [24]:

1. Building appropriate sidewalk for pedestrians (security, lightness, appropriate width, pavement)
2. Controlling street parking and the design of optimal use of parking (access, the distance between parking and destination, security of parking)
3. The actions related to the increase of the number of urban buses
4. The actions related to BRT buses
5. Enacting rules related to taxies (the number of taxies, the path of movement, the facilities of taxies)
6. Street lining (the quality of color, appropriate color, lining place)
7. Modifying street (decreasing traffic, controlling priority, building square)
8. Installing traffic signs
9. Actions related to traffic signs
10. Limitation making
11. Executing cultural programs and training people regarding the necessity of observing traffic rules for pedestrians and observing the enacted rules
12. Actions related to metro and the increase of various paths

**Improving Service Providing in Tehran Metro:**
In addition to attempting to provide safe and timely transportation of passengers, Tehran Urban and Suburban Railway Company put some other projects in its agenda in 2011 [7] and [17], including:

1. Construction prayer room in stations: to appreciate passengers and promoting the culture of praying in Tehran and suburb metro stations, the project of constructing prayer room has been started in all metro stations;
2. Building appropriate stations for disabled and blinds: this highly important project has been considered to facilitate traffic of disabled and blinds. It has been executed in 7 stations including Bagheri, Tehran Pars, Golbarg, Fadak, Melat, Baharestan, Hasan Abad, Sarsabz, and Imam Khomeini.
3. Installing automatic ticket-selling machine: this project has executed to facilitate buying ticket and prevent wasting passengers’ time in 90% of the stations. The presence of these machines leads to the decrease of references to ticket selling [2].
4. Evaluating passengers’ satisfaction: to evaluate passengers’ satisfaction, new opinion polling sheets have been designed and their opinions have been polled several times. Currently, 80% of passengers are completely satisfied with the opportunities provided by Tehran Urban and Suburban Railway Company.
5. Improving technical equipment’s: with respect to the specificity of trains’ control equipments and their communication with command centers and using electronic and telecommunication technology on the one hand and the improvement of technology level in this category on the other hand, and to facilitate service providing for passengers, the improvement of command centers and radio system was put in the agenda of company [7].

**Performance Evaluation:**
Performance evaluation refers to a set of activities and actions performed to increase the level of optimal use of facilities and resources to achieve objectives as well as an efficient economic method [1] and [5]. As one of the organizations whose function is to supply public benefits, Tehran metro plays a highly important role in urban system and traffic control [11]. With all the efforts performed by Metro organization to decrease traffic on the streets of Tehran, currently, there are still some shortages in terms of evaluating citizens’ satisfaction. So, it is necessary that Tehran metro focus on those points in which public satisfaction contribute their successful execution. The most important point from which Tehran metro Company can start is to investigate its performance to decrease traffic, gain citizens’ satisfaction and try to convince citizens to use metro to travel in the city [6].
Customer Satisfaction:

From the early 1990s, scholars found that customer oriented organizations outperformed over market oriented organizations in the global competitive markets [10]. Today, productive and service providing organizations consider customer satisfaction as an important criterion to measure the quality of their work and such a trend is still growing. The importance of customer and his/her satisfaction is something referred to competition at global level. Meanwhile, comprehensive quality management has not also ignored such a fact while it has been concerned with better and more satisfying customers’ expectations [8]. A successful organization is an organization which can meet customers’ needs, deliver and distribute regularly and on time and provide some services beyond their expectation in addition to provide high quality products and services to customers. In fact, the primary goal of a successful organization is to achieve the highest level of customer satisfaction but not more benefit since their satisfaction will be automatically followed by the increase of benefit [4].

The Advantages of Customer Satisfaction:

Although every successful marketer tends to provide services to satisfy customers, it is not their only goal. Companies and institutes cannot ignore their basic objectives such as achieving competitive advantage or creating benefit. Maintaining good customers in long term is more useful than attracting new customers to replace with customers left the relation [14]. Customers who are highly satisfied with an organization state their positive experiences for others and so, they play an advertising factor for that organization, leading to the decrease of the cost of attracting new customers. Such a fact is particularly important for professional services providers since their reputation and stating their positive points and advantages by others is a source of key information for new customers. High customer satisfaction is a kind of insurance against probable mistakes of company and as a result of changes related with services production, they will be inevitable [9].

Fig. 1: The advantages of customer satisfaction and the quality of services [21]

Given to the discussed theoretical concepts, the conceptual model of the research (Shayeste, 2003; Ziari et al., 2011) can be shown as follow:

Fig. 2: The research conceptual model

Considering the research conceptual model, the following hypotheses can be presented to be investigated in the study:

The main research hypothesis: there is a significant relation between the performance of Tehran Metro and citizens’ satisfaction.

The secondary research hypotheses:
1. There is a significant relation between the price of Metro tickets and citizens’ satisfaction.
2. There is a significant relation between departure time of Tehran Metro and citizens’ satisfaction.
3. There is a significant relation between informing and citizens’ satisfaction.
4. There is a significant relation between service providing by Tehran Metro and citizens’ satisfaction.
5. There is a significant relation between considering the needs of citizens by Tehran Metro and citizens’ satisfaction.
6. There is a significant relation between heating and cooling systems of Tehran Metro and citizens’ satisfaction.

**Literature Review:**

In an article entitled “the stimulation of waiting time of passengers in metro stations and investigating its influencing factors using simulation approach”, Nouri Hasan Abadi and Nik Fal Azar (2011) found that in urban public transportation systems, determining waiting time of passengers in stations is of high importance to make use of the provided services. Simulation is an instrument through which time can be compacted.

In MA thesis entitled “investigating railway (rapid transit) transportation systems”, Shakeri (2012) found that due to the comprehensive development of technology, more security, less transportation cost, lower energy consumption, less destructive environmental effects, and higher transportation capacity in different railway transportation systems relative to other transportation systems, the use of railway system has been accelerated in most of developed and developing countries.

Baharvand (2012) investigated the role of information technology to control and decrease traffic. He stated that traffic is an unpleasant phenomenon which occurs as a result of the growth of modernization and urbanization. Therefore, most of experts of traffic consider that as the main solution of culture building for information technology, using information technology and new electronic experiences can solve the problem of traffic.

Partnership (2000) also evaluated the quality of urban railway transportation. As a part of total transportation system, urban transportation is one elements of urban communication system undertaking traffic and transportation of human and cargo between these adjusted spaces of uses with the aim of access between various uses in urban area.

Diken (2001-2003) studied the development of urban trains and their performance. As he found, the most important objectives and services of a steady transportation system include supplying the maximum security and security which can be applied on life and buildings, supporting economic welfare and steady quality of life, and considering environmental heritage for future generations.

Again, Gein (2009) examined rapid transit system of BRT buses in United States and Southern America. As they concluded, using full passenger vehicles based on the principle of more passenger transportation with fewer vehicles is superior over other transportation alternatives in terms of various aspects including density, security, air population, energy consumption, etc. accordingly, finding strategies of encouraging citizens to use public transportation can solve many problems existing in cities.

**Methodology:**

The present research was a descriptive-correlation survey study. In terms of the purpose of the research, it was an applied study. Applied study is a research performed to solve an individual, cumulative or social problem. Statistical population included all customers and citizens using credit ticket. To determine the statistical sample, infinite population method was used (N = 384). To gather the required data, filed and library methods were employed. In the study, two standard questionnaires of citizens’ satisfaction measurement and metro performance measurement were applied. The questionnaires were Likert Scale based (5-alternative). To evaluate the reliability of the questionnaires, Cronbach’s alpha was used. The computed alpha was 0.86 and 0.89 for the first and second questionnaires, respectively.

**Findings:**

To test the normality of data distribution, Kolmogorov–Smirnov test was used. Then, to test the research hypotheses, Pearson correlation coefficient was applied. Finally, Friedman test was used to prioritize the alternatives.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample number</th>
<th>Test statistic</th>
<th>Sig</th>
<th>Test result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating and cooling system</td>
<td>384</td>
<td>0.803</td>
<td>0.539</td>
<td>Normal distribution</td>
</tr>
<tr>
<td>Ticket price</td>
<td>384</td>
<td>0.522</td>
<td>0.744</td>
<td>Normal distribution</td>
</tr>
<tr>
<td>Departure time of trains</td>
<td>384</td>
<td>0.744</td>
<td>0.636</td>
<td>Normal distribution</td>
</tr>
</tbody>
</table>
With respect to the obtained results, all the variables have normal distribution; accordingly, Pearson test can be applied. Based on the research model, the research hypotheses are tested.

The main hypothesis: “there is a significant relation between the performance of Tehran metro to decrease traffic and citizens’ satisfaction”.

Table 2: The result of testing the main hypothesis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Error level (α)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>the performance of Tehran metro to decrease</td>
<td>0.755</td>
<td>0.05</td>
<td>0.000</td>
</tr>
<tr>
<td>traffic and citizens’ satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to Table 2 and considering significance level of Pearson correlation coefficient (P-value = 0.000 < 0.01), the main hypothesis is confirmed indicating that there is a significant relation between the performance of Tehran metro to decrease traffic and citizens’ satisfaction.

The first secondary hypothesis: “there is a significant relation between ticket price and citizens’ satisfaction.”

Table 3: The result of testing the first secondary hypothesis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Error level (α)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>ticket price and citizens’ satisfaction</td>
<td>0.310</td>
<td>0.05</td>
<td>0.000</td>
</tr>
</tbody>
</table>

According to Table 3 and considering significance level of Pearson correlation coefficient (P-value = 0.000 < 0.01), the main hypothesis is confirmed indicating that there is a significant relation between ticket price and citizens’ satisfaction.

The second secondary hypothesis: “there is a significant relation between departure time Tehran metro and citizens’ satisfaction.”

Table 4: The result of testing the second secondary hypothesis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Error level (α)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>departure time and citizens’ satisfaction</td>
<td>0.401</td>
<td>0.05</td>
<td>0.000</td>
</tr>
</tbody>
</table>

According to Table 4 and considering significance level of Pearson correlation coefficient (P-value = 0.000 < 0.01), the main hypothesis is confirmed indicating that there is a significant positive relation between departure time of Tehran metro and citizens’ satisfaction.

The third secondary hypothesis: “there is a significant relation between informing citizens by Tehran metro and citizens’ satisfaction.”

Table 5: The result of testing the third secondary hypothesis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Error level (α)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>informing citizens by Tehran metro and citizens’ satisfaction</td>
<td>0.484</td>
<td>0.05</td>
<td>0.000</td>
</tr>
</tbody>
</table>

According to Table 5 and considering significance level of Pearson correlation coefficient (P-value = 0.000 < 0.01), the main hypothesis is confirmed indicating that there is a significant positive relation between informing citizens by Tehran metro and citizens’ satisfaction.

The fourth secondary hypothesis: “there is a significant relation between service providing by Tehran metro and citizens’ satisfaction.”

Table 6: The result of testing the fourth secondary hypothesis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Error level (α)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>service providing by Tehran metro and citizens’ satisfaction</td>
<td>0.595</td>
<td>0.05</td>
<td>0.000</td>
</tr>
</tbody>
</table>
According to Table 6 and considering significance level of Pearson correlation coefficient (P-value = 0.000 < 0.01), the main hypothesis is confirmed indicating that there is a significant positive relation between service providing by Tehran metro and citizens’ satisfaction.

The fifth secondary hypothesis: “there is a significant relation between citizens’ need and citizens’ satisfaction.”

Table 7: The result of testing the fifth secondary hypothesis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Error level (α)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>citizens’ need by Tehran metro and citizens’ satisfaction</td>
<td>0.595</td>
<td>0.05</td>
<td>0.000</td>
</tr>
</tbody>
</table>

According to Table 7 and considering significance level of Pearson correlation coefficient (P-value = 0.000 < 0.01), the main hypothesis is confirmed indicating that there is a significant positive relation between citizens’ need and citizens’ satisfaction.

The sixth secondary hypothesis: “there is a significant relation between heating and cooling system of Tehran metro and citizens’ satisfaction.”

Table 8: The result of testing the sixth secondary hypothesis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson correlation</th>
<th>Error level (α)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>heating and cooling system of Tehran metro and citizens’ satisfaction</td>
<td>0.683</td>
<td>0.05</td>
<td>0.000</td>
</tr>
</tbody>
</table>

According to Table 8 and considering significance level of Pearson correlation coefficient (P-value = 0.000 < 0.01), the main hypothesis is confirmed indicating that there is a significant positive relation between heating and cooling system of Tehran metro and citizens’ satisfaction.

Testing the research hypotheses revealed that all the research variables have been confirmed in the model. Here, the variables are prioritized to contribute Tehran Metro Company can use the results obtained by the present study to increase citizens’ satisfaction.

\[ H_0 \]: the preferences are identical.
\[ H_1 \]: at least two preferences are different.

Table 9: Mean of ranks

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean of ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating and cooling system of Metro</td>
<td>4.72</td>
</tr>
<tr>
<td>Ticket price</td>
<td>3.23</td>
</tr>
<tr>
<td>Departure time</td>
<td>4.36</td>
</tr>
<tr>
<td>Considering citizens’ needs</td>
<td>4.68</td>
</tr>
<tr>
<td>Informing citizens by Tehran metro</td>
<td>2.65</td>
</tr>
<tr>
<td>Providing services by Tehran metro</td>
<td>4.43</td>
</tr>
<tr>
<td>The performance of Tehran metro to decrease traffic</td>
<td>3.97</td>
</tr>
</tbody>
</table>

Table 10: Friedman test

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>384</td>
</tr>
<tr>
<td>Chi-square</td>
<td>0.524</td>
</tr>
<tr>
<td>Df</td>
<td>116</td>
</tr>
<tr>
<td>Sig</td>
<td>0.000</td>
</tr>
</tbody>
</table>

As shown in Table 10, since significance level is less than 0.05, \( H_0 \) (the preferences are identical) is rejected and \( H_1 \) (at least two preferences are different) is confirmed. That is, the variables of the conceptual model have different ranks.

Conclusion:

Metro is a rail rapid transit method. All or a part of metro has been constructed underground, transporting passengers within city through several certain routes with the accessible and constant stations on the earth. It has many advantages including the decrease of fuel consumption, the decrease of produced pollutants, the possibility of transporting a large number of passengers securely and rapidly, and saving time and cost of passengers. Various factors influence the increase of efficiency and quality of a public transportation system. Therefore, the present study attempted to investigate the amount of satisfaction in people using metro and the factors influencing their satisfaction. Customers cannot be satisfied based on formulated rules, opinion polling and checking customers’ views collected in suggestions and critiques box, but it is sometimes completely indirect. For example, the color of walls and platforms’ pavement, installed advertising tables and the way of driving trains have allocated a significant portion in satisfaction evaluation. Such a fact explains the research
findings since the studied variables are of indirect factors influencing customers; satisfaction. In the present research, it was found that indirect factors such as metro ticket prices, the way of informing citizens, considering their needs and demands, the way of providing services, and so forth influence citizens satisfaction about the performance of Metro Company. Accordingly, the indirect factors can be prioritized as follow:

1. The importance of heating and cooling systems, modern and update equipments used within wagons to supply citizens’ ease and comfort
2. Considering citizens’ needs and demands
3. The way of providing services for citizens
4. Departure time of train
5. The performance of metro to decrease urban traffic
6. Ticket price
7. The way of informing citizens

Finally, effective public transportation systems should transport a large amount of passengers with a high efficiency and encourage people not to use personal automobiles. One of the most effective ways is to conduct such researches and using their achievements to increase citizens’ satisfaction and encouraging them to use public transportation.

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