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Journal of
Land Use, Mobility and Environment

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SMART COMMUNITIES
BETWEEN E-GOVERNANCE AND SOCIAL PARTICIPATION

SMART COMMUNITIES BETWEEN E-GOVERNANCE AND SOCIAL PARTICIPATION 2 (2014)

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TeMA

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Contents

EDITORIALE	157	EDITORIALE
Rocco Papa		Rocco Papa

FOCUS

Partecipazione e Governance per Smart Cities Più Umane	159	Participation and Governance for More Human Smart Cities
Gabriella Pultrone		Gabriella Pultrone
Social Mobile Marketing: Evolution of Communication Strategies in the Web 2.0 Era	173	Social Mobile Marketing: Evolution of Communication Strategies in the Web 2.0 Era
Stefano Franco		Stefano Franco
L'accessibilità nelle Smart Cities	185	Accessibility in the Smart City
Giuseppe Trieste, Silvia Gabrielli		Giuseppe Trieste, Silvia Gabrielli

LAND USE, MOBILITY AND ENVIRONMENT

LAND USE, MOBILITY AND ENVIRONMENT

The Determinants of Transportation Mode Choice in the Middle Eastern Cities: the Kerman Case, Iran	199	The Determinants of Transportation Mode Choice in the Middle Eastern Cities: the Kerman Case, Iran
Hamid Soltanzadeh, Houshmand Masoumi		Hamid Soltanzadeh, Houshmand Masoumi

TeMA

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Residential Location Preferences.
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and Religious Attributes

G.K. Sinniaha, M.Z. Shahib, G. Vigarc, P.T.Aditjandra

223

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OSSERVATORI

Gennaro Angiello, Gerardo Carpentieri,
Valentina Pinto, Laura Russo, Floriana Zucaro

239

REVIEW PAGES

Gennaro Angiello, Gerardo Carpentieri,
Valentina Pinto, Laura Russo, Floriana Zucaro



THE DETERMINANTS OF TRANSPORTATION MODE CHOICE

IN THE MIDDLE EASTERN CITIES: THE KERMAN CASE, IRAN

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ABSTRACT

Having a precise understanding of the determinants of transportation mode choices and decisions can be under the influence of regional and cultural aspects. This paper outlines such determinants in the Iranian city of Kerman as a representative of the similar Middle Eastern cities located in hot-arid climates and Moslem cultures. The descriptive analysis of the results derived from a short survey that was a part of a larger study conducted in the second half of 2013 indicated that adding to accessibility to public transportation and the convenience of using it can persuade people to shift from car driving to public transit use. The main barriers to bicycling are socio-cultural aspects, while for walking the obstacles are physical and environmental. Increasing the quality of pedestrian infrastructure and spaces is a stronger deterrent than personal attitudes against walking. Such findings show slight dissimilarities from the results of some of the western studies that find the built environment more effective. Chi-square tests indicates that the four variables of gender, household size, age, and household car ownership significantly affect modal choice decisions. These findings can be a general guide for the Middle Eastern planners to promote walking, biking, and public transport use.

KEYWORDS:

Sustainable Mobility; Urban Transportation planning; Transportation Mode Choice; The Middle East; Iran

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中东城市选择交通方式的决定因素——伊朗克尔曼案例研究

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摘要

要准确理解选择和确定交通方式的决定因素，必须要考虑地区和文化方面的影响。本文以伊朗的克尔曼作为气候干热兼穆斯林文化的中东城市的典型代表，整体描述了这些决定因素。对 2013 年下半年研究中一份简单调研结果的描述分析表明，通过增加公共交通的便利性和舒适性，可以促使人们放弃驾车，改乘公共交通。自行车的障碍主要来自社会文化方面，而步行的障碍是生理和环境。改变人们对于步行的负面态度，比改善人行道基础设施和空间质量更有效。这些发现与西方一些认为环境建设更重要的研究略有不同。卡方分布测试 (Chi-square tests) 表明性别、家庭规模、年龄及家庭汽车持有量四个因素对出行方式选择有重大影响。这些发现可以为中东规划者们在推动步行、自行车及公共交通方面提供综合指导。

关键词

可持续交通系统、城市交通规划、交通方式选择、中东、伊朗

1 INTRODUCTION

Identifying the most effective motives behind mobility decisions is essential for planners and decision makers to set transportation policies. The complexity of personal decisions has become more obvious when a wide range of variables including observed and unobserved ones are brought in the analyses. Comparing the significance of different determinants gives the planners the opportunity to distinguish the most influential factors based on which transportation system can be constructed.

Since the dominant factors may be varying in different cultures and climatic conditions, the necessity of stand-alone studies becomes clear. A large body of research about such factors comes from the western countries, while regions with clearly different cultures and climates like the Middle East have been understudied. In case major differences in the affecting factors are seen, the planners and strategists of countries similar to Iran are recommended to make use of the priorities set by this study and the like.

This study tries to explain the factors affecting short-term mobility decisions such as commute and non-work trips by employing a short survey which was conducted in 2013 in Kerman, Iran. The objective is to, firstly, define the factors for personal car, public transportation, bicycling, and walking separately. Secondly, it is aimed to compare the Iranian determinants with the outcomes of the similar western literature. The outcomes are suggested to act as potential generators of mobility behavior change and producers of modal shift through time.

2 DETERMINANTS AFFECTING TRAVEL MODE CHOICE

The determinants affecting modal choice can be divided into two main categories which are physical and personal/societal factors. The physical or environmental factors contain built environment including urban design and transport infrastructure, while the personal/household attributes, personal preferences, lifestyles, income, perceptions, social issues, etc. make up the influential personal/societal aspects. The recent studies have emphasized on the importance of subjective determinants of travel behavior such as life situation and lifestyle as well as environmental factors like urban form. The subjective determinants can include socio-economic and cultural specifications which can have direct or indirect impacts on transportation mode choice. The examples of such works have been conducted on German case studies (such as Scheiner & Holz-Rau, 2010). The weight given to physical issues in the related urban transportation planning literature has been obvious. An example is Zhao et al (2002) who divide the effective factors into five main categories, namely travel mode Level of Service (LOS), accessibility, land use/ urban design, transit users' socioeconomic/demographic characteristics, and finally characteristics of the trips. Only one of the five groups of parameters of this research has been allocated to personal/societal phenomena. Also as Racca and Ratledge (2004) note, the factors which have been frequently examined in the literature are mode travel time, mode costs, income, availability of personal vehicle, parking availability and costs, access to alternative modes, time of the day of transit service and service frequencies, population densities, land use traits, and transit service factors. As a part of physical attributes, urban land use factors such as mix of uses, density, neighborhood design, and job-housing balance have been considered as prominent attributes that determine transportation choices (for example: Holtzclaw et al. 2002; Cervero&Radisch, 1995; Kitamura et al. 1994; Plaut&Boarnet, 2003). A similar category of studies are those that consider the measurable factors related to travel attributes. These characteristics are often other than human-perceived qualities. For example a survey (Neel-Schaffer, 2011) done on Mobile County in Alabama shows that the residents of a typical American county find lack of physical facilities the most important barrier that prevents them from walking/biking. Travel distance/time has also been repeatedly considered as a deterrent to commute bicycle use, for example Antonakos (1994) concluded that trip length in bicycle commute trips is significantly shorter than that of recreational trips.

Combinations of social/attitudinal and environmental determinants have also been studied, such as a research on 7 Czech cities and their suburbs that focused on neighborhood type, accessibility to facilities, socio-economic factors, and individual preferences and lifestyles (Braun Kohlová, 2009).

AUTHOR	YEAR	COUNTRY OR STATE OF OBSERVATION	STUDY TYPE		MODE	STUDIED DETERMINANTS
			SURVEY	RESEARCH		
Scheiner&Holz-Rau	2010	Germany		×	General	Socio-economic, Cultural specifications
Zhao et al	2002	USA		×	General	Level of Service, Accessibility, Land use, Urban design, Transit users, Socioeconomic, Demographic Characteristics, Characteristics of the trips
Racca and Ratledge	2004	USA		×	General	Mode travel time, Mode costs, Income, Availability of personal vehicle, Parking availability and costs, Access to alternative modes, Time of the day of transit service and service frequencies, Population densities, land use traits, Transit service factors
Holtzclaw et al.	2002	USA		×	General	Physical attributes, Urban land use factors, Density, Neighborhood design, job-housing balance
Cervero&Raddisch	1995	USA		×	General	Physical attributes, Urban land use factors, Density, Neighborhood design, job-housing balance
Kitamura et al.	1994	USA		×	General	Physical attributes, Urban land use factors, Density, Neighborhood design, job-housing balance
Plaut&Boarnet	2003	USA		×	General	Physical attributes, Urban land use factors, Density, Neighborhood design, job-housing balance
Neel-Schaffer	2011	Alabama	×		Walking, Biking	Travel attributes
Antonakos	1994	USA	×		Bicycle	Travel attributes
Braun Kohlová	2009	Czech		×	General	Neighborhood type, Accessibility to facilities, Socio-economic factors, Individual preferences and lifestyles
Krizek	2000	Alabama		×	General	Socio-demographic and individual/household attributes
Scheiner&Kasper	2003	Germany		×	General	Socio-demographic and individual/household attributes
Scheiner	2005	Germany		×	General	Socio-demographic and individual/household attributes
Axhausen et al.	2006	USA		×	General	Socio-demographic and individual/household attributes
Scheiner&Holz-Rau	2013	Germany		×	General	Socio-demographic and individual/household attributes
Johansson et al.	2006	Sweden		×	General	Environmental preferences, Safety, Comfort, Convenience and flexibility
Vredin et al	2006	Sweden		×	General	Flexibility, Convenience, Comfort, Environment important
Steg and colleagues	2001	Netherlands		×	Car	Socio-demographic, Socioeconomic variables account
Bhat	1997	USA		×	Car	Personality traits and attributes, Household/individual socio-demographics
Garvill et al.	2003	Sweden		×	Car	Personality traits and attributes, Household/individual socio-demographics
Bhat&Sardesai,	2006	USA		×	Car	Personality traits and attributes, Household/individual socio-demographics
Creemers et al.	2012	Belgium		×	Light Rail	Socio-economics, Attitudinal factors and perceptions
Chatterjee	2011	England		×	Bus	Socio-economics, Attitudinal factors and perceptions
Murray et al.	2011	New Zealand		×	Public Transport	Socio-economics, Attitudinal factors and perceptions
Goldsmith	1992	USA		×	Walking, Bicycling	Traffic safety, Convenience, cost, Valuation of time, Valuation of exercise, Physical condition, Family circumstances, Habits, Attitudes and values, Peer group acceptance
The Gilmore Research Group	2007	USA	×		Walking, Bicycling	Attitudinal factors and perceptions
TDC	2007	Australia	×		Car	Perceptions
Holzer et al	2013	USA	×		Bus, Rail	Bus and rail travel choices

Tab. 1 Summarization of literature related to the determinants of mode choice

Nevertheless a number of other studies have examined the effects of socio-demographic and individual/household attributes. Such variables should be added to other self-selections and psychological decisions like the transportation choices related to residential location (Krizek, 2000; Scheiner& Kasper, 2003; Scheiner, 2005; Axhausen et al. 2006; Scheiner&Holz-Rau, 2013). A Swedish study has demonstrated the significance of individual preferences such as environmental preferences, safety, comfort, convenience and flexibility in determining travel modes (Johansson et al. 2006). Similarly Vredin et al (2006) find personal attitudes about flexibility, convenience, comfort, and environment important in defining modal choices. Steg and colleagues (2001) showed that socio-demographic and socioeconomic variables account for 21% of the car travels. Personality traits and attributes, household/individual socio-demographics as well as awareness of alternative transportation have particularly been focused in similar researches (Bhat, 1997; Garvill et al. 2003; Bhat&Sardesai, 2006). Socio-economics, attitudinal factors and perceptions have been found to be important in choosing light rail transit in Flanders, Belgium (Creemers et al. 2012), bus in England (Chatterjee, 2011), and public transport in New Zealand (Murray et al. 2011). An older study undertaken by U.S. Federal Highway Administration finds a couple of subjective parameters effective in decisions made for choosing walking and bicycling including traffic safety, convenience, cost, valuation of time, valuation of exercise, physical condition, family circumstances, habits, attitudes and values, and peer group acceptance (Goldsmith, 1992).

Personal reasons affecting walking/biking decisions seem to have an undeniable role in shaping modal split. A survey conducted on Washington State shows that people have chosen the following options as reasons for not walking: disability/other health impairment (39%), too busy (18%), don't want/don't enjoy it (5%), other (15%), and don't know (7%). The personal reasons for not biking are: don't know how to ride/no bicycle (45%), don't want to (12%), too busy (12%), no safe place to ride (6%), age (6%), prefer to walk/jog (4%), bad weather (4%), other (6%), and don't know (2%) (The Gilmore Research Group, 2007).

The first most influential factors are related to parking, car availability, and price. Speed and what people perceive about stress and joy as well as awareness about environment are the other causes of decisions. Every respondent provided more than one reason about their choice reasons. The report also shows that Sydney residents use personal car mostly because of its speed and also the problems and deficiencies of bus and trains systems. They also believe that car is a better mobility mode because it can take them near their destination any time they wish with more comfort (TDC, 2007 cited in Corpuz, 2008). A recent survey undertaken by Holzer et al (2013) from Central Houston Inc. on commute travels in downtown Houston shows that several factors define bus and rail travel choices, strongest of which are to avoid driving in traffic (81%) and saving gas (77%) (Holzer et al. 2013). The above studies are listed in Tab. 1.

3 METHODOLOGY

To partially represent Middle Eastern cities, Kerman is taken as observation area. As a part of a larger study, people in 4 neighborhoods of western Kerman were asked about their transportation choices and preferences. Situated in south east of Iran, the city of Kerman accommodates 527650 people in 11370.86 hectares (2013). The short survey contained 800 questionnaires where 200 were allocated to each neighborhood. The data collection covered 1.5 persons out of 1000 residents of Kerman. Bahonar, Amir Kabir, Motahari, and Pars were the four neighborhoods which accommodate 2722, 1845, 2663, and 3028 residents respectively (Fig. 1). The neighborhoods are selected in a way that the family conditions such as household size and income are near to that of the city averages. The population densities of the four neighborhoods are 80.05, 61.05, 76.08, and 94.62 persons per hectare respectively, which can be compared to the density of Kerman city which is 40 persons per hectare.

Like many cities of the Middle East, the city of Kerman has hot-arid climate which possibly lays affect urban mobility-concerned personal decisions. In 2011 Kerman had a population of 534441 people which is comparable to cities like Ad-Dammam, Saudi Arabia (744.321- 2004), Zahedan, Iran (534.773- 2003), Imbaba, Egypt (523.265, 1996), At-Ta'if, Saudi Arabia (521.273- 2004), Amarah, Iraq (511542- 2012), Ramadi, Iraq (483.209- 2004), and Al Mahallah al Kubra, Egypt (535,278- 2012). 51.4% of Kermanis are male and 48.6% are female, while this figure is 50.4 to 49.6 for Iran. In Kerman the average age is about 28, while this figure for Iran and the Middle East are 29.86 and 25.3. The average monthly income is 11500000 Rial in Kerman which is less than the Iranian average of 13690000 Rial. The daily mean July temperature of Kerman is 28.4 degrees Celsius which is comparable to 28.3 in Cairo, 27.2 in Beirut, 34.3 in Basra, and 29.4 in Tehran. Majority of the residents of Kerman are Muslim such as most of Iranians (99.4%) and Middle Eastern people (95%). In general, the socio-cultural conditions give the case-study area possibility to represent considerable parts of Iran and the Middle East.

The questions concerning decisions for or against non-motorized transportation and public transit were asked in face-to-face interviews in autumn 2013. Apart from the individual and household attributes, the interviewers asked the respondents about the main reasons and factors behind their transport mode choices. 5 questions were asked to clarify these decisions, including (1) the main reason for personal car use in commute trips, (2) the main reason for commute and non-commute public transportation use, (3) the main factor against public transportation use, (4) the main factor against bicycling as a mode for non-commute trips, and (5) the main factor against walking as a mode for non-commute trips. Each interviewee was asked to choose one of the options or add a new option. The logic behind choosing one option is that the study sought to find the main motive for selecting or rejecting each transport mode. During the survey it happened that the respondents did not find any relations between the options and their motives and suggested to add new options. The survey was conducted during day time of October and November of 2013.

Among the limitations of this study lie difficulties of doing surveys by mail, email, and telephone in Iran. The mentioned survey techniques are seldom done. People know little about mail surveys and there is little trust to telephone data collections. As a result face-to-face interview was employed as the surveying technique although it might have bias to some extent.

To answer the question about car use, the respondents chose from a variety of options such as price, convenience, safety/security, speed, accessibility, and personal interest. The 11 factors that may influence on public transportation decisions are price, speed, safety/security, personal interest, price of car fuel, unavailability of car, and awareness and interest to improve public transport use culture (awareness of public transportation), convenience of use, distance to stations, accessibility, and social issues. 4 dissuading phenomena such as social problems and security, facilities and routes, price, and personal interest were triggered in question 4. Finally, trip length, environment and routes, safety/security, social problems, and personal interest were asked about as deterrents to walking trips.

Social problems that are discussed in this study refer to the general look of residents or social attitudes that limit others' transport choices. Cultural habits and religious beliefs may restrict some transportation behaviors. For example, bicycling by women can be strange in some sub-cultures, which may cause women not to bike at all. Another example is perception about lack of security which affects walking at night, particularly for women. Also what people perceive about wealth or social class can push other people to use more personal cars. Convenience is a crucial word that needs definition. Independence of time, reliability and comfort are the main qualities that a convenient transportation mode offers according to Noland and Kunreuther (1995). This study takes this definition to make usage of "convenience" clear. The most important convenience-related element that car use provides is door-to-door mobility that attracts many people (Huey & Everett, 1996). In addition, what people called "convenient" was a mode that had less waiting time. Also people are asked about

two indicators of availability of public transportation; one is accessibility to public transportation, which refers to the distances from the houses to the public transport lines and stations, and the second is distance between PT lines (buses).

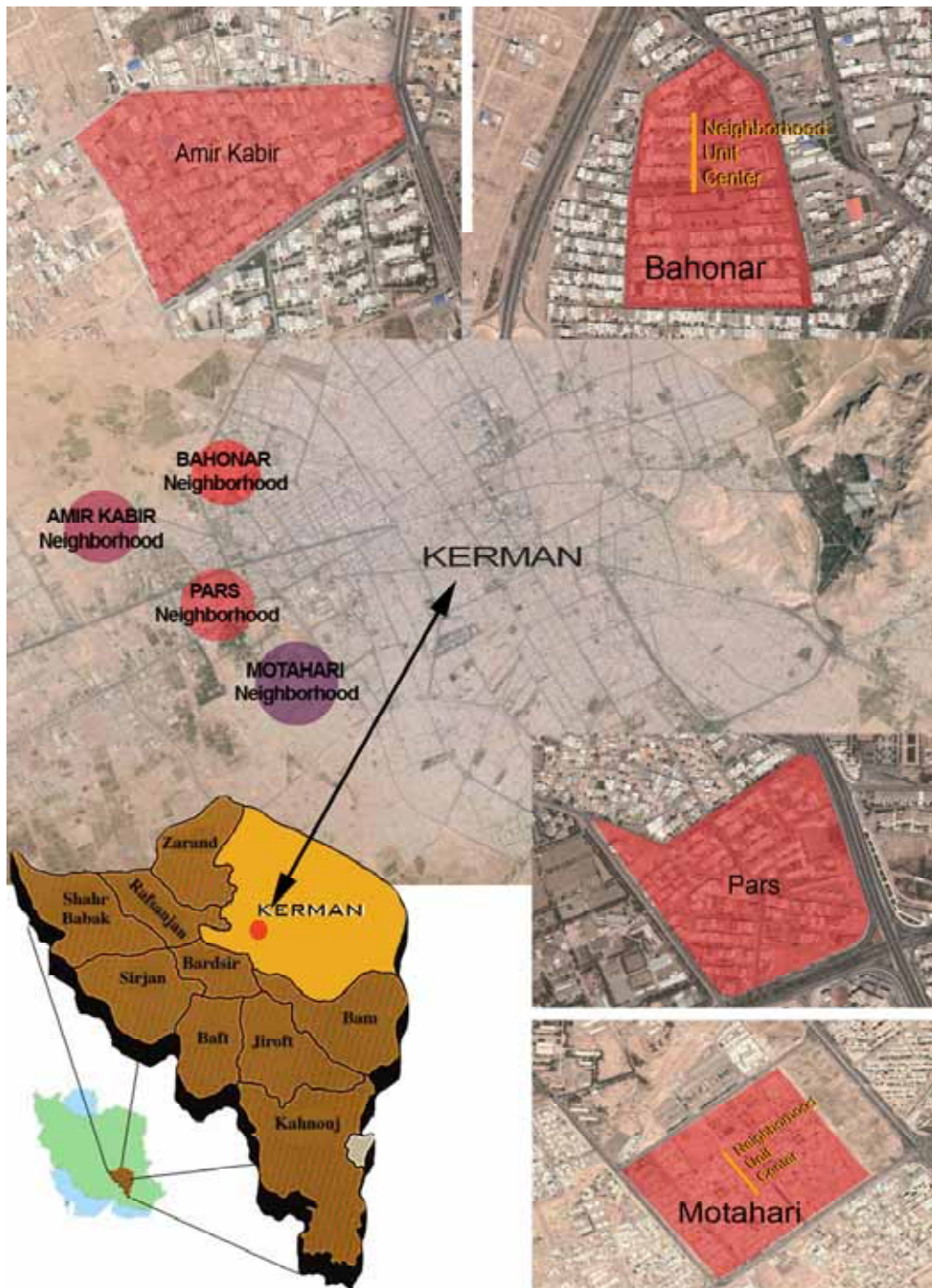


Fig. 1 Location of the case-study areas

The questions are designed to give an understanding of socio-cultural factors versus built environment characteristics. The outcomes are presented in both neighborhood and city levels. The dissimilarities in case of walking and bicycling are also triggered. The interviewees were taken in a random confrontation in the streets of the target areas in a way that the questions were asked from an equal share of women and men. Table 4 indicates the demographic and individual specifications of the respondents in general.

	AVERAGE	FREQUENCY	SHARE
1. Gender			
Male		416	52%
Female		384	48%
2. Age	30.75		
3. Daily Activity			
Work		376	47%
Study		368	46%
Housekeeper		56	7%
4. Car Ownership			
Owning Driving License		643	80.40%
Individual Car Ownership		387	48.40%
Household Car Ownership	1.6		
Household Size	4.2		
5. Household Income			
No income		0	0%
Less than 7,000,000 Rial*		44	5.50%
7,000,000 - 13,000,000 Rial		180	22.50%
13,000,000 – 20,000,000 Rial		236	29.50%
20,000,000 – 30,000,000 Rial		243	30.40%
More than 30,000,000 Rial		97	12.10%

*Rial is the official currency of Iran. One US Dollar equaled 28000 Rial at the time of survey.

Tab. 2 Individual and demographic specifications of the sample

In order to find associations between the collected data with the socio-economic characteristics of the study area, four variables including gender, household size, age, and household car ownership with the results of the five mode choice–related questions are statistically tested. Since all the variables are categorical, Pearson chi-square test is taken. Significance is tested via a level of confidence is 95%.

The null hypothesis is that the compared socio-demographic groups do not differ from one another based on their main reason of choosing transportation modes. The null hypotheses are rejected in case p-values are less than 0.05.

The four socio-demographic variables are categorized into different groups so that categorical variables are resulted. Gender is a categorical variable by itself, while household size is divided to “alone & small family” that stands for families 3 and less members. “Mid-sized family” has 4 or 5 members, and “large family” consists of 6 or more members.

Age is categorized to three groups, including “young” with 29 year of age or less, “middle age” referring to people between 30 and 49 years, and “old” that stands for residents with 50 years or more. Household car ownership is divided into 3 categories consisting availability of “0”, “1”, “2”, and “3 or more” car(s) per household.

4 FINDINGS

The observation results are divided into two parts of descriptive analysis of the frequencies of responses in the study areas and statistical analysis of the output raw data.

4.1 DESCRIPTIVE ANALYSIS

During the past decades the car use rate has jumped in the same time that the urban population increased after 1960s and 1970s. This study gives a raw answer based on the end users' opinions. The most prominent is convenience of car use compared to other modes. As seen in Fig. 2, 37.9 percent of the interviewees use personal cars because they find it more comfortable, albeit the residents of case study neighborhoods have different perceptions about the importance of this option. 27 percent of the residents of "Pars" have chosen "convenience" as the most important motif for car driving, while this figure is 53.8 percent in "Bahonar", which is extremely high. "Convenience" been selected far more than "it is faster" with 19 percent, "high safety and security" with 17.3 percent, and "it is cheaper" with 14.5 percent. Individual interest to driving and price are marginal factors.

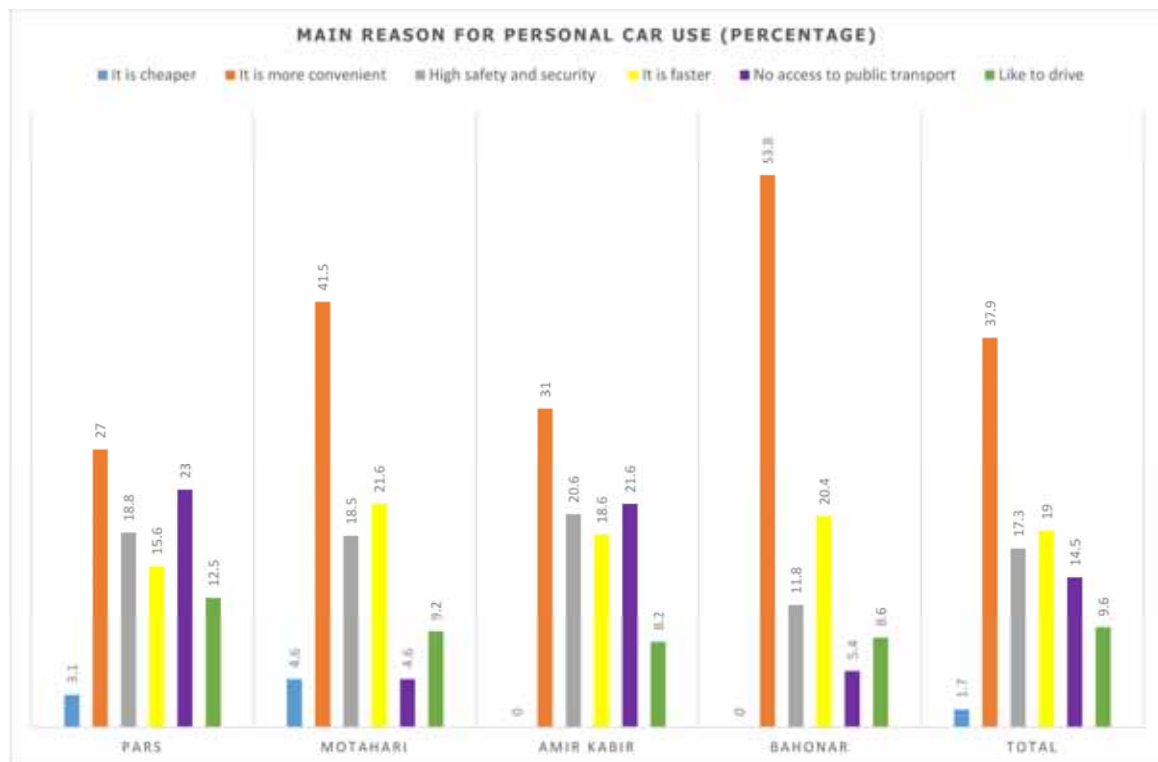


Fig. 2 Main reason for personal car use in studied areas

Fig. 3 indicates undeniable dominance of financial motives for using public transportation. The option "it is cheaper" makes 33.8 percent of the whole responses ranging from 20.4 percent in Amir Kabir and 44.6 percent in Bahonar. "Safety and security" is the second reason for public transport use, which encourages 23.7 percent of the interviewees. 12 percent of the people use public transportation not because of its capabilities but because personal vehicle is not available to them. The only declared reason that is directly related to public transportation specification is "it is faster" that can motivate as few as 10.8 percent.

Question 3 reveals intriguing information about the role of convenience in encouraging people to use public transit. According to Fig. 4, less than half of Kermani residents declare that they do not use bus and taxis,

which are the main public transport means, only because of lack of convenience. This amount (48.15 percent) is more or less seen in all four neighborhoods with little deviation ranging from 41.3 to 50.7 percent. This finding completes the result of Question 2 which already showed that more than one third of respondents use automobiles because they believe it is more convenient than public transportation. In fact 60 persons have declared that car is more convenient and public transport is not. This makes 45% of those who find personal car easier to use and 38% of those who believe using public transport is not easy.

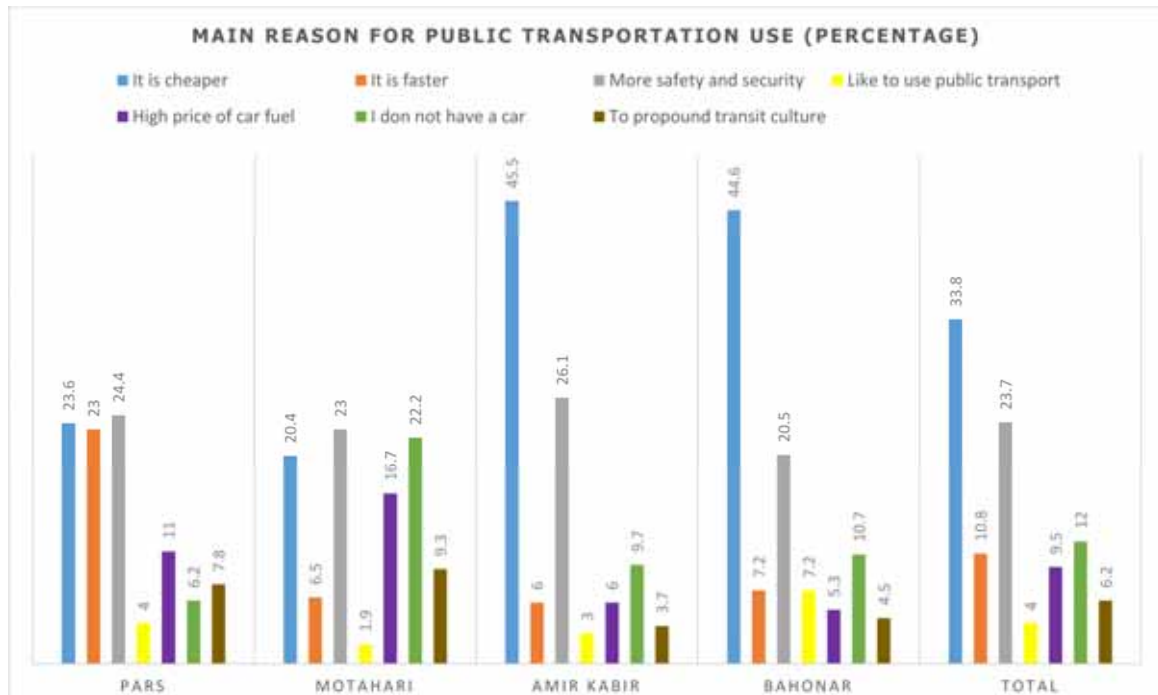


Fig. 3 Main reason for public transit use in studied areas

The second and third deterrents to public transportation use are related to accessibility. "Long distance between the stations" and "no or little access to public transport" cause a sum of 41.3 percent not to use buses and taxis. The importance of social problems is less than physical variables (less than ten percent).

The individual/socioeconomic issues play a major role in defining the bike trip characteristics in Kerman according to the outcomes of Question 4 which is illustrated in Fig. 5. More than one third (35.8 percent) of the respondents do not have any special interest in using bike for non-commute travels and 32 percent find social problems such as other people look and opinions a barrier to their bike use.

The responses for these two options are almost equal in the four areas. Lack of facilities and infrastructure as well as financial problems play a minor role in limiting bike use. "Lack of facilities or routes" has been chosen less in the two neighborhoods that have a central urban structure including a neighborhood center with shops within a short distance of the houses.

It does not appear that bike use is an obstacle for the residents.

Unlike biking, pedestrian trips are limited by a combination of physical and personal factors, while social issues are less effective. As seen in Fig. 6. 25.7 percent have said that "far-away destinations from the house" dissuades them from walking. 24 percent do not show any interest to walking; and again 22.3 percent prefer to walk in more suitable environments. "Lack of safety and security" and "social problems" have little influence on walking activity in the study areas.

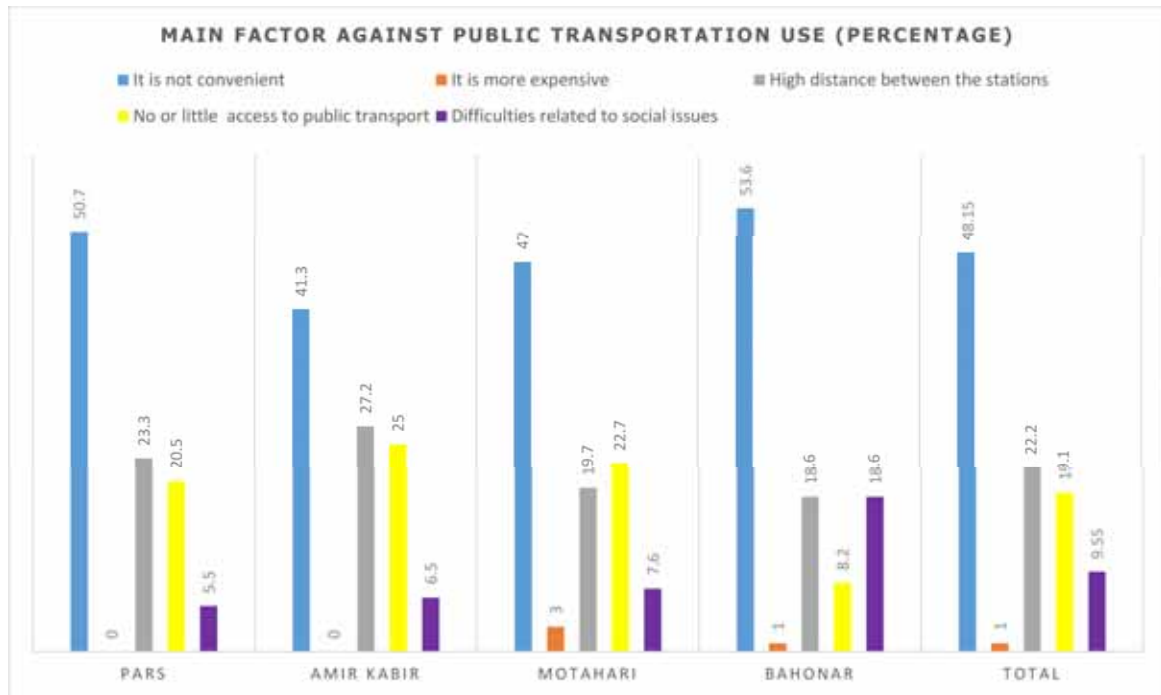


Fig. 4 Main factor against public transit use in studied areas

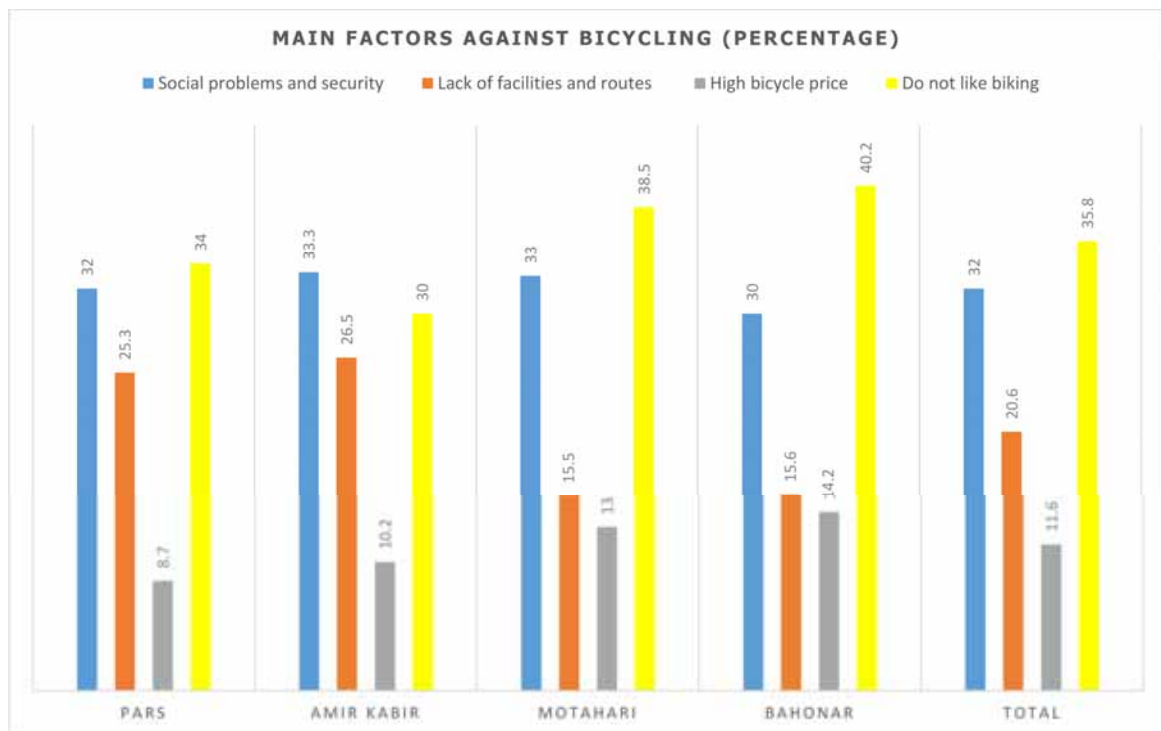


Fig. 5 Main factor against bicycling in studied areas

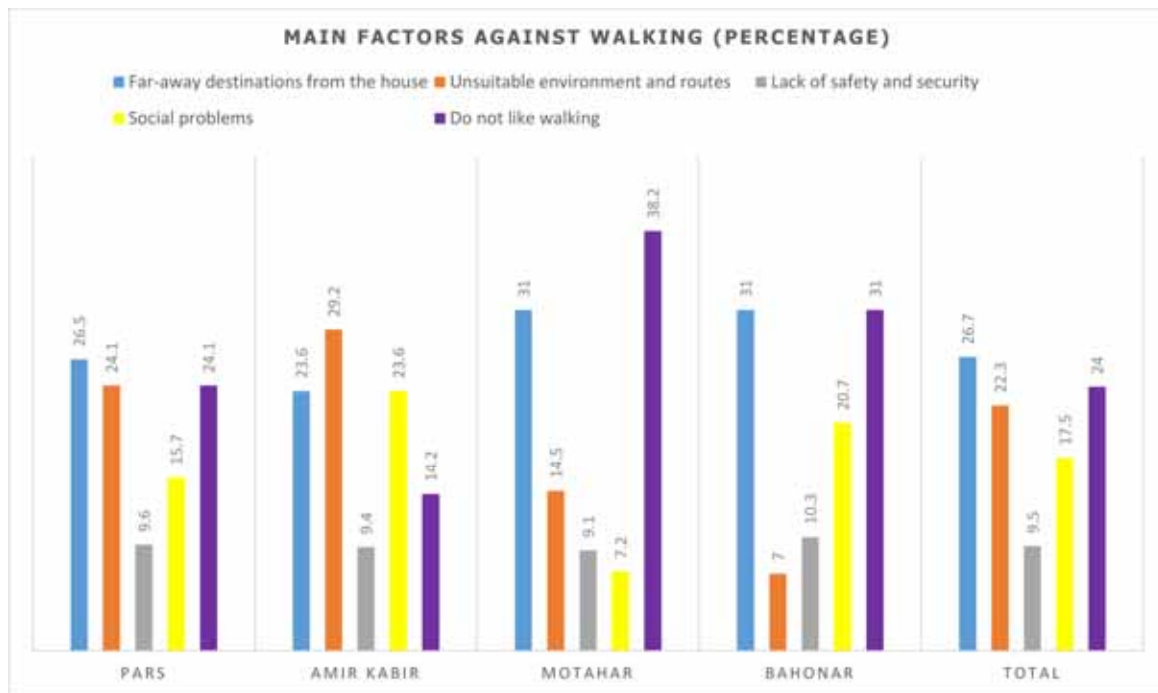


Fig. 6 Main factor against walking in studied areas

4.2 STATISTICAL ANALYSIS

The results of the chi-square association test are shown in Tab.3. According to the analysis, car use is significantly associated with all four socio-demographic explanatory variables (gender, household size, age, and household car ownership). The detailed results including frequencies related to all categories, standardized residuals, and p-values are illustrated in Tab. 4 to 8.

Personal car use: All the four socio-demographic variables very significantly explain reasons for car use (Tab. 3). The reasons given by males and females are meaningfully different. Safety and security is significantly more important for women compared to men, while men use personal car because they find it more convenient, faster, and cheaper. Household size has also significant influences.

Low price of driving has been only stated as a reason by small families. Mid-sized families drive car because it is more safe-secure and faster, or they like driving, or they have little access to public transport (Tab. 4).

Public transport use: All of the four socio-demographic variables significantly affect decisions for or against public transport use. The exception is the role household car ownership in discouraging people from public transport use (Tab. 3). In other words, to own a car necessarily does not discourage people to use public transport. Males use public transport because of its low cost or the high price of car fuel, while women do it for not having a car, personal interest, speed, and safety/security.

Again here we see than the role of safety/security concerns is much more effective for women than men. Mid-sized families (4 and 5 members) have chosen options related to public transport use. Residents of 29 years of age or less use public transport by far more than others because of its lower price and higher safety and security. The other reasons for PT use are not having a car, high speed, promotion of PT culture, and personal interest.

		Gender			Hosehold Size			Age			Household Car Ownership		
MAIN REASON FOR CAR USE		Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.
	Pearson Chi-Square	28,851	6	<.,0001	38,936	12	<.,0001	148,153	12	<.,0001	36,572	18	,006
	Likelihood Ratio	31,518	6	<.,0001	41,921	12	<.,0001	159,451	12	<.,0001	44,171	18	,001
	N of Valid Cases	352			352			352			352		
MAIN REASON FOR PUBLIC TRANSIT USE		Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.
	Pearson Chi-Square	18,215	7	,011	32,254	14	,004	109,178	14	<.,0001	36,427	21	,020
	Likelihood Ratio	18,325	7	,011	32,162	14	,004	113,541	14	<.,0001	39,295	21	,009
	N of Valid Cases	473			473			473			473		
MAIN FACTOR AGAINST PUBLIC TRANSIT USE		Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.
	Pearson Chi-Square	27,363	5	<.,0001	25,093	10	,005	115,235	10	<.,0001	13,874	15	,535
	Likelihood Ratio	29,355	5	<.,0001	25,524	10	,004	112,653	10	<.,0001	16,176	15	,370
	N of Valid Cases	328			328			328			328		
MAIN FACTOR AGAINST BICYCLE USE		Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.
	Pearson Chi-Square	156,086	4	<.,0001	18,149	8	,020	39,767	8	<.,0001	29,830	12	,003
	Likelihood Ratio	168,534	4	<.,0001	16,686	8	,034	39,610	8	<.,0001	31,666	12	,002
	N of Valid Cases	586			586			586			586		
MAIN FACTOR AGAINST WALKING		Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.
	Pearson Chi-Square	65,429	5	<.,0001	10,803	10	,373	29,566	10	,001	12,104	15	,671
	Likelihood Ratio	70,925	5	<.,0001	10,899	10	,365	30,481	10	,001	13,726	15	,546
	N of Valid Cases	284			284			284			284		

Tab.3 Chi-Square Test Results

HOUSEHOLD CAR OWNERSHIP	Total	61		51		34		67		133		6		352
	3 & more	6	-0,8	9	0,8	4	-0,3	10	0,3	23	1,2	0	-0,9	52
	2	22	0,3	18	0,2	18	1,9	31	1,7	50	0,7	0	-1,4	139
	1	33	0,4	23	-0,5	12	-1,2	26	-1,3	60	-0,9	6	1,7	160
	0	0	-1,2	1	-0,1	0	-0,9	0	-1,2	0	-1,7	0	-0,4	1
AGE	Total	61		51		34		67		133		6		352
	Old	4	-0,2	2	-0,9	0	-1,6	9	1,8	16	2	0	-0,7	31
	Middle Age	37	2,3	47	5,6	23	2,4	41	2,5	60	0,7	4	1	212
	Young	20	-2	2	-4,7	11	-1,5	17	-3	57	-1,4	2	-0,6	109
HOUSEHOLD SIZE	Total	61		51		34		67		133		6		352
	Large Family	7	-0,3	1	-2,2	1	-1,6	5	-1,2	14	-0,8	0	-0,9	28
	Mid-Sized Family	35	-0,3	39	1,5	24	0,8	44	0,6	74	-0,6	0	-1,9	226
	Small Family	19	0,6	11	-0,8	9	-0,1	18	-0,1	45	1,5	6	3,4	108
GENDER	Total	61		51		34		67		133		6		352
	Male	25	-1,2	29	0,5	17	-0,2	40	0,9	90	2,5	6	1,6	207
	Female	36	1,2	22	-0,5	17	0,2	27	-0,9	43	-2,6	0	-1,7	145
PROCAR	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	
	Safety & Security		No Access To PT		Like To Drive		Faster		More Convenient		Cheaper		Total	

Tab.4 Main reason for car use

Fuel price is a concern for mid-aged groups. Those who have a car are more likely to use PT than other car ownership groups. Men do not use public transport because they do not find it convenient, or there is little accessibility, or the distance between stations are long, while women do not use it because it is expensive or they have some social concerns (Tab.5 and 6).

Bicycling: All of the four socio-demographic variables significantly affect decisions concerning biking (Tab.3). The effects of lack of social security targets females and discourage them from biking. Men do not bike because of lack of bike facilities, its high price, or lack of interest. Young people may not bike because of social problems, high bike price, or personal interest (Tab. 7).

HOUSEHOLD CAR OWNERSHIP	Total	165		60		52		45		30		19		102		473
	3 & more	25	0,6	5	-1,1	6	-0,4	5	-0,4	5	0,5	1	-1	10	-1	57
	2	42	-1,9	15	-1,2	21	0,8	20	1,2	10	-0,1	7	0,2	32	-0,4	147
	1	90	0,7	36	1	23	-0,6	20	-0,6	15	0	11	0,5	57	0,8	252
	0	8	2,2	4	2,3	2	0,8	0	-1	0	-0,8	0	-0,7	3	0,5	17
AGE	Total	165		60		52		45		30		19		102		473
	Old	8	-1,2	2	-1,2	5	0,6	3	-0,2	3	0,5	2	0,5	3	-1,6	26
	Middle Age	32	-4,4	20	-1	19	-0,5	26	1,7	8	-1,3	6	-0,7	32	-1,6	143
	Young	125	4,4	38	1,3	28	0,3	16	-1,5	19	0,9	11	0,4	67	2	304
HOUSEHOLD SIZE	Total	165		60		52		45		30		19		102		473
	Large Family	36	3,2	9	0,5	7	0,1	3	-1,2	2	-0,9	2	-0,3	18	1,3	78
	Mid-Sized Family	99	0	33	-0,5	32	0,2	26	-0,2	21	0,7	10	-0,4	61	0	282
	Small Family	30	-2,2	18	0,4	13	-0,3	16	1,1	7	-0,4	7	0,8	23	-0,9	114
GENDER	Total	165		60		52		45		30		19		102		473
	Male	84	-0,2	28	-0,6	24	-0,6	27	0,7	15	-0,2	8	-0,6	38	-2,1	416
	Female	81	0,2	32	0,6	28	0,6	18	-0,8	15	0,2	11	0,6	64	2,1	384
PROPULIC		Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count	Std. Residual	Count
		Cheaper		Don't Have Car		Faster		High Fuel Price		Propound Transit Culture		Liket to Use PT		Safty & Security		Total

Tab.5 Main reason for public transport use

Walking: Only age and gender affect walking activity, while household size and household car ownership stay neutral (Tab. 2). Men do not walk because of unsuitable urban environment, far away destinations, and personal interest, while women's problems is social problems and lack of security. Mid-aged residents concern against walking is social problems and lack of security. Younger generation do not walk because of personal interests (Tab. 8).

HOUSEHOLD CAR OWNERSHIP	Total	158		61		73		3		33		328
	3 & more	24	0,6	4	-1,5	10	0,1	1	0,9	5	0,3	44
	2	55	0,2	27	1,4	29	0,9	1	0	12	0,2	124
	1	78	-0,2	29	-0,3	34	-0,5	1	-0,4	15	-0,4	157
	0	1	-1,4	1	-0,3	0	-1,3	0	-0,3	1	0,3	3
AGE	Total	158		61		73		3		33		328
	Old	21	2,7	1	-1,6	8	1,1	0	-0,5	8	3,6	38
	Middle Age	75	1,2	45	3,9	47	3,1	2	0,7	17	0,9	186
	Young	62	-2,1	15	-2,9	18	-3,2	1	-0,4	8	-2,2	104
HOUSEHOLD SIZE	Total	158		61		73		3		33		328
	Large Family	14	-1,4	5	-1	5	-1,4	0	-0,6	2	-1,1	26
	Mid-Sized Family	87	-0,8	36	-0,1	52	1,3	2	0,2	17	-0,6	194
	Small Family	57	2,1	20	0,8	16	-0,9	1	0,2	14	1,7	108
GENDER	Total	158		61		73		3		33		328
	Male	91	1	44	2,2	41	0,5	0	-1,2	8	-2,2	184
	Female	67	-1	17	-2,3	32	-0,5	3	1,3	25	2,3	144
CONPUBLIC		Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count
		Not Convenient		Not Access To Pt		High Distance Between Stations		More Expensive		Difficulties Of Social Issues		Total

Tab. 6 Main factor against public transit use

HOUSEHOLD CAR OWNERSHIP	Total	190		121		68		207		586
	3 & more	19	-1,3	14	-0,5	9	0	24	-0,7	66
	2	60	-0,5	51	1,6	20	-0,6	57	-1,6	188
	1	103	0,7	56	-0,7	38	0,6	120	1,5	317
	0	8	1,8	0	-1,7	1	-0,4	6	0,6	15
AGE	Total	190		121		68		207		586
	Old	9	-1,3	11	0,7	1	-1,8	29	3,5	50
	Middle Age	83	0,5	59	1,3	16	-2,3	75	-1,2	330
	Young	98	0,1	51	-1,4	51	2,7	103	-0,3	303
HOUSEHOLD SIZE	Total	190		121		68		207		586
	Large Family	18	-1,3	13	-0,7	17	2,8	28	0,3	76
	Mid-Sized Family	115	0,1	66	-0,8	32	-1,4	131	0,6	344
	Small Family	57	0,7	42	1,6	19	0,1	48	-1,1	166
GENDER	Total	190		121		68		207		586
	Male	27	-7,2	81	2,3	53	3,0	113	0,5	274
	Female	163	7,5	40	-2,4	15	-3,1	94	-0,5	312
CONBIKING		Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count
		Social Problems & Security		Lack Of Facilities & Routes		High Price Of Bicycle		Don't Like To Biking		Total

Tab.7 Main factor against bicycle use

HOUSEHOLD CAR OWNERSHIP	Total	62		48		25		74		75		284
	3 & more	9	0,2	2	-1,7	4	0,4	8	-0,6	14	1,3	37
	2	20	-0,2	14	-0,6	5	-1,2	28	0,6	23	-0,5	90
	1	32	0,1	31	1,4	16	0,9	36	-0,2	37	-0,1	152
	0	1	-0,3	1	-0,1	0	-0,8	2	0,3	1	-0,5	5
AGE	Total	62		48		25		74		75		284
	Old	3	-0,7	3	-0,3	3	0,9	2	-1,5	3	-1,1	14
	Middle Age	30	0,9	30	2,3	14	1,1	36	1	20	-2	130
	Young	29	-0,5	15	-1,9	8	-1,3	36	-0,3	52	2,2	140
HOUSEHOLD SIZE	Total	62		48		25		74		75		284
	Large Family	6	-0,7	3	-1,3	3	-0,1	9	-0,2	10	0,1	31
	Mid-Sized Family	32	-0,8	29	0	14	-0,3	41	-0,5	43	-0,3	159
	Small Family	24	1,7	16	0,8	8	0,5	24	0,9	22	0,3	94
GENDER	Total	62		48		25		74		75		284
	Male	43	1,9	5	-4	10	-0,8	49	1,7	56	2,7	163
	Female	19	-2	43	4,2	15	0,9	25	-1,8	19	-2,8	131
CONWALKING		Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count	Std.Residual	Count
		Unsuitable Environment & Routes		Social Problems		Lack Of Safety & Security		Far Destinations From House		Don't Like To Walk		Total

Tab.8 main factor against walking.

5 DISCUSSION

The findings of this research gives an understanding of how the Iranian and other Middle Eastern decision makers and planners can stimulate sustainable transportation and change the arrangement of modal split. Also the dissimilarities of the determinants of mobility choices in Iran are compared with the findings of other countries, majority of which come from western countries.

5.1 MODAL SHIFT FROM PERSONAL CAR TO PUBLIC AND NON-MOTORIZED TRANSPORT MODES

It would be useful to consider the survey results of personal car and public transport together. There is a coincidence between reasons behind car use and the deterrents to public transportation use. This common point is convenience. A considerable number of people drive car because it is more convenient than other modes, while almost half of them fled buses and taxis because of their inconvenience. This provides with an opportunity for a modal shift from car to public transport especially traditional buses that offer little comfort. With keeping constant the public transit fares and enhancing consumer quality, it would be possible to attract car drivers particularly when accessibility to public transport systems is promoted. That becomes visible when we take into account that one third of people withdraw from public transit only because of lack of accessibility. People tend to use buses because of its low fares, safety and security. When convenience and accessibility to public transit systems is increased, adding a push factor of increasing costs of car use can be a kick off. During the past 7 years car fuel has been increased dramatically. The authorities claimed that this will lead to less car use. Nevertheless very little (if not zero) impact were observed, because the push was added to the system without any pull factor such as convenience/comfort.

Here, taking stand-alone policies and neglecting diversity has led to such a failure. It is believed that multi-dimensional public policies covering a wide range of consumers can lead to better results in changing mobility behaviors. Different socio-demographic groups may have dissimilar behaviors. Therefore these differences should be accounted for in defining policies and targeting desirable changes. Section 5.3 gives more related details in case of the city of Kerman. Also it is noteworthy that the capabilities of public policies are only "potential" and unobserved and hidden factors can always have unwanted effects on the results.

The most powerful deterrents to biking (at least in Middle Eastern cities exemplified by Kerman) are individual and social concerns. 67.8 percent of the respondents do not bike because of lifestyles and perceptions.

For shifting from car use to biking, the most necessary plan for the future of the country or the whole Middle East can be increasing awareness about bike use as a transportation mode. Informative TV/radio programs and newspaper articles would have an essential role in persuading people to bike as an economic transport mode. Of course in warmer areas, hot climate can be a limiting factor, which should be thought of.

Although there are studies about overcoming cold climate with the purpose of easing commute biking (like Spencer et al. 2013), but in case of warm-arid weather, there is a long road to analyze the problem and identify the solutions. Attractive and accessible destinations together with nearby local centers and jobs can also help to change the perceptions and lifestyles that oppose biking.

Environmental solutions stand in the second place for promoting bicycling in Iran. Bike lanes and routes can attract one fifth of people to bike as commute or non-commute travel mode. Tracks and lanes are not yet developed in Kerman, so making use of the experiences in bike-sharing systems in eastern Tehran can be a strategic move in bicycle planning of mid-large cities such as Kerman.

Unlike bicycle, the largest obstacles against walking are physical and environmental. Lack of accessibility to destinations, leisure, and employment as well as unsuitable environment and routes prevent approximately half of people from walking. The second group of phenomena is social concerns and human perceptions about

safety and security that can encourage one third of city dwellers. Anyhow, the personal perceptions play an effective role in defining the characteristics of slow travels including walking and biking. One person out of four is not willing to walk, while this figure is more than 35 percent for biking.

5.2 DISSIMILARITIES BETWEEN MODE CHOICE DETERMINANTS IN IRAN AND WESTERN COUNTRIES

The findings of this study strongly agree with the western literature that emphasize on the importance of the socio-economic traits and personal perceptions (such as Goldsmith, 1992; Steg et al. 2001; Johansson et al. 2006; The Gilmore Research Group, 2007). The observation results are not in line with a large body of North American studies that find built environment characteristics more important than self-selections and personal preferences (for example: Bhat & Guo, 2007).

However two important points must not be neglected. Firstly, the balance of socio-economic and built environment factors are different in defining the decisions of different modes. This difference catches eye in walking and biking. While social deterrents are very strong in discouraging people especially women from biking, the main obstacles of walking are more physical rather than subjective. It seems that what other people think matters to others, and this impact is shown in their modal decisions about bicycling.

The solutions to overcome this barrier needs more in-depth studies. On the other side, the large share of responses regarding the strong role of lack of physical facilities and accessibility in weakening walking activities provides the opportunity for local governments and planning organizations to change the modal split in a shorter time. The above is based on the belief that providing physical amenities such as facilitated walkways, suitable lighting, designing neighborhood centers, shortening the walking distances, and as a result making walking easier and more pleasant needs less time and energy than changing the socio-economic and cultural attributes of a Middle Eastern society.

The size and scale of the necessary changes in case of physical facilities that can be done in the neighborhood scale versus the nation-wide social and economic conditions make infrastructural improvements easier for municipalities and planners to shift the modal split to more sustainable ways of transport.

Secondly, although the socio-economic factors are obviously more effective in the Iranian society, but the physical infrastructure and urban form including accessibility are also influential, although this effect is weaker particularly in the neighborhood scale. The importance of physical facilities is more in case of walking, according to the findings of this study.

5.3 MODAL SHIFT POLICIES TARGETING CONSUMER GROUPS

The findings of this study may be employed by policy makers to focus on transport mode shift of special groups. Tab. 9.

This summary shows which group of people are more likely to be affected by changes that originate from policies. The cells related to non-significant association have been left blank.

According to this table, change in safety and security of transport systems and urban environment will affect modal decisions of young and middle-aged women who come from mi-sized families and have a car. This influence will happen about all four modes investigated.

If availability of public transport is increased, mid-aged men coming from 4-5-member families will be encouraged to use PT more than others. If promotional programs and advertisements can be successfully implemented to encourage people to walk more, the largest group of people who are capable of changing behavior are young males who come from mid-sized families and have one car. Policies that can potentially limit car speed will trigger middle-aged males of mid-sized families with 1 or 2 cars.

		GENDER	HOUSEHOLD SIZE	AGE	HOUSEHOLD CAR OWNERSHIP
PROCAR	Change in safety & security	Female	Mid-sized family	Middle age	1
	Change in access to public transport	Male	Mid-sized family	Middle age	1
	Change in personal interest to driving	–	Mid-sized family	Middle age	1 or 2
	Change in speed	Male	Mid-sized family	Middle age	1 or 2
	Change in convenience	Male	Mid-sized family	Middle age	1 or 2
	Change in price	Male	Small family	Middle age	1
PROPUBLIC	Change in safety and security	Female	Mid-sized family	Young	1
	Change in car ownership rate	Female	Mid-sized family	Young	1
	Change in personal interest to PT	Female	Mid-sized family	Young	1
	Change in speed	Female	Mid-sized family	Young	1
	Change in PT culture awareness	–	Mid-sized family	Young	1
	Change in fuel price	Male	Mid-sized family	Middle age	1 or 2
	Change in PT use price (tickets)	–	Mid-sized family	Young	1
CONPUBLIC	Change in convenient	Male	Mid-sized family	Middle age	–
	Change in access to PT	Male	Mid-sized family	Middle age	–
	Change in distance between stations	Male	Mid-sized family	Middle age	–
	Change in price	Female	Mid-sized family	Middle age	–
	Change in social issues difficulties	Female	Mid-sized family	Middle age	–
CONBIKING	Change in social problems & security	Female	Mid-sized family	Young	1
	Change in biking facilities	Male	Mid-sized family	Middle age & Young	1 or 2
	Change in fuel price	Male	Mid-sized family	Young	1
	Change in personal interest to biking	Male	Mid-sized family	Young	1
CONWALKING	Change in suitability of urban environment	Male	–	Middle age & Young	–
	Change in social problems	Female	–	Middle age	–
	Change in safety& security	Female	–	Middle age	–
	Change in distances to destinations (walkability)	Male	–	Middle age & Young	–
	Change in personal interest to walking	Male	–	Young	–

Tab.9 The most likely socio-demographic group affected by change in decision motives

A point discussed in previous sections is that public policies will be more effective when they include a diversity of approaches. An example is that promoting high quality built environment with walkable, safe, and secure quarters can persuade two groups of people to walk: young and middle-aged men and middle-aged women. Similarly, policies for providing higher quality, accessibility, and at the same time less prices are most likely to influence both middle-aged men and women.

The findings presented in this table can be interpreted the other way. If transport plans seek to affect mobility behaviors of a certain demographic group, Tab. 9 suggests focusing on specific transport and environmental

characteristics. For instance, to decrease the car use rate of women, the best strategy is to increase safety and security. Similarly, to increase walking in young males, the most effective way is to influence their perceptions about walking.

6 CONCLUSION

This article indicates the most influential determinants of modal choices in Kerman as an example of the Middle Eastern cities. The outcome is presented to planners and decision makers who seek to change the arrangement of their community's modal split and reduce car dependency. Another type of audience are the researchers who would like to quantitatively model the major variables of modal choice. The paper gives a pre-estimation of the effectiveness of the main determinants that should be measured. Since the Middle Eastern cities are less studied compared with the western counterparts, the findings of this paper can outline some dissimilarities that are often neglected. The main outcome of the study is making an emphasis on the importance of socio-economic, cultural, and preferences of the end-users in defining modal split. Although the findings somewhat oppose the mainstream of western [specially North American] studies that gives an extra value to the built environment, but some aspects of urban form such as accessibility to local centers and public transport remain of notable effectiveness. The succession of the importance of the determinants that this paper suggests of the Middle Easterners represented by Kerman is as follows:

- Socio-economic and cultural factors;
- Built environment;
- Personal and household preferences and lifestyles;
- Residential self-selection.

As marginal outcomes, this paper shows how an increase in the combination of convenience/comfort and accessibility of public transportation systems can encourage car drivers to shift to public transit use. Social issues are the most powerful barriers to biking, while lack of facilities and infrastructures are the strongest obstacles to overcome for the purpose of stimulating walking.

Finally, the differences among different consumer groups in Kerman were studied. The outcomes show that socio-demographic determinants have effective impacts on mobility choices. Four most influential variables that were observed in this study are gender, household size, age, and household car ownership. The paper suggests improving the diversity of public policy approaches to get remaining modal shift.

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IMAGE SOURCES

Figure in front page (Southern Karegar st. in central Tehran): Houshmand E. Masoumi.

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