

Original article

## An economic evaluation of a forest park using the individual travel cost method (a case study of Ghaleh Rudkhan forest park in northern Iran)

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### ABSTRACT

The true economic value of ecosystem services may not be reflected in market transactions, because there is no real transaction for ecosystem services in the market. Therefore, it is important to evaluate the cost of time and travel to define the value people place on something in the absence of a market price. This study estimates the recreational value of Ghaleh Rudkhan forest park in the north of Iran using the individual travel cost method. This method is considered to be a substitute approach for the market. The data required were collected using questionnaires. Therefore, 271 questionnaires were randomly distributed between the visitors of the recreational site in 2016. In this study, a linear function is used to estimate the effects of explanatory variables including economic and social variables on the number of visits to estimate the recreational value of the forest park. Results showed that a consumer surplus of each person for their visit was 21500 Rials and the annual recreational value of the park was 78390595 Rials per ha. Furthermore, the variables such as travel expenses, income, distance, family size and visitor's age are effective factors in the recreational use of the park. The results of this study can improve the quality of environmental services of the Ghaleh Rudkhan forest park and could expand the variety of services that they could supply based on the demand of the people.

**KEY WORDS:** economic valuation, non-market goods, forest park, individual travel cost method

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### 1. Introduction

Nowadays, the economic valuation of environmental resources, is important for many reasons such as the importance of the assessment of environmental damage, providing green national accounts, imposing taxes and duties for controlling and preventing the destruction of recreational centers. Among environmental resources, forests and forest parks play a vital role in human welfare. Recreational values, which serve as a part of the consumption values of forest parks, include using parks for recreation, leisure, entertainment, mountain-climbing and aesthetic aspects. In addition to the supply of wood, forests provide many services to humans in terms of climate regulation (e.g. carbon sequestration), air purification, recreation and tourism, fresh water supply, soil protection, biodiversity (habitat and gene pool

protection) and many others (MAES, 2014). Outdoor recreation is an activity that increases visitors' relaxation. The demand for outdoor recreation has been increasing with increasing population size. However, natural and financial resources are limited for outdoor recreation. Therefore, it is necessary to estimate the economic benefit of recreational sites for the optimum allocation of scarce resources.

Options for recreation are one of the cultural services provided by forest ecosystems. Cultural forest services include the non-material outputs of forest ecosystems. These services are regarded as the physical settings, locations or situations that produce benefits in the physical, intellectual or spiritual state of people (HAINES ET AL., 2013). Valuation of environmental resources, and among them, forests and forest parks, seem to be very effective and important for policy-making in order

to enhance public welfare (PAJOOYAN & FALIH, 2008). Recreational planning for forests which serves as the result of environmental potential and local-regional potential evaluation requires indigenous or local people to be ready for changes in the social and environmental conditions. Meanwhile, recreational planning for the forests is the best policy to manage forests in order to reduce the factors causing forest degradation as well as to protect the sustainability of forests (KARTER, 2008). Recreational benefits constitute a substantial part of the total non-market economic value of forests, and are important for the design and implementation of multifunctional forest policy options (BARTCZAK ET AL., 2008). Valuing services such as recreation opportunities in forest parks can be quite problematic, because markets and prices for such ecosystem services do not exist. Instead of relying on market information, economists must use other means to estimate the value of recreational experiences. Economists have devoted substantial efforts to creating non-market valuation methodologies to estimate the marginal benefit function (i.e. the demand curve) for non-marketed natural resource goods and services. This notion is of particular importance when conducting cost-benefit analysis, because the demand function is used to measure total benefit. The Travel Cost Method (TCM) is one such valuation approach (MITCHELL-NELSON & SCHAFFER, 2015). In TCM, the recreational value of a site is calculated based on time and cost of travel to access the site. Hence, the relationship between the number of site visitors and an average cost of accessibility to the area is estimated. The unique advantage of this method is being able to apply real data rather than hypothetical ones. Therefore it is possible to provide real values (PURGRAVNDY & CONANY, 2012).

HEBERLING & TEMPLETON (2009) estimated an individual travel cost model for Great Sand Dunes National Park and Preserve (GSD) in Colorado. They considered travel cost and income to estimate the model. They found a negative binomial model corrected for truncation and endogenous stratification was the best fit for the data.

FIXON & PANGAPANGA (2016) estimated the recreational value of the Lengwe protected park in Malawi by TCM with the estimated annual recreational value of the park as 24194003 MWK. This value necessitates further study and better conservation of this area based on the number of people visiting this region. NILLESEN ET AL. (2005) evaluated the annual recreational value of Portland Park and it was USD 31 million. Results of this study showed that applying this method better

helps the conservation and development of this park. BESTARD & RIERA FONT (2010) evaluated the annual recreational value of forests in the Mallorca area in Spain. It was about USD 51.25 million and results showed the significant impact of age, income, education, travel expenses and gender on the number of times that people visit this place. STOCLE ET AL. (2006) evaluated the annual recreational value of Alps National Park in Australia and it was about 10000-200000 million Australian dollars. The presence of good facilities and protection measures for the park as well as the high number of visitors from all around the world show the high value of this area. AMOAKO & MARTINEZ (2012) evaluated the annual recreational value of Grasmere Park in Canada using this TCM. The consumer surplus of this study was about 100 dollars and when travel cost increased the number of visitors decreased. BAGHERI ET AL. (2014) determined the recreational value of Naharkhoran Park in Gorgan province in Iran using Individual Travel Cost Method (ITCM) and Contingent Valuation Method (CVM).

There are some studies which have evaluated recreational sites in Iran using TCM such as AMIRNEJAD & MOAYEDIAN (2015), MOHAMMADI LIMAEI ET AL. (2014, 2017), MANSOORI ET AL. (2014), PIRIKIA ET AL. (2015), KOUNANI & POURGARAVANDY (2016).

There have not been any studies to evaluate the recreational value of Ghaleh Rudkhan forest park which is located in Guilan province in Iran. The main purpose of this study was to estimate the recreational value of Ghaleh Rudkhan using ITCM. Economic evaluation of this forest park can help improve its current state as well as introducing this spectacular site to people on a national and international scale.

## 2. Study area

*Geographical location.* Ghaleh Rudkhan forest park is located about 50 km away from Rasht, the capital city of Guilan province, in north Iran (Fig. 1). Ghaleh Rudkhan castle is also located in this park and is a brick and stone medieval castle. It was a military complex which had been constructed during the Sasanian era (224-651), and later rebuilt during the Seljuq era. The area of this castle is 6.2 ha and its altitude ranges from 655 to 715 m. The cultural city of Masouleh is also located close to the Ghaleh Rudkhan forest park. Hence, this park is one of the most popular tourist destinations in Iran and is an attractive place for foreign visitors as well. The elevation of this park ranges from 655 to 715 m with coordinates of 49° 14' 19" E and 37° 03' 51" N (PANDY, 2016).

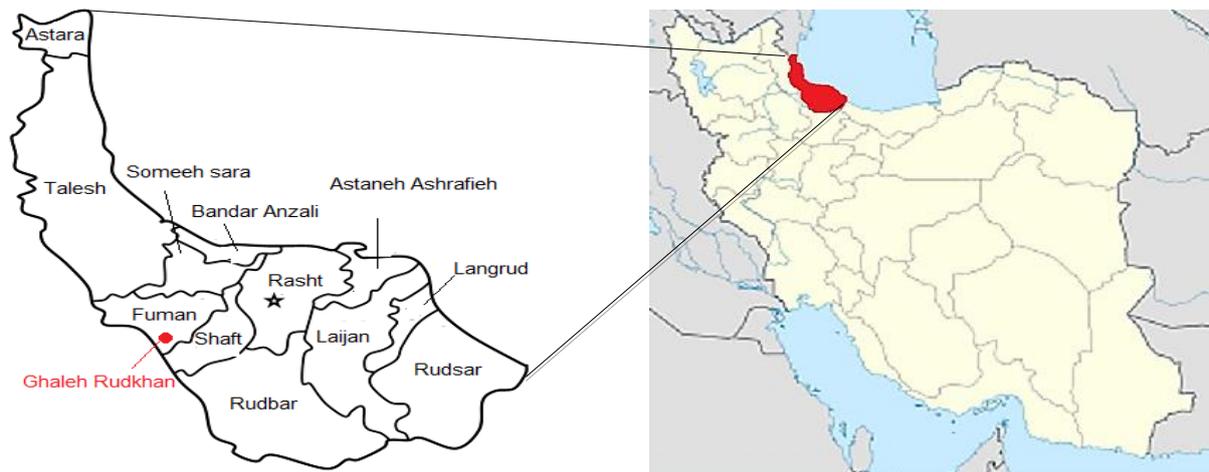


Fig. 1. Ghaleh Rudkhan forest park

**Vegetation.** This region has various species of tree, shrubs and grass such as psidium guajava (*Pyrus glabra*), honey locust (*Gleditsia triacanthos*), Caucasian persimmon (*Diospyros lotus*), hornbeam (*Carpinus betulus*), black berry (*Rubus fruticosus*), plum (*Prunus domestica*), medlar (*Mespilus germanica*), yew (*Taxus baccata*), sweet cherry (*Prunus avium*), field elm (*Ulmus minor*), maple (*Acer sp.*), lime tree (*Tilia begonifolia*), fig (*Ficus carica*), viola (*Viola sp.*), chicory (*Cichorium intybus*) and European pennyroyal (*Mentha pulegium*).

**Wild life.** Golden jackal, fox, pig and brown bear are among the animal species found in this park. Brown bear is the biggest mammal in Gilan province.

**Forest types.** The forest structure of this park is uneven-aged and the main species are alder, hornbeam, and beech.

**Facilities.** Some facilities exist in the park such as walking paths, forest cottages and resorts facilities for tourists. The climate is rather cold in winter and moderate in summer.

### 3. Material and methods

#### 3.1. Individual travel cost method (ITCM)

The travel cost method is a non-market procedure which seeks to place a value on recreational sites by using consumption behaviour in related markets. Specifically, the costs of consuming the recreational amenity of a particular site are used as a proxy for price; these costs can include travel costs, entry fees, on-site expenditure and outlay on capital equipment. The method assumes a weak relationship between the recreational site and consumption expenditure. This implies that when consumption expenditure falls to zero, the marginal utility of visits is also

zero, or alternatively the recreational site will only be valued if consumption expenditure is positive (HANLEY & SPASH, 1993). The method has become widely accepted and is generally regarded as one of the success stories of non-market valuation (SMITH, 1993). The most important economic and social factors affecting travel cost include age, education and income. The main point is how to conduct the TCM. Travel expenses usually include the sum of the entrance fee, fuel, food, time. Applying this method requires regular visitors each year, therefore this method is more complicated and needs more data to be collected but the results will be more accurate. The travel production function is the proposed function for modeling which includes variables such as individual visiting cost, number of visits, and some social and economic factors that affect the visit. The individual travel cost approach is similar to the zonal approach, but uses survey data from individual visitors in the statistical analysis, rather than data from each zone. This method thus requires more data collection and a slightly more complicated analysis, but will give more precise results (ECOSYSTEM VALUATION, 2018).

A linear function is used to estimate the effects of explanatory variables including economic and social variables on the number of visits to estimate the recreational value of the forest park as below (Eq. 1):

$$V_i = f(TC_i + P, X_{1i}, \dots, X_{ni}) \quad (1)$$

where:

$V_i$  is number of visits by individual  $i$  to a recreational site per year.

$TC_i$  is individual travel cost per visit. This includes the sum of the entrance fee, fuel, food, time (opportunity cost), etc. as mentioned in the questionnaire.

$P$  is the hypothetical 'entry price' paid by visitors to the park.

$X_{1i}, \dots, X_{ni}$  are economic and social variables such as income, education rank, age, preferences and proximate substitutions characterizing individual visitors (LANSDELL & GANGADHARAN, 2003).

Eq. 1 is used to estimate the demand curve. By increasing the hypothetical entry price and by Eq. 2, the number of total visits ( $Q$ ) for varying prices is determined as below:

$$Q = \sum_{i=1}^n f(TC_i + P) \quad (2)$$

This is the process by which the entire Marshallian or normal demand curve is derived (GILLESPIE, 1997). This Marshallian demand curve predicts how the total number of visits would change if the costs of visiting the park changed. Rational individuals will weigh up the recreational benefits against the costs of that recreation and will visit the park only if the net value of the visit is positive.

The basic principle for the valuation provided by the TCM is consumer surplus. An individual's consumer surplus is the amount he or she would be willing to pay less the amount she actually pays to visit the park. The total consumer surplus of the park is the sum of individual consumer surpluses. It follows that the area under the Marshallian demand curve is the estimated consumer surplus. If the park has no entry fee, then the total area under the demand curve gives the economic benefit to consumers from visiting the park.

The total number of visitors in this study was collected from the Department of Cultural Heritage and Tourism in Guilan province, Iran. Due to the geographical location, desirable weather, the presence of Ghaleh Rudkhan castle in this park and facilities could be the main reasons for a large number of people visiting the park. Research methodology at this study is based on collecting quantitative and qualitative data, visiting the site, preparing and testing the questionnaire, completing

the questionnaire by visitors. The SPSS, Eviews, and Excel software were used for data analysis. In this study, a random sampling method was applied and a number of 40 pre questionnaires containing 32 socio-economic questions were completed by visitors of Ghaleh Rudkhan Park in the summer and autumn seasons of 2016 (MOHAMMADI LIMAIE ET AL., 2017). Pre questionnaires used to assess the clarity of the questionnaire, suitability for the participants and it enables the surveyor to reconstruct some of the wording of the questions in the main questionnaire. The Cochran formula with a confidence coefficient of 95% and error of 5% was used in this study to estimate the recreational value and determine the sample size Eq. 3.

$$n = \frac{t^2 s^2}{d^2} \quad (3)$$

Replacing the values of  $t$ ,  $s$  and  $d$  in equation 3, the required sample was determined and it was 272 questionnaires.

Therefore, the required questionnaires were distributed and completed among the recreational site visitors. Out of 272 questionnaires, three questionnaires were excluded because of incomplete information.

#### 4. Results and discussion

Table 1 shows the descriptive statistics of social-economic features of Ghaleh Rudkhan forest park visitors. It shows that the average age of visitors, family size, educational level and family income were 35.24 years, 2.44 people, 14.34 educational levels, and 20238.617 Rials, respectively. It should be noted that 1 USD was about 30000 Iranian Rials when the required data of this study was collected in 2016 (Central Bank of Iran, 2018). Also, the average number of visits per each year was 2.43 times per individual. In addition, 48.7% of visitors had a family size of 5 members or more.

Table 1. Socio-economic characteristics of the forest park's visitors

Variables	Average	Standard aviation	Maximum	Minimum
Age	35.24	12.5	69	18
Educational level (number of years)	14.34	2	22	9
Family size	2.44	1	7	2
Income (thousand Rails)	2038.6617	900	5300	500
Number of visits (per year)	2.43	2	5	1
Distance (km)	199.62	3.465	1800	5
Travel cost (Rials)	3740.35	1.602	1800000	100
Staying in the park (hour)	13.3	2.631	24	1

Groups with the highest number of visitors were male as well as married who came to the park with their family using their own cars. The group with highest number of visitors (43.9%) was in the age class of 25-35 years and (21.9%) had a bachelor's degree, with monthly income levels between 10-20 million Rials.

Based on the results (Table 2), 45.9% of the people were self-employed. Of these, 53 people had a bachelor's degree with monthly income levels between 5 - 1.5 million Rials.

Travel costs included food, fuel, entry, time (opportunity cost) and visitor's time spent on site. In this study, 41.3% of the people (Table 3) had paid more than 350000 Rials for visiting the park. Also, people were willing to pay more in order to improve the park facilities. The distance travelled by forest park visitors is shown in Table 4.

According to Table 5, about 31.7% of visitors were satisfied with park facilities and services. In the interview, they responded that they were willing to pay more in order to improve facilities and to protect the park. Since most of the people visit the park at official holidays and weekends, most of them (116 people, 43.1%), spent more time in the park.

Table 6 shows the length of time visitors spent on site. Most people visited the park from nearby, 43.1% of them spent all day in the park. Results of questionnaires indicated that visitors were willing to stay longer in the park if the park's facilities improved. In this study, 48.7% of visitors had a family size of 5 or more (Table 7).

According to Table 8, 38.7% of people visited the forest park once a week which is not far from expected due to the large number of visitors who visited the park many times.

Table 2. Evaluation of visitors's jobs

Job	Relative frequency	Relative frequency (%)
Self-employed	123	45.9
Government employee	84	31.3
Retired	15	5.6
Unemployed	16	6.0
Other	30	11.2

Table 3. Travel costs to visit the forest park

Travel cost (Rials)	Relative frequency	Relative frequency (%)
<500	90	33.5
501-1500	55	20.4
1501-2500	11	4.1
2501-3500	2	0.7
>3500	111	41.3

Table4. Distance travelled by forest park visitors

Distance (km)	Relative frequency	Relative frequency (%)
0-200	153	56.9
201-400	62	23.0
401-600	20	7.4
601-800	15	5.6
801-1000	1	0.4
1001-1200	4	1.5
1201-1400	7	2.6
1401-1600	1	0.4
1601-1800	6	2.2

Table 5. Visitor's satisfaction with available welfare facilities

Quality of facilities	Relative frequency	Relative frequency (%)
Very weak	32	12.2
Weak	16	6.1
Medium	60	22.9
Good	71	27.1
Very good	83	31.7

Table 6. Time spent inside the forest park

Time spent	Relative frequency	Relative frequency (%)
1-2h	47	17.5
2-3h	67	24.9
3-4h	28	10.4
Half a day	11	4.1
A day	116	43.1

Table 7. Family size of the forest park visitors

Family size	Relative frequency	Relative frequency (%)
<=2	12	4.5
3-4	126	46.8
>=5	131	48.7

Table 8. Frequency visits to the forest park

Number of visits	Relative frequency	Relative frequency (%)
Weekly	104	38.7
Biweekly	27	10.0
Monthly	70	26.0
Once a season	55	20.5
Once a year	13	4.8

As the results of the socio-economic part of the questionnaire indicate, most of the visitors (32.3%) urged protection and development of the forest park and 32.2% of the people regarded the facilities of the park to be appropriate. About 25.1% of people choose springtime and official holidays to visit the park. Most of the visitors (91.1%) disagreed with logging and construction of resorts in the park.

## 5. Estimating different forms of travel cost functions

Ordinary Least Square (OLS) was used to determine the relation between variables using Eviews software. Various relations were considered and the most appropriate model was linear relation

(Table 9). Table 10 shows that variables of education, family size, income, travel cost and willingness to pay was significantly correlated with the number of visits at a confidence level of 99%. Also, the variable of duration of residence in the park was significantly correlated with number of visits at a confidence level of 95%.

Table 9. Estimation of travel cost functions to estimate the recreational value of the forest park

Estimated model	Significant variables	Estimated coefficients	Statistic value
Linear	Travel cost (Rials) Income (Rials) Education (year) Family size Distance (km) Constant coefficient	0.000425 0.000319 0.092798 0.685434 -0.014274 2.229606	Durbin Watson = 1.9733 F statistic = 600.5157 Log-likelihood= 72.48- Adjusted coefficients of determination=0.9399
Linear-log	Travel cost (Rials) Income (Rials) Education (year) Family size Distance (km) Constant coefficient	-0.181518 0.666273 1.11814 -1.421324 -0.031800 -3.4443	Durbin Watson=-3.444345 F statistic =522.1293 Log-likelihood= -90.1278 Adjusted coefficients of determination =0.9315
Log-linear	Travel cost(Rials) Income(Rials) Education(year) Family size Distance(km) Constant	-0.000403 0.000104 0.041031 -0.237273 -0.001637 0.705342	Durbin Watson=1.902607 F statistic =562.4444 Log-likelihood= 126.8288 Adjusted coefficients of determination =0.9378
Log-log	Travel cost(Rials) Income(Rials) Education(year) Family size Distance(km) Constant	-0.131906 0.329163 0.582827 0.273567 0.006982 2.397077	Durbin Watson=1.926818 F statistic =536.0450 Log-likelihood = 120.1740 Adjusted coefficients of determination =0.9349

Table 10. Results of linear regression model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.229606	0.315117	7.075498	0.0000
Distance	-0.014274	0.011518	-1.239343	0.2163
Education	0.092798	0.010028	9.254368	0.0000
Family size	-0.685424	0.079557	-8.615507	0.0000
Income	0.000319	3.99E-05	8.011262	0.0000
Visitor's time spent on site	-0.046649	0.022570	-2.066895	0.0397
Total cost	-0.000425	9.07E-05	-4.691369	0.0000
Willingness to pay	0.100902	0.027973	3.607066	0.0004
R-squared	0.941540	Mean dependent variable		2.427509
Adjusted R-squared	0.939973	S.D. dependent variable		1.312734
S.E. of regression	0.321626	Akaike information criterion		0.598437
Sum squared residual	26.99877	Schwarz criterion		0.705342
Log likelihood	-72.48971	F-statistic		600.5175
Durbin-Watson stat	1.973375	Probability(F-statistic)		0.000000

Out of 6 explanatory variables in the linear regression model, 5 of these are statistically significant and have an effect on the number of visitors to the forest park (Table 10). The variable coefficient of travel cost to visit the recreational site was - 0.000425 and it was significant at significance level of 1%. It shows that increasing the travel cost by 10000 Rials, the number of visits will decrease by a factor of 0.425 and the negative sign confirms this relationship. The income variable was significant at a significance level of 5% and shows an increase in income of 10000 Rials, the number of visits will be decreased by a factor of 0.000319. The education variable shows that with an increase of one year of people's education, the number of visits will be increased by about 0.0927 units. Furthermore, with increasing family size by one individual, the number of visits will increase by about 0.65 units. The distance variable was significant with a negative coefficient at significance level of 5% and shows that with an increase of 1 km to the travel distance, the number of visits will decrease by about 0.014 units.

The willingness to pay has a significant relationship with a significance level of 1% with the number of people visiting the forest park. It shows that there is a direct relationship between the number of people visiting and their willingness to pay for protecting the park.

Coefficient of determination was about 0.93 which shows that the related variables have been able to explain 93% of the variance of the independent variables.

The highest entrance cost which caused the number of visitors to reach zero was about 52460 Rials per family. According to the average family size (2.44) this value is estimated at about 21500.05 Rials per individual. Regarding these results, the consumer surplus for each visitor will be determined as:

$$N = 0.000452 - 2.229606 \times TC$$

$$TC = 2.229606 \div 0.000452 = 524600.13176$$

Consumer surplus for each visitor =

$$\int_0^{21500.05} 2.229606 - 0.000452 \times TC = 479300.76$$

Given that, the total number of visitors was 125861 people in 2016 and according to Table 1 which shows the average number of annual visits per individual as 2.43. Hence, the recreational value of Ghaleh Rudkhan forest park based on ITCM is about 146590413279 Rials per year. Also, the recreational value of the park per hectare was estimated and is about 78390595 million Rials.

## 6. Discussion

In this study, the economic value of Ghaleh Rudkhan forest park as one of the main tourist destinations in Guilan province, northern Iran, was estimated using ITCM. Results indicated that the travel cost was negatively correlated with the number of visits at a confidence level of 99% which shows that by increasing the travel cost, the number of visits will be reduced and the results of this study were in line with the results of other studies such as [FIXON & PANGAPANGA \(2016\)](#) and [CHAE ET AL. \(2011\)](#) and [MOHAMMADI LIMAEI ET AL. \(2014\)](#).

In a study by [FIXON & PANGAPANGA \(2016\)](#) on Lengwo forest park in Malawi, it was found that there was an inverse relationship between number of visits and travel costs for each individual per year and also a direct relationship was found between income and number of visits. The negative relationship between number of visits and distance travelled was significant at the confidence level of 95%. Most of the people (55.8%) visiting the Ghaleh Rudkhan forest park were local people with a travel distance of less than 200 km and 38% of people visit the park once a week and stay there for about half a day. As the distance to the site increases, the stay duration will increase and also the cost will be increased. [MOHAMMADI LIMAEI ET AL. \(2014\)](#) in a study at Masouleh forest park in the north of Iran using TCM found that the number of visits, travel duration and distance were significantly correlated whereas with increasing travel distance and cost, the number of visitors will be reduced. Also, the number of visitors as a dependent variable was significantly correlated with travel cost. Therefore, by increasing the travel cost, the number of visitors will be decreased. In our study area, because of cold weather condition many kiosks are closed in winter, roads are inappropriate because of rainfall and visiting hours will be limited and this is a reason why numbers of visitors are lower in winter time. According to the visitors, the main reason to visit the park is relaxing and enjoying the beauty of nature in the forest park.

This study shows that educational level plays an important role in attracting tourists to the Ghaleh Rudkhan forest park. Only 20.1% of the people had a high school education while 46.9% of them had a bachelor degree or higher. Educational level is significantly positively correlated with income and by increasing the educational level, the leisure opportunities of people increases, which confirm the above result. Educated people are willing to spend their time with entertainment that encourages them to visit nature and enhance

their awareness of nature and this helps to protect nature by these people which is in line with the results of MOJABI & MONARARI (2005), MAFI GHOLAMI & YARALI (2008). Income will increase with increasing educational level. Results show that income and number of visits were significantly positively correlated confirming the results of CHAE ET AL., (2011) and MOHAMMADI LIMAEI ET AL. (2014). According to the results of the questionnaire, it is suggested to create a medical centre for people who are willing to stay more than one day and also to build facilities such as cable transport in the park for older people. TCM studies in different parks using different methods and assumptions are essential in order to refine and increase the robustness of this method, and to increase the understanding of its capabilities and limitations (HEBERLING & TEMPLETON, 2009).

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