

Exploring access modes to Baghdad international airport

Rusul Sabit^{1*} and Noor Asmael¹

¹Mustansiriyah University, College of Engineering, Baghdad, Iraq

Abstract. Baghdad International Airport receives nearly two million visitors annually. So it's important to analyze the accessibility of the airport. This research aims to show the effect of several factors on the accessibility to the airport and diagnose the problems facing passengers, and identify some significant factors that affected user preference for an airport transfer, by making a questionnaire to the passengers who traveled from Baghdad International Airport. A structured questionnaire was developed in English and translated into Arabic for a high response, and to ensure the result with a 95% confidence level, 404 airline passengers will receive a questionnaire through an online survey. The accessibility was evaluated through about 20 factors, such as gender, age, passenger's income, mode of transportation to the airport, car ownership, children on the trip, luggage, time, trip purpose, distance, origin, and destination, type of the flight, comfortable, and others. Statistical analysis for the variables by using the SPSS V.20 program was conducted, using the chi-square test to check for independence and the correlation between variables (gender, age, income, mode of transportation to the airport, flight time) was analyzed. The findings indicate that gender and income variables affected how people could access the airport.

1 Introduction

Numerous research has looked at how factors like travel time, cost, and sociodemographics of people influence the mode of transportation they choose while going to and from airports. [1-10] A number of these studies are based on airport surveys that collect information on travelers and their trip-related attributes. For instance, to forecast market shares when the airport is relocated, Psaraki and Abacoumkin [8] look at the current modal shares at the Athens International Airport. They first divide travelers into several categories according to their residency status, travel locations, and travel objectives, and then examine the mode selections of these groups independently.

Research by Tsamboulas and Nikoleris focuses on people's willingness to pay to save time on airport trips (2008). They discover that a significant portion of travelers would not be prepared to pay any amount of money to shorten their travel times to the airport based on surveys taken at the Athens International Airport. This may be explained by the fact that travelers arrive at the airport well in advance and have plenty of time, that they picked modes

* Corresponding author: edma023@uomustansiriyah.edu.iq

of transportation that provide high-quality services, and that they were not interested in paying extra to minimize their travel times. [10]

Gulsah Akar looks at the passengers' ground access mode choices when they travel to Port Columbus International Airport in Columbus, Ohio by using a survey [11]. Ilgin Gokasar and Gurkan Gunay add to the body of knowledge by addressing a topic that hasn't been addressed in prior research in this area: the influence of transit regions on mode choice. He uses Multinomial Logit to study the ground access mode choice to airports (MNL) [12].

Numerous issues are brought on by the regular use of more autos. Many people have emphasized how unsustainable the current transportation system is [13]. To create a more sustainable transportation system, several different approaches have been put forth. One can generally distinguish between behavioral changes and technological developments. Changes in behavior are intended to decrease the amount of car use, such as switching to less polluting forms of transportation, altering destination preferences, condensing trips, or traveling less. These techniques could enhance environmental quality, urban quality of life, and accessibility to destinations.

Recently, a variety of methods have been employed in the construction of accessibility models to assist in the decision-making process for land use and transportation [14]. The need for effective techniques to assist planners and decision-makers with urban and transportation management and provide a better evaluation of the impacts of various schemes (or combinations of schemes) advanced by transportation and land-use policies led to the translation of accessibility into a practical planning tool.

Providing safe, convenient, and secure access to people's destinations is one of the issues that big cities face today. Creating new transportation modes is one strategy being tested to address the need for long-distance travel [15]. For the development, design, and administration of airport lounges, Manataki and Zografos offered a decision-support tool [16]. Minato and Morimoto studied regional airports as business ecosystems, developed a simulation model of the system, and then recommended formulating the best management practices for guaranteeing the airport's commercial sustainability [17]. Numerous authors have reviewed accessibility measures, frequently concentrating on certain aspects, such as geographic accessibility (e.g. Song, 1996; Handy and Niemeier, 1997) [18,19], and individual accessibility (e.g. Kwan, 1998) [20].

The demand for airline travel has increased phenomenally in the present-day world. More and more passengers are using airlines for travelling from one place to another. Iraq country is growing fast. Due to the limited research that takes the passenger perspective to measure airport accessibility, the relevant attributes based on passenger activities were explored. Many evaluation criteria are used to measure Airport's accessibility that relates ground infrastructure to the airport. Relevant attributes for airport transfer include: location of trip origin, income, age, gender, car ownership, security Screening, Baggage Transfer, and others were evaluated based on user satisfaction.

2 Study Area

Baghdad International Airport is Iraq's biggest airport and is the main center for operations for Iraqi Airways. It is situated 16 kilometers west of Baghdad. According to data from the Iraqi Ministry of Planning for Aviation, 3,222,081 people traveled by airline there in 2018. The airport contains 3 main buildings, which are (Babil, Nineveh, and Samarra), and each of these buildings include six drawbridges to deliver passengers to aircraft, in addition to VIP lounges for VIPs. The annual passenger capacity of Baghdad International Airport is estimated to be 7.5 million. See "Fig. 1".

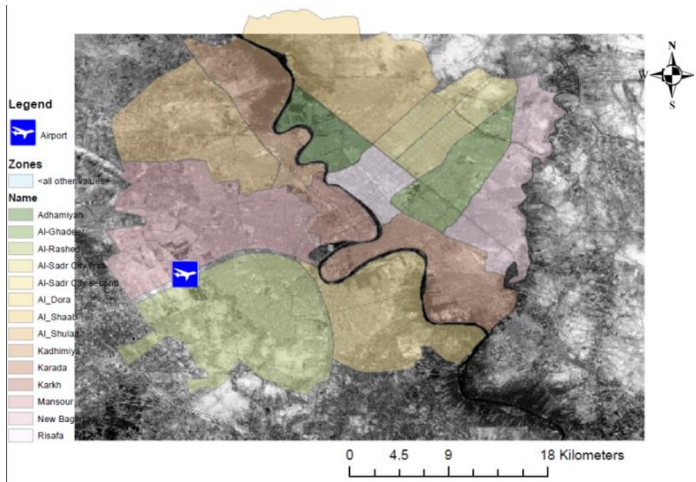


Fig. 1. Study area

3 Data and methods

3.1 Data collection and Sample size

The data was collected through a survey of passengers who traveled from Baghdad international airport during the year (2021_2022). Customer satisfaction surveys are collected from population sampling to evaluate the service quality based on the customer’s point of view. The flight schedule for Iraqi Airways was observed for one week, according to the observed data, the following histogram below was created. Fig.2 it is shown that the peak flight number occurred at 4 pm. This period is selected to estimate population data; the number of passengers is estimated to be about 4200. “See Fig. 2”.

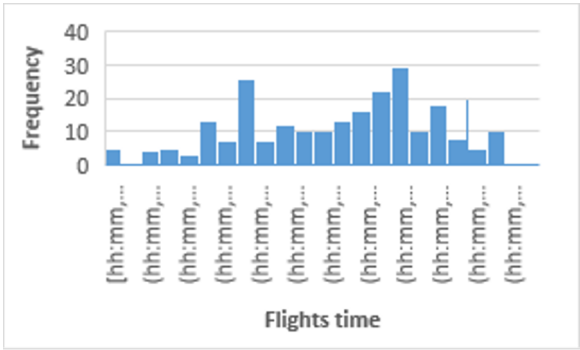


Fig. 2. Flight schedule

Use the Cochran formula to determine the optimum sample size according to a desired level of precision, a desired level of confidence, and an estimated fraction of the attribute present in the population. So Cochran’s formula for a small population is as follows:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} \tag{1}$$

Where n_0 is the sample size that was determined for an infinite population using the following formula:

$$n_0 = \frac{z^2 p q}{e^2} \quad (2)$$

Researchers initially determined n_0 using eq. (2), and z as the critical value of the desired confidence interval.

Where: e is the desired level of precision, p is the (estimated) proportion of the population that has the attribute in question, q is $1 - p$, and the z -value is found in a Z table.

Take the confidence of 95%, The normal tables give us Z values of 1.96 at a 95% confidence level. P is an attribute's estimated proportion, which is typically taken to be 50% to produce the best results. P (50%) is represented by 50/100, which equals 0.5, and q is represented by 0.5 as well. the desired level of precision must be about 5%, so the Value of e is taken as 0.05. so: $n_0 = 384.16$

Then by using eq. (1), $N = 4200$ and $n_0 = 384.16$, the final sample size is equal to 352, so that means 352 questionnaires were collected.

The questionnaire was carried out online via google form because it was difficult to interview passengers in touch at the airport and requires a lot of time.

3.2 Questionnaire Design

Questionnaires have been used to obtain passenger perception of the relative importance of attributes affecting airport access mode. The design of questionnaires for survey research represents one of the most challenging aspects in terms of accuracy in measuring respondents' perceptions (Sato, 2003). Service attributes in every airport domain will be used to assess airport service performance based on the passenger experience. The survey was logically divided into three parts due to their belonging to certain topics. The first part of the questionnaire related to the socioeconomic respondent was aimed at defining informants' general attributes such as gender, age, and place of residence. The second part related to the type of modes used to reach the airport with their characteristics.

A structured questionnaire was developed in English and translated into Arabic for a high response, distributed among the passengers who traveled. A questionnaire will be sent through an online survey to 404 air passengers to secure the result with a 95% of confidence level. The online questionnaire was used for data collection. Statistical analysis was processed with MS Excel software and SPSS software to represent the results.

4 Results and discussion

The link to the questionnaire was distributed to groups of travelers from Baghdad international airport on several social media sites. As a result, 404 people answered the questions.

A customer survey is an effective tool to inquire about what customer needs and expects. Data Analysis includes Percentage, frequencies, mean, and standard deviation analysis methods the statistical tools used for analysis. For the testing of the variance and significance of the results; data were analyzed using descriptive analysis, Chi-square test, and ANOVA analysis.

4.1 The summary of the questionnaire respondents.

Below shown the detailed tables of the summary of the questionnaire respondents. Table 1. shows that the majority of questionnaire respondents (281 in total, or 69.6% of the total) are men, and then (123 in total, or 30.4% of the total) are women.

Table 1. The gender of the passengers

Gender	N	%
Male	281	69.6
Female	123	30.4
Total	404	100

Table 2. shows that the majority of questionnaire respondents (37.1% of the total) are more than 18 years old and less than 30 years old, followed by (35.6% of the total) who are more than 30 years old and less than 40 years old. There are 65 persons or 16.1% of the total who are in the age group (40-50), and there are 7.2% of the sample size are in the age group (50-60), and lastly, the age more than 60 years old represented by 4% of the total.

Table 2. The age of the passengers

Age	N	%
age group (18-30)	150	37.1
age group (30-40)	144	35.6
age group (40-50)	65	16.1
age group (50-60)	29	7.2
more than (60 years old)	16	4
Total	404	100

Table 3. shows that the majority of questionnaire respondents (40.8% of the total) have an income between (1000\$-2000\$), followed by (40.6% of the total) have an income of less than (1000\$). There are 9.2% for (2000\$-3000\$) group income and 9.4% of the total have an income of more than (3000\$).

Table 3. The income of the passengers

Income	N	%
less than (1000\$)	164	40.6
(1000\$-2000\$)	165	40.8
(2000\$-3000\$)	37	9.2
more than (3000\$)	38	9.4
Total	404	100

Table 4. show the majority of the respondents have traveled only once represented by 40.6% of the total. There are 25% of the total who have traveled two times, and lastly, the people who have traveled three times represented 8.7% of the total, followed by (25.7% of the total) that have traveled more than three times.

Table 4. Number of travel frequencies per each passenger for the year (2021-2022)

How many times have you traveled for the year(2021-2022)	N	%
1	164	40.6
2	101	25
3	35	8.7
more than 3	104	25.7
Total	404	100

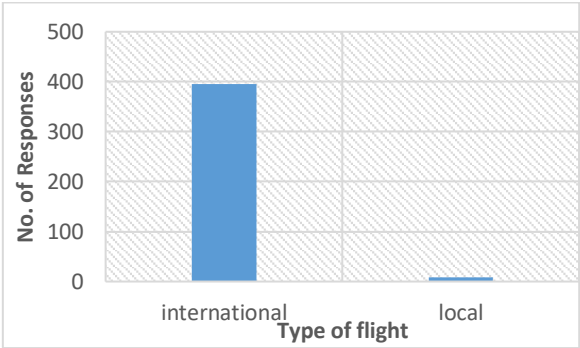


Fig. 3. Type of the flight according to the destination

According to the destination of the respondents, there are only 17 local flights and the majority of flights were international. See “Fig. 3”.

Table 5. Type of mode of transportation to the airport

Mode of transportation to the airport	N	%
Personal car	103	24.5
Taxi	154	37.9
VIP taxi	125	30.9
public transportation	15	3.7
Other modes	12	3
Total	404	100

According to “Table 5”, most respondents (37.9% of the total) use a taxi to the airport, followed by the people who use the VIP taxi to the airport account for (30.9% of the total). There are 24.5% of the total use a personal car to the airport, the people who use public transportation to the airport represented 15 persons of the total, and lastly, the people who use other modes represented only 3% of the total.

Table 6. Use the airport parking to park the car of the passengers

Use the airport car park to park your car	N	%
Yes	60	14.9
No	344	85.1
Total	404	100

According to “Table 6” there are 85.1% of the respondents didn’t use airport parking to park their cars, and 14.9% of the total used airport parking.

Table 7. Number of persons accompanying the passenger on the trip

Number of persons accompanying the trip	N	%
No	123	30.4
1	97	24
2	78	19.3
3	51	12.6
More than 3	55	13.6
Total	404	100

Table 7. shows that the majority of the respondents represent 30.4% of the total who are not accompanied by anyone on the trip, followed by 24% of the total accompanied by only one person. There are 19.3% of the total accompanied by two persons, 13.6% of the total accompanied by more than three persons, and lastly, 12.6% of the total accompanied by three persons.

Table 8. Number of children accompanying the passenger on the trip

Number of children accompanying the trip	N	%
No	319	79
1	34	8.4
2	35	8.7
3	15	3.7
More than 3	1	0.2
Total	404	100

Table 8. shows that the majority of the respondents represent 79% of the total who are not accompanied by a child on the trip, followed by 8.7% of the total were accompanied by two children. There are 8.4% of the total accompanied by one child, 3.7% of the total accompanied by three children, and lastly, 0.2% of the total accompanied by more than three children.

Table 9. Weight of the baggage and luggage on the flight trip

Weight of the baggage and luggage	N	%
Less or equal to 10 kg	52	12.9
More than 10 kg and less than 20 kg	133	32.9
More than 20 kg and less than 30 kg	148	36.6
More than 30 kg and less than 40 kg	37	9.2
More than 40 kg and less than 50 kg	34	8.4
Total	404	100

Table 9. shows that the majority of respondents represented 36.6% of the total accompanied by baggage and luggage weighing more than 20 kg and less than 30 kg per flight, followed by 32.9% of the total, accompanied by baggage and luggage weighing more than 10 kg and less than 20 kg. There 12.9% of the total accompanied by baggage and luggage weighing less or equal to 10 kg, 9.2% of the total by baggage and luggage weighing more than 30 kg and less than 40 kg, and lastly, 8.4% of the total accompanied by baggage and luggage weighing more than 40 kg and less than 50 kg.

Table 10. The Purpose of the trip

Purpose of the trip	N	%
Religious	13	3.2
Tourist	200	49.5
Work	66	16.3
Educational	80	19.8
Social	45	11.1
Total	404	100

According to “Table 10” most respondents representing 49.5% of the total have traveled for tourism. Conversely, the least respondents represented 3.2% of the total have traveled for religious, there are 19.8% of the total have traveled for education, and 16.3% of the total have traveled for work. Lastly, the people traveling for social represented 11.1% of the total.

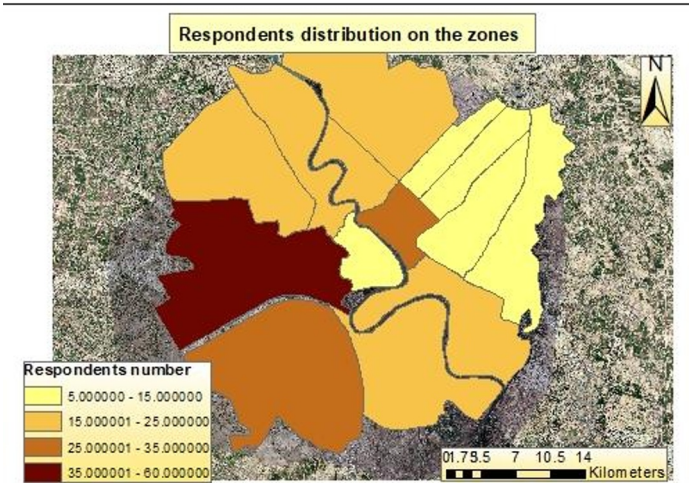


Fig. 4. The origin areas of the passengers

“Fig. 4. represents the respondent's distribution to the fourteen zones in the city of Baghdad depending on their origin areas of them.

Table 11. The comfortable of carrying luggage and baggage

Was it comfortable to carry luggage and baggage?	N	%
Yes	246	60.9
No	158	39.1
Total	404	100

Depending on the results from “Table 11”. There are 60.9% of the respondents were comfortable carrying luggage and baggage, and 39.1% of the total were not comfortable carrying luggage and baggage.

Table 12. Missing flight tickets in the last 3 years

Have you missed a flight ticket in the last 3 years	N	%
Yes	51	12.6
No	353	87.4
Total	404	100

Table 12. shows that there are 87.4% of the respondents didn't lose a flight ticket, and 12.6% of the total lost a flight ticket.

Table 13. preferred time to arrive at the airport before flight time

The time you want or preferred to arrive at the airport before the flight time	N	%
Half an hour before flight time	35	8.7
1 hour before flight time	156	38.6
2 hours before flight time	128	31.7
3 hours before flight time	80	19.8
4 hours before flight time	5	1.2
Total	404	100

According to "Table 13". Most respondents represented 38.6% of the total preferred to arrive 1 hour before flight time, followed by 31.7% of the total preferred to arrive 2 hours before flight time. There are 19.8% of the total preferred to arrive 3 hours before flight time, 8.7% of the total preferred to arrive half an hour before flight time, lastly 1.2% of the total preferred to arrive 5 hours before flight time.

Table 14. Car ownership

Do you own a car	N	%
Yes	126	68.8
No	278	31.2
Total	404	100

Table 14. show that there are 68.8% of the respondents have a personal car, and 31.2% of the total don't have a personal car

Table 15. Establish a second airport in the city of Baghdad

Do you want to establish a second airport in the city of Baghdad	N	%
Yes	193	47.8
No	211	52.2
Total	404	100

Table 15. show there are 47.8% of the respondents don't want to establish a second airport in the city of Baghdad, and there are 52.2% of the respondents want to establish a second airport in the city of Baghdad.

4.2 Chi-square test by using SPSS statistical program

Adding the questionnaire responses, SPSS statistical program was used to analyze the variables by using the chi-square test to check for independence between variables (gender, age, income, mode of transportation to airport), and the results are summaries as follows:

check for independence between the gender and mode of transportation.

The results from the chi-square test table (16-a, b) show that the mode of transportation to the airport depends on the gender variable since the value of P (0.002 less than 0.05).

Table 16-(a). Gender vs. Mode of transportation to the airport Cross tabulation Chi-Square tests

Chi-Square tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.685 ^a	4	.002
Likelihood Ratio	16.769	4	.002
Linear-by-Linear Association	5.073	1	.024
N of Valid Cases	404		
2 cells (20.0%) have an expected count of less than 5. The minimum expected count is 3.65.			

Table 16-(b). Symmetric measures

Symmetric measures		Value	Asymp. Std. Error	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	.112	.051	2.264	.024 ^c
Ordinal by Ordinal	Spearman Correlation	.126	.051	2.551	.011 ^c
N of Valid Cases		404			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					
c. Based on normal approximation.					

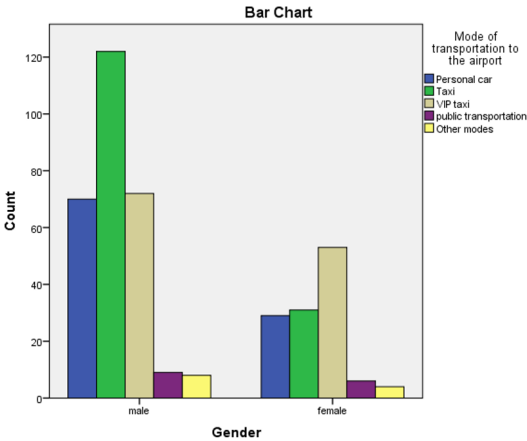


Fig. 5. Gender vs. Mode of transportation to the airport

check for independence between income and mode of transportation. The results from the chi-square test Table 17-(a, b) show that the mode of transportation to the airport depends on the income variable since the value of P (0.022 and 0.009 less than 0.05).

Table 17- (a). Income vs. Mode of transportation to the airport Cross tabulation Chi-Square tests

Chi-Square tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.678 ^a	12	.022
Likelihood Ratio	26.393	12	.009
Linear-by-Linear Association	.099	1	.753
N of Valid Cases	404		
a. 6 cells (30.0%) have an expected count of less than 5. The minimum expected count is 1.10.			

Table 17-(b). Symmetric measures

Symmetric measures		Value	Asymp. Std. Error	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	.016	.047	.314	.754 ^c
Ordinal by Ordinal	Spearman Correlation	.042	.050	.849	.396 ^c
N of Valid Cases		404			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					
c. Based on normal approximation.					

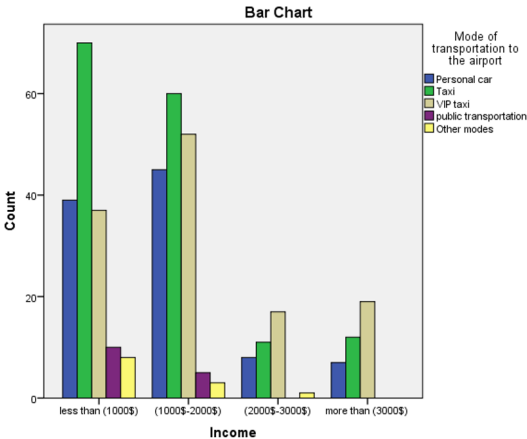


Fig. 6. Income vs. Mode of transportation to the airport

check for independence between the age and mode of transportation.

The results from the chi-square test Table 18-(a, b) show that the age variable independence on the mode of transportation to the airport variable since the value of (0.527 and 0.306 greater than 0.05).

Table 18-(a). Age vs. Mode of transportation to the airport Cross tabulation Chi-Square tests

Chi-Square tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.969 ^a	16	.527
Likelihood Ratio	18.315	16	.306
Linear-by-Linear Association	.288	1	.591
N of Valid Cases	404		
a. 10 cells (40.0%) have an expected count of less than 5. The minimum expected count is .48.			

Table 18-(b). Symmetric measures

Symmetric measures		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	.027	.048	.537	.592 ^c
Ordinal by Ordinal	Spearman Correlation	.062	.049	1.238	.216 ^c
N of Valid Cases		404			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					
c. Based on normal approximation.					

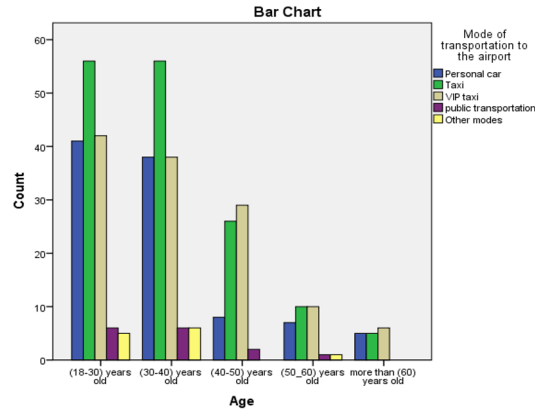


Fig. 7. Age vs. Mode of transportation to the airport

5 Conclusions

The findings of the research were expected to provide guidelines to the management of the airport in improving the services. According to the questionnaire responses, the security screening, and the airport processing domain has the highest impact value contributing to the overall airport performance. Facilitation to reach directly to the airport and not to get off in yards far from the airport and to head back to the airport using taxis of the airport. This research highlighted the effect of the variables on access mode to the airport and showed some important attributes that influenced user preference for airport transfer. The results show that access mode to the airport depends on gender and income variables, the age variable has no significant effect on mode selection. Accessing passengers to the airport was very high cost and the respondents shows unpleasant satisfaction due to security, high cost, and check-in services. The dominant mode to access the airport is by taxi because there are no other modes available to the user. It is preferable to increase accessibility to the airport by enhancing and improving public transport.

6 Acknowledgments

The author expresses her appreciation to Mustansiriyah University (www.uomustansiriyah.edu.iq) in Baghdad – Iraq for providing academic advice to her research.

References

1. S.N. Alhussein, *Journal of Transport Geography* **19**, 1361-1367 (2011) <https://doi.org/10.1016/j.jtrangeo.2011.07.007>
2. C. Cirillo, and R. Xu, *Journal of Urban Planning and Development* **136**, 186-194 (2010) [https://doi.org/10.1061/\(asce\)up.1943-5444.0000018](https://doi.org/10.1061/(asce)up.1943-5444.0000018)
3. P.J. Foote, S.J. LaBelle, and D.G. Stuart, *Journal of the Transportation Research Board* **1600**, 1-9 (2007) <https://doi.org/10.3141/1600-01>
4. S. Gupta, P. Vovsha, and R. Donnelly, *Transportation Research Record: Journal of the Transportation Research Board* **2042**, 3-11 (2008) <https://doi.org/10.3141/2042-01>

5. R.-C. Jou, D.A. Hensher, and T.-L. Hsu, *Transportation Research Part E: Logistics and Transportation Review* **47**, 371-381 (2011) <https://doi.org/10.1016/j.tre.2010.11.008>
6. A.B.F. Monteiro, and M. Hansen, *Journal of the Transportation Research Board* **1562**, 38-47 (1996) <https://doi.org/10.1177/0361198196156200105>
7. E. Pels, P. Nijkamp, and P. Rietveld, *Transportation Research Part A: Policy and Practice* **37**, 71-83 (2003) [https://doi.org/10.1016/s0965-8564\(02\)00007-1](https://doi.org/10.1016/s0965-8564(02)00007-1)
8. V. Psaraki, and C. Abacoumkin, *Journal of Air Transport Management* **8**, 89-98 (2002) [https://doi.org/10.1016/s0969-6997\(01\)00033-3](https://doi.org/10.1016/s0969-6997(01)00033-3)
9. M.L. Tam, W.H.K. Lam, and H.P. Lo, *Journal of Choice Modeling* **4**, 49-69 (2011) [https://doi.org/10.1016/s1755-5345\(13\)70057-5](https://doi.org/10.1016/s1755-5345(13)70057-5)
10. D.A. Tsamboulas, and A. Nikoleris, *Transportation Research Part A: Policy and Practice* **42**, 1274-1282 (2008) <https://doi.org/10.1016/j.tra.2008.03.013>
11. G. Akar, *Journal of Air Transport Management* **30**, 25-31 (2013) <https://doi.org/10.1016/j.jairtraman.2013.04.002>
12. I. Gokasar, and G. Gunay, *Journal of Air Transport Management* **59**, 1-7. (2017) <https://doi.org/10.1016/j.jairtraman.2016.11.003>
13. L. Steg, and R. Gifford, *Journal of Transport Geography* **13**, 59-69 (2005) <https://doi.org/10.1016/j.jtrangeo.2004.11.003>
14. S. Karou, and A. Hull, UK. *J Transp Geogr* **35**, 1-11(2014) <https://doi.org/10.1016/j.jtrangeo.2014.01.002>
15. Y. Li, J. Ye, X. Chen, P.E.M. Abdel-Aty, and M. Cen, *Chin Geogra Sci* **20**, 554-561(2010) <https://doi.org/10.1007/s11769-010-0431-3>
16. I.E. Manataki, and K. Zografos, *A system dynamics approach for airport terminal performance evaluation*. Proc. 4th Int. Work. Model. Simulation, Verif. Valid. Enterp. Inf. Syst. MSVVEIS 2006 - Conjunction with ICEIS, pp. 206-209, (2006) <https://doi.org/10.5220/0002479202060209>
17. N. Minato, and R. Morimoto, *Research in Transportation Business & Management* **1(1)**, 80-90 (2011) <https://doi.org/10.1016/j.rtbm.2011.06.009>
18. S. Song, *Land Economics* **72(4)**, 474-482 (1996) <https://doi.org/10.2307/3146910>
19. S.L. Handy, and D.A. Niemeier, *Environment and Planning A* **29**, 1175-1194 (1997) <https://doi.org/10.1068/a291175>
20. M.P. Kwan, *Geographical Analysis* **30(3)**, 191-216 (1998) <https://doi.org/10.1111/j.1538-4632.1998.tb00396.x>