An Empirical Study of the Adoption of Autonomous Vehicles by Chinese Tourists

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Abstract： The traveling mode and consumption preferences of Chinese tourists are undergoing profound changes with more opting for sightseeing tours to enjoying a wider variety of sightseeing and leisure vacations. Especially after Covid-19 pandemic, “road Trip” or “self-driving tour” were selected by more Chinese tourists with the benefits of higher privacy, security and more freedom. In this research, we supplement the Technology Acceptance Model (TAM) with other consumer factors (from recent studies in China) to investigate Chinese tourists’ perspectives towards the use of autonomous vehicles for holiday tours. Based on a survey of 500 respondents from China, regression analysis confirmed three internal factors and three external factors that supplement TAM to predict adoption. We contribute to technology adoption theory by advancing the understanding of the motivational mechanisms of consumers’ adoption of autonomous vehicles that will enhance the tourism literature.

Keywords: Autonomous Vehicles (AV), Technology Adoption, Chinese Tourists, TAM

Track: Innovation

Word Count: 1703

1. Introduction

An autonomous vehicle, often known as a self-driving car, is a vehicle that, upon startup, operates without human involvement, utilising computerised systems to detect and gather information on the surrounding environment (such as traffic lights, road, signage and obstacles). The information will be analysed to regulate the vehicle's response actions (such as steering, acceleration, and braking) for safe navigation (Hulse et al., 2018). In smart cities, there is a growing interest in the potential of autonomous vehicles to enhance road safety and reduce traffic congestion, gas emissions and fuel consumption with the associated sustainability benefits (Chehri and Mouftah, 2019).

This empirical study aims to understand Chinese tourists' intention to adopt autonomous vehicles (AV) for tours during holidays (not for work) integrating the Technology Acceptance Model (TAM) with adoption predictors. The research enhances TAM by considering group conformity which is a key influencing factor in China and other relevant factors. This paper also investigates the moderating effects of demographics amongst Chinese tourists a group whose traveling mode and consumption preferences are undergoing through profound changes particularly post Covid-19.

2. Theoretical Background

2.1. Innovation theories

According to TAM, the two main variables of perceived usefulness (PU) and perceived ease of use (PEOU) influence user acceptance. PU is defined as the extent to which an individual believes that using an innovation will enhance performance. PEOU refers to the extent to which an individual believes that using an innovation will be free of effort (Tang et al., 2023; Jing et al., 2020). The validity of the TAM has been verified in many technology and innovation areas (Hu et al., 2015) using statistical testing, which provides a strong theoretical support for understanding and predicting the acceptance degree of new technology in the market. The comprehension of consumer acceptance behaviour has been further explored through the integration of the Innovation Diffusion Theory (IDT) (Yuen et al., 2020).

2.2. Users' acceptance of AVs

In addition to TAM factors, other factors will be considered during this research to conduct a comprehensive study of Chinese tourists' perspectives, as shown in Figure 1.

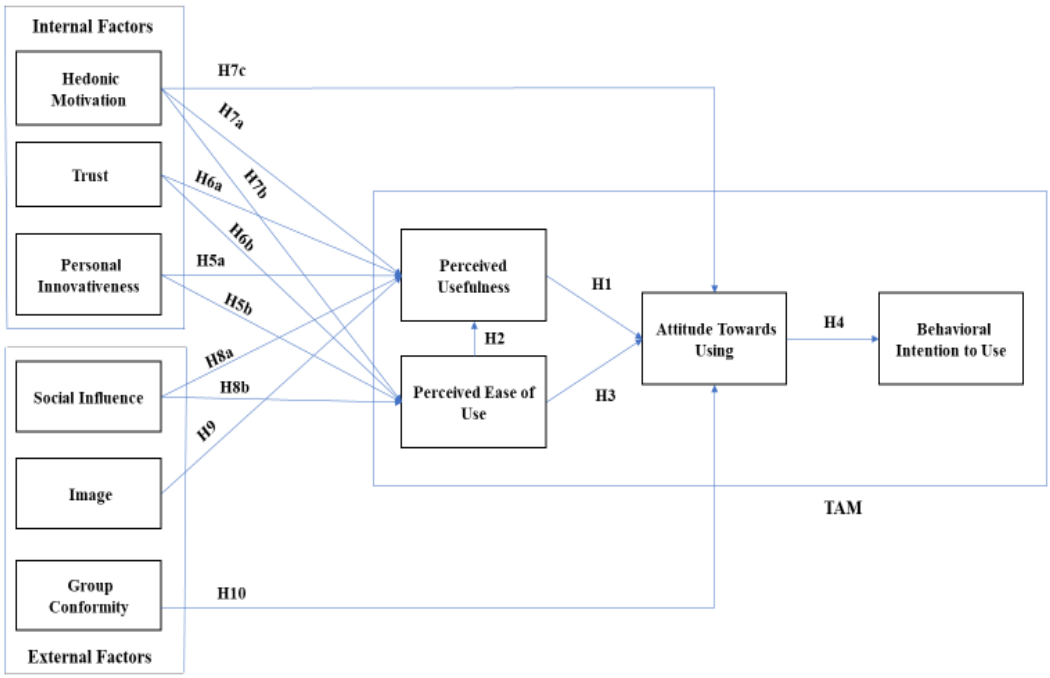

Figure 1. The Conceptual Framework

3. Research Model and Methodology

3.1.Research Model

The conceptual framework of the paper consists of three phases comprising fifteen hypotheses. The first phase is internal factors, which consist of three constructs: Hedonic Motivation (HM), Trust (TRU), and Personal Innovativeness (PI). The second phase consists of External factors, which have three constructs: Social Influence (SI), Image (IMG) and Group Conformity (GC). The third phase (referred to as TAM) contains two predictors of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), and two outcomes of the study as Attitude Towards Use (ATU) and Behavioral Intention to use (BI) (Figure 1) .

3.2.Methodology

3.2.1. Survey design

To obtain a good breadth of responses from adults across China an electronic survey was conducted. This study posted questionnaires to Sojump to which there were 500 respondents via a random selection method. These respondents were from different regions, spanning 30 provinces, autonomous regions, and municipalities in China.

3.2.2. Measures

A questionnaire comprised of two parts was designed to collect data. The first part collected demographic information of the respondents, and the second part included the measurement items of various constructs. The measuring method was based on a 7-point Likert scale ranging ranging from 1 = disagree, 2=n, 3=slightly agree, 4=agree, 5=strongly agree, 6=very strongly agree, and 7 = completely agree, with more positive options to better distinguish respondent's views on AV.

3.2.3. Respondents and Data Collection

Among the 500 respondents, the proportion of male (46.6%) and female (53.4%) respondents was quite evenly distributed. The study employed the robust SPSS software to run multiple regression for hypothesis testing, a data analysis method known for its reliability and accuracy.

4. Results

4.1.Reliability and Normality Test Results

The reliability of the measurement was assessed by calculating Cronbach's alpha, commonly used as a measure of internal consistency. The analysis reveals that the Cronbach's alpha scores for all factors across the various technologies investigated in this paper are above 0.70, indicating a high level of reliability for all factors. As shown in Table 1, all the scores obtained for skewness are within the acceptable range, thus indicating a normal distribution of the data.

Table 1 Reliability and Normality Test for Model Factors

Variables	Mean	SD	α	Skewness	Kurtosis
BI	3.9530	1.54412	0.899	-0.006	-0.866
ATU	4.1405	1.64911	0.917	-0.128	-0.999
PU	4.1060	1.53794	0.900	-0.058	-0.899
PEOU	3.9970	1.49481	0.906	-0.016	-0.844
HM	4.3200	1.57108	0.904	-0.210	-0.870
TRU	4.2465	1.51731	0.895	-0.172	-0.809
PI	3.9280	1.45819	0.871	0.086	-0.811
SI	3.6410	1.60508	0.912	0.156	-0.987
IMG	3.5875	1.64800	0.860	0.292	-1.000
GC	3.8130	1.55245	0.916	0.113	-0.882

4.2.Linearity

An inter-correlation test was conducted to assess the degree of relationship among the various model factors. As indicated in Table 2, the correlation coefficients between the constructs are strong, which will be tested further using statistical techniques, particularly for HM, TRU, PI, SI, IMG, and GC. The result suggests a close interrelationship within the study's theoretical framework. Consequently, these findings lend credence to the research hypothesis positing a significant correlation among the aforementioned constructs, thereby laying a solid foundation for subsequent regression analysis.

Table 2 Pearson's Correlation Matrix

Correlations										
	BI	ATU	PU	PEOU	HM	TRU	PI	SI	IMG	GC
BI	1									
ATU	.906**	1								
PU	.826**	.865**	1							
PEOU	.831**	.850**	.853**	1						
HM	.835**	.874**	.864**	.838**	1					
TRU	.822**	.860**	.846**	.836**	.883**	1				
PI	.787**	.773**	.793**	.827**	.780**	.779**	1			
SI	.820**	.828**	.804**	.837**	.816**	.810**	.841**	1		
IMG	.771**	.768**	.767**	.782**	.753**	.750**	.806**	.896**	1	
GC	.834**	.847**	.826**	.838**	.827**	.821**	.836**	.877**	.850**	1

* Correlation is significant at the 0.01 level ** Correlation is significant at the 0.05 level

4.3.Multiple Regression of three phases

Phase 1: Internal factors

The impact of internal factors on attitude towards using AV technology was comprehensively examined in the first phrase of the model, as clearly outlined in Figure 2. This analysis was conducted with the aim of gaining a deeper understanding of the factors that influence people's perception and willingness to adopt such technology. The statistical data revealed that the findings of the multiple regression analysis indicated a statistically significant model (P value < 0.05).

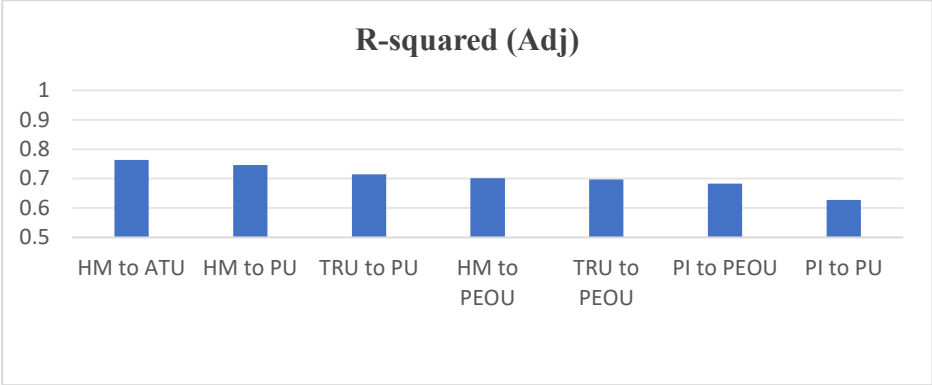

Figure 2. The R-squared (adj.) of phase 1

Phase 2: External factors

In the second phase of the study, a thorough examination was conducted to assess the impact of external factors on Chinese tourists' attitude towards the utilisation of AV, as outlined in Figure 3. The multiple regression analysis on these factors indicated a statistically significant model (P value < 0.05).

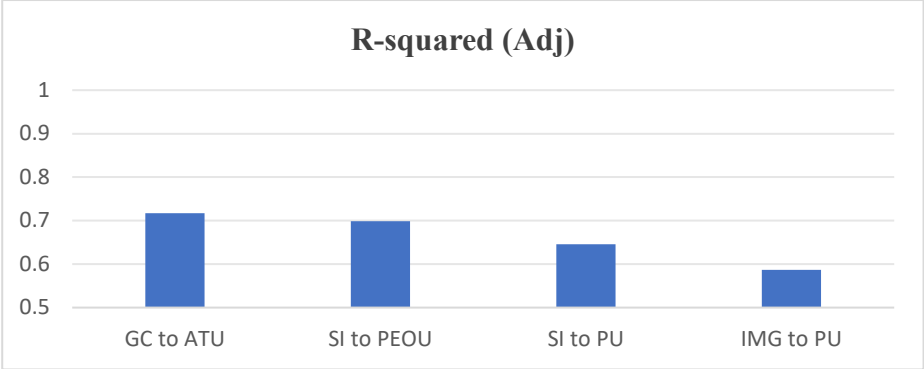

Figure 3. The R-squared (adj.) of phase 2

Phase 3: TAM

Figure 4 demonstrated the influence of TAM on individuals' attitudes towards utilisation, specifically through the perceived usefulness and the perceived ease of use. The statistical data revealed that the findings of the multiple regression analysis indicated a statistically significant model (P value < 0.05).

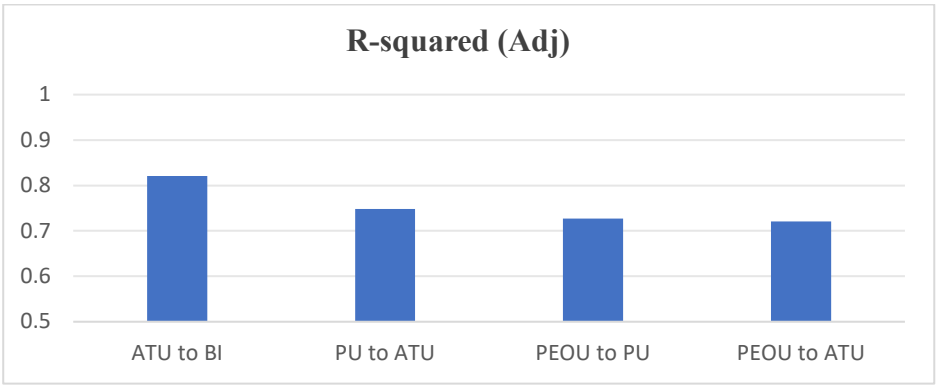

Figure 4. The R-squared (adj.) of phase 3

The Beta coefficient results were significant for all fifteen hypothesis and are shown on the theoretical framework where the highest external factor is Group Conformity which is an important cultural aspect in China (Beta 0.847). The other regression analysis results showed in Figure 5 indicated that the highest internal factor is Hedonic Motivation on attitude (Beta 0.874). This study indicates that for tourists in China they will actively use AV to travel if they perceive it will bring pleasure and fun during their holidays. This three-phase theoretical framework that has been tested during this research will contribute to technology adoption theory by enhancing TAM and the understanding of consumers' perceptions and adoption behaviour towards autonomous vehicles in the area of tourism.

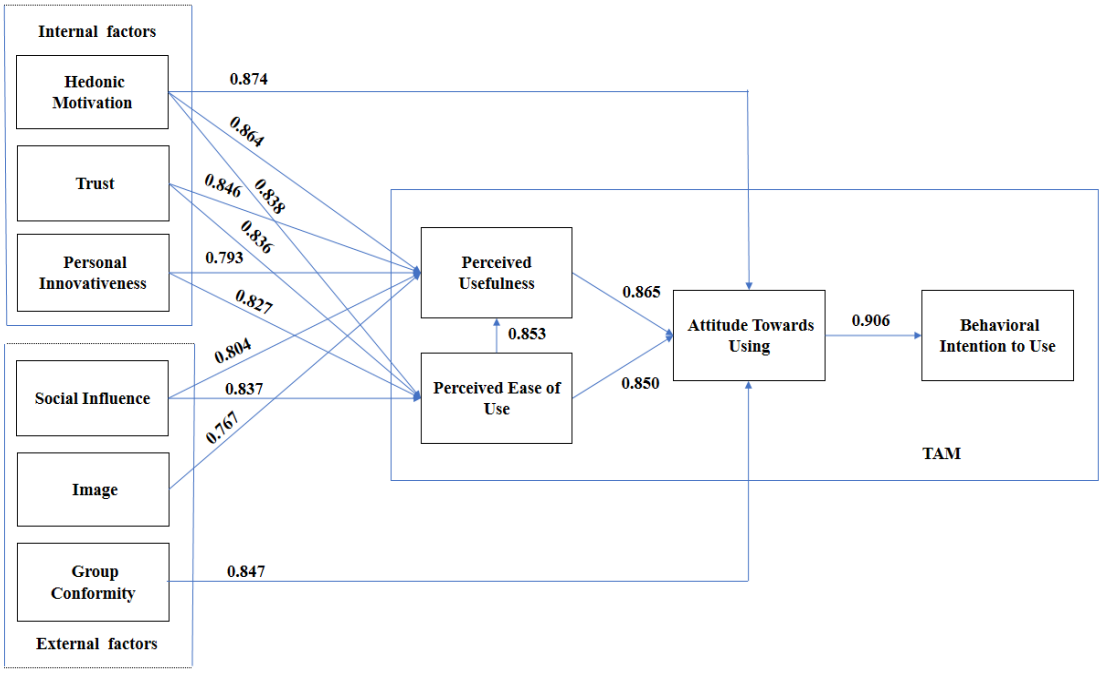

Figure 5. Regression Analyses

4.4.Segmentation by ANOVA

In this paper, significance tests were made for a variety of respondent's characteristics, including age, gender, driving experience, and frequency of travel per year. For this China study, the AVONA test results showed that significant differences exist between the groups at 0.001, which was less than <0.05.

The F-statistic shows the ratio of the sum of squares between and within age groups in Figure 6.

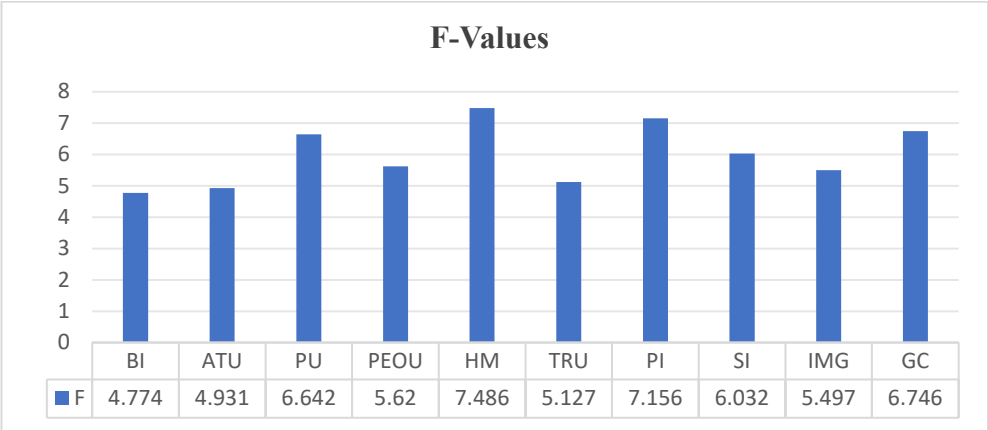

Figure 6. AVONA test results on different age groups

5. Discussion

The results of this study show that TAM factors, internal and external factors in theoretical framework are determinants of adoption of AV by Chinese tourists.

Under the framework of TAM, the analysis results of the study are consistent with a series of previous studies, which reveals the important impact of PU and PEOU on consumer adoption attitudes and behavioral intentions (Muller, 2019; Yuen et al., 2020).

In addition to TAM factors, this study emphasises the significance of various factors that influence the acceptance of AV among Chinese tourists, encompassing both internal and external aspects. Specifically, it focuses on hedonic motivation (HM), trust (TRU), personal innovation (PI), social influence (SI), image (IMG), and group conformity (GC). The categorisation into internal and external factors is based on two primary dimensions: the subjective willingness and objective influence of Chinese tourists utilising AV as a travel tool.

The findings of the study reveal that PI exerts a significant impact on the adoption of AV by Chinese tourists, thereby indicating that those who possess a greater degree of innovativeness and openness to novel experiences are more likely to perceive AV technologies as highly useful and beneficial. However, when compared to other variables, PI does not demonstrate the strongest explanatory power for the overall model in explaining the variation of the dependent variable.

The comprehensive analysis of this study demonstrates that HM, following attitude, emerges as the prime influencer of ATU in the adoption of AV among Chinese tourists. This observation is consistent with previous research studies, which has highlighted the preponderant role of customer hedonic motivation in determining customer acceptance behavior (Ribeiro et al., 2022; Battistini et al., 2020; Tang et al., 2022). However, HM as the most important factor affecting users' use of AV travel is different from previous studies.

The findings of this study in the early roll out of AV indicates that IMG's influence on Chinese tourists' adoption of AV travel remains relatively modest.

In this research consumers who perceive that these key individuals endorse their utilisation of AV, they are more susceptible to the sway of such social influence, ultimately fostering their acceptance and willingness to adopt this innovative technology.

While the research findings indeed reveal a notable influence on the acceptance of AV among Chinese tourists, it is noteworthy that the associated analytical data and responses to open-ended questions posed to the participants did not align with the anticipated outcomes. Furthermore, considering that the majority of respondents fell within the age range of 26 to 34, belonging to a generation that is increasingly exhibiting traits of individuality and autonomy, it is anticipated that the influence of GC will gradually wane in the future.

6. Conclusion

Employing TAM and IDT principles, this study delves into the influential elements that Chinese tourists consider when traveling with autonomous vehicles. The research extends the theoretical horizons by broadening the range of applicability and presenting a comprehensive framework, which offers a distinctive perspective in understanding tourists' technological adoption patterns.

In future studies, the research will expand the sample size, optimise the rigour of the study design, and comprehensively consider more potential influencing factors to promote the application of AV in more practical scenarios such as urban tourism, so as to further consolidate and expand the results of this study.

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