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# A Study on the Factors influencing Behavioral Intention of Indian consumers in adopting Voice Assistants

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## Abstract.

In the past few years, Internet of Things (IoT) has led to multiple devices interacting with humans as well as other devices, helping create a huge network of these entities that share data on a regular basis. The use cases of IoT technology have become synonymous with devices used to enable “Smart Home”, wherein various applications inside the house are usually controlled using smartphones or smart speakers. These Smart Speakers and Smart Phones are enabled using Voice Assistants developed by various Tech Giants from all over the world. Various Tech Companies have developed their own Voice Assistants that are integrated in multiple devices, ranging from Smart phones, Smart Speakers to Smart TVs. Using their ability to connect to the Internet and the eco-system formed by the Tech Giants, Voice Assistants are helping to improve the quality of life.

Despite the extensive coverage in media, review of Literature showed that no such research about adoption of Voice Assistants by Indian Consumers has been conducted. There hasn't been any study that evaluates factors that influence the adoption of Voice Assistants by Indian Consumers. That is the gap which this research addresses and tries to fill. Through this study, we aim to build a model which finds out Indian consumers' acceptance of Voice Assistants for this technology to reach commercialisation.

The purpose of this study is to explore the user attitudes, satisfaction, and other factors governing and encouraging or discouraging the intention of Indian Consumers to adopt Voice Assistants. Through analysis, we can find out the inconveniences of adoption and usage process and propose the direction of product improvement.

**Keywords:** Internet of Things (IoT), Voice Assistants, Behavioral intention, System quality, perceived usefulness, perceived ease of use, Behavioral Control, intention to use

## **1 Introduction:**

In recent years, the use of devices such as Smart phones and speakers has become widespread in India. According to a recent research carried out by Edison research- a US based research firm, smart speakers are influencing a wide range of consumer habits like reduction in their time spent with screens, consumption of audio content like news, music, documents, podcasts, commerce etc. This revolution has been accelerated by lower data costs over the past few years in the country. The market for smart speakers was established in India in 2017 with the successful launch of Amazon Echo. Since then, many companies have launched various products that compete with each other. But the response of these consumers in India hasn't been as positive as that of foreign users. It really brings up the question of whether the Voice Assistants that meet the needs and requirements of foreign users can really adapt to the Indian Market. Each country is different and the consumers differ extensively as well. If the Voice Assistant usage in India has to increase beyond the initial uptake, then companies like Amazon and Google will have to adapt for the Indian audiences to increase acceptance and improve experience. Given the huge investment that has been made by Technology Companies in creating their own respective ecosystems, it is very important to understand and explain the intention of Indian consumers to adopt Voice Assistants.

## **2 Literature Review:**

This ( Berdasco, López, Diaz, Quesada, & Guerrero, 2019) study evaluates two dimensions of Voice Assistants: how natural the answers sound to the users and correctness of the answers. The findings showed that Google Assistant and Alexa are way better as compared to Cortana and Siri. Cortana and Siri provided the poorest performance according to the research. Siri is one of the most popular Voice Assistants being used in the US, due to the popularity of iPhones there and yet showed poor performance as compared to Google Assistants and Alexa.

The study conducted by (Hwang & ShinYoung, 2018) examined the kind of effect that consumer satisfaction towards smart speakers may have on usage intentions and expression of loyalty towards the brand. User Satisfaction was calculated based on 2 parameters: Information Quality and System Quality of the smart speaker. The findings showed that the ones who were satisfied with smart speakers were using the service continuously and expressed loyalty towards the brand. Frequency of use of these devices also had a positive influence on intention to use.

A recent study carried out by (Xiao & Kim, 2018) showed a comparison between the experience of users with two of the most popular Smart Speakers in China: MI AI Speaker and Tmall Genie. The users were found to be uncomfortable with the functional aspect of the Smart Speakers. These users also expressed their discomfort when it came to the usability aspect of these devices. The research also showed that very few participants use the smart speakers to control smart home devices due to the fact that penetration of smart home appliances in China is very meagre. This is actually a big selling point of smart speakers which cannot be made use of in China.

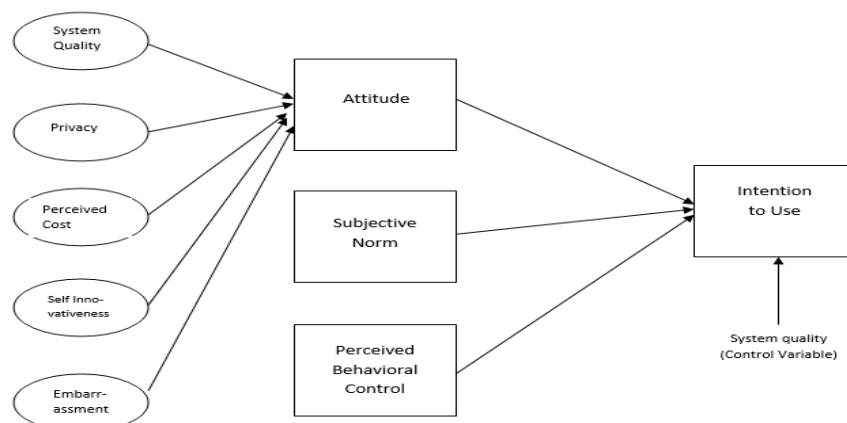
This study conducted by (Kowalczyk, 2018) was primarily to identify the factors that motivate or discourage consumers from using Smart Speakers in their daily lives. In order to conduct this research, acceptance models were tested, whilst following a mixed approach. The study found out that enjoyment had a strong effect on usage intention of consumers. Also, the results showed that security/ privacy risk, system diversity, technology optimism of consumers, and system quality had a huge impact on consumer acceptance. Apart from these factors, perceived ease of use and perceived usefulness had effect on consumer acceptance.

(Chu, 2019) conducted research in order to find out the factors that would affect a consumer's intention to adopt a smart speaker. A new model that was extended and developed using the Technology Acceptance Model (TAM) was proposed. The characteristics that were analysed in the model were product characteristics, social factors, consumer characteristics and financial factors. Some of the variables considered included attitude, enjoyment, Internet of Things (IOT) skills, social influence, cost, consumer self-innovativeness, trust, and reliability. Findings showed that Factors like Social Influence and Trust had a big impact on consumer intention to adopt smart speakers. Factors like security/privacy, IOT Skills, social influence also had an effect, Trust proved very useful in predicting attitude and perceived ease of use (PEOU).

### 3 Conceptual Model

The Research Model of this study uses Technology Acceptance Model (TAM) penned down by Davis in 1989 alongwith Theory of Planned Behavior (TPB) by Ajzen (1991) in order to understand and predict the behavioural Intention of Indian Consumers in regards with adoption of Voice Assistants. The following factors are examined in this Research: System Quality, Security, Perceived Cost, Self-Innovativeness, Perceived Usefulness, Perceived Ease of Use, Attitude, Social Norms, Perceived Behavioral Control and Intention to Use and their relationship with each other.

The conceptual model of study is shown as under:



## 4 Research Model and Hypothesis Development:

The model to be used for estimating the behavioural intentions towards usage of voice assistants and smart speakers is a hybrid model which considers the parameters of both TAM and TPB theories

### 4.1 Exogenous variables:

#### 1. System Quality-

System Quality is defined as the observed quality of the various performance features of the system. The sound of the speakers, Response time, Robustness, Quality of responses etc. are the variables which contribute the system quality of smart speakers and voice assistants.

H4. System Quality is positively associated with attitudes to using smart home services.

#### 2. Security/privacy risk:

Smart voice assistant systems collect data about residents' lifestyles, such as purchase preferences, in order to support them effectively. Consequently, these systems face the challenge of ensuring the safety of personal data (Balta-Ozkan et al., 2014). Kalakota and Whinston (1997) defined security risk as a "circumstance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of service, and/or fraud, waste, and abuse." Security risk includes the risk of the violation of a user's privacy. In this study, therefore, security/privacy risk refers to voice assistant users' fear that their personal data will be leaked or that systems will be hacked by criminals.

H5. Security/privacy risk is negatively associated with attitudes toward using voice assistant services.

#### 3. Perceived Cost

The perceived costs of systems strike a balance between the ease that a particular system caters to the price of installing the particular system. A rational person will implement a solution only if the perceived cost is less than the benefits catered by the solution. It is very difficult to enlist the benefits linked to cost or monetary savings in case of using voice assistants or smart speakers.

H6. Perceived Cost is negatively associated with the attitudes towards using smart speakers.

#### 4. Self-Innovativeness

Self-innovativeness is the motivation (internal/external) to try using new technologies as an experiment. It is the behaviour trait where people use newer technologies on their

own and find experimentation worth the time spent. The people who are innovators, having an inclination towards technology use latest technology devices.

H7. Self-innovativeness is positively associated with the attitudes towards using voice assistant.

### **5. Embarrassment**

This is an important factor as far as using technology is considered. People face social difficulties when trying to communicate with a device in public. It's this embarrassment that restricts many people from using voice assistants in public. Many people especially in India consider talking to a voice assistant in public to be socially weird or unusual.

H8. Embarrassment is negatively associated with the attitudes towards using voice assistants.

## **5 Research Methodology:**

Primary as well as secondary research was carried out to understand the phenomenon of behavioural intention of using Voice Assistants in India.

**Survey Instrument:** The mentioned relationships have been examined by the means of a structured questionnaire. The questionnaire consists of 24 questions as shown in Table 7. Other demographic variables such as age, gender, profession, and level of education are also considered.

**Target Respondents:** The sample size consists of 100 respondents. Both males and females are taken into consideration. The respondents are included from diverse age groups, and levels of education practicing different professions.

**Procedure:** An online questionnaire consisting of all the questions was circulated amongst a sample set and they were asked to answer the questions. The responses were recorded for interpretation, analysis and discussion. SPSS was used to understand the effects of independent variables on the dependent ones and also to understand the strength of the relationships between the variables.

## **6 Data Analysis:**

Data Analysis was done using SPSS and AMOS20. All hypotheses relationships in this study are estimated using Structural Equation Modelling (SEM).

### **6.1 Validity and Reliability Check:**

Exploratory Factor Analysis was carried out to check reliability and validity of the model. The research instrument involved modified validated instrument scales from previous empirical studies for measuring of variables as shown in Table 7. A Likert Scale (1-7) was used to rate all the items on the scale. Principal Component Axis and

Varimax Rotation were used in EFA. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.743 (greater than 0.6.) establishing sampling adequacy as shown in Table 1. The results of Bartlett's Test of Sphericity as given in Table 1 is also considered appropriate as value  $p < 0.05$  indicating that the test is significant and sample is adequate.

The correlation results show that the questions are mutually exclusive, mutually independent and not leading into each other. A highest correlation of 0.641 was found which shows that those questions are similar in nature. The correlation matrix had dimensions of a higher degree.

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.743
Bartlett's Test of Sphericity	Approx. Chi-Square	974.508
	df	276
	Sig.	0.000

Table 1: KMO and Bartlett's Test

The extraction of the factors clearly shows that all the factors have fairly good extraction in the analysis. Some technical factors like "compatibility with other devices" have low extraction i.e. 0.367. Other factors show fairly high extraction coefficients, which depicts their significance.

The Analysis shows that 58.98% i.e. approximately 60% of the total variance can be accounted for five principal variable factors. Thus 24 questions can be grouped together into five different factors, which would properly explain the variance.

	Initial	Extraction
Manuall_searching_cumbersome	1.000	0.600
Likely_to_buy_new_gadget_in_market	1.000	0.749
Liking_the_ideaOfUsingVA	1.000	0.674
Time_taken_to_respond	1.000	0.762
Accuracy_in_understanding	1.000	0.696
Sound_quality	1.000	0.572
Compatibility_with_OtherDevices	1.000	0.367
AnswerAccuracy	1.000	0.543
I_AmAffraid_Other_people_may_Access	1.000	0.523
Voice_search_improves_the_quality	1.000	0.422
I_will_not_use_other_devices_before_others_use_them	1.000	0.456
Improves_productivity	1.000	0.608
Price_expensive	1.000	0.458
Risky_to_disclose_personal_information	1.000	0.571
VoiceAssistant_usage_is_beneficial	1.000	0.622
VoiceAssistant_easuTo_use	1.000	0.522
Intention_to_use_VoiceAssistants_than_alternative	1.000	0.657
Cost_to_operate_voiceAssistants	1.000	0.577
Uncomfortable_to_give_command_inFront_ofPeople	1.000	0.549
Opinions_are_valued_want_me_to_use_VA	1.000	0.570
Its_mostly_uptome_whether_to_Use_VA	1.000	0.670
Having_Resources_knowledge_ability_to_Adopt_VA	1.000	0.700
Important_people_use_VA	1.000	0.562
Intention_to_use_VA_in_month	1.000	0.726

Table 2: Communality  
Extraction Method: Principal Component Analysis.

All the models have a significance coefficient less than the determined 0.05 which shows that all the cases are statistically significant. The 6th case takes into consideration the maximum factors i.e. six. Hence we consider the model with six independent variables. The model has an R value as 0.789 and adjusted R-square 0.598, which shows that 59.8% of the variance in the dependent variable is due to the change in these independent variables as shown in Table 3 below:



Model Summary										
Model	R	R Square	Adjusted R Sq	Std. Error of the Estimate	Change Statistics					DW
					R Sq Change	F Change	df1	df2	Sig. F Change	
1	.580 <sup>a</sup>	0.337	0.330	0.98485	0.337	49.805	1	98	0.000	
2	.695 <sup>b</sup>	0.484	0.473	0.87359	0.147	27.550	1	97	0.000	
3	.739 <sup>c</sup>	0.547	0.533	0.82272	0.063	13.367	1	96	0.000	
4	.761 <sup>d</sup>	0.578	0.561	0.79755	0.032	7.155	1	95	0.009	
5	.778 <sup>e</sup>	0.606	0.585	0.77555	0.027	6.466	1	94	0.013	
6	.789 <sup>f</sup>	0.623	0.598	0.76252	0.017	4.241	1	93	0.042	2.010
Predictors: (Constant), Q1, Q23, Q12, Q11, Q7, Q17										

The coefficients were analysed. The multiple regression model has a p-value of 0.042 which is less than 0.05, which shows that the results are significant.

Based on the regression analysis model given, the following coefficients can be used for the regression model.

$$Y = -0.293 + 0.280X_1 + 0.379X_2 + 0.261X_3 - 0.205X_4 + 0.203X_5 + 0.195X_6$$

Hence, according to the model used for determination of the intention to use voice assistants, it is clear that factors like the ease of use, system quality, lack of self-innovativeness (especially in India) and subjective norm coupled with peer pressure are the significant factors, considering the Indian context.

CMIN is the chi-squared coefficient. The values of CMIN/DF must lie between 1.0 and 5.0 in terms of the acceptable limits. Here, the independence model has a ratio of CMIN/DF of 4.660 which shows that the model is a proper fit as shown in Table 5 below:

Table 5: CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	39	446.567	151	.000	2.957
Saturated model	190	.000	0		

Model	NPAR	CMIN	DF	P	CMIN/DF
Independence model	19	796.818	171	.000	4.660

Here we can observe in Table 6, GFI of 0.695 and 0.430 for the default model and the independence model respectively.

Table 6: RMR, GFI, FMIN

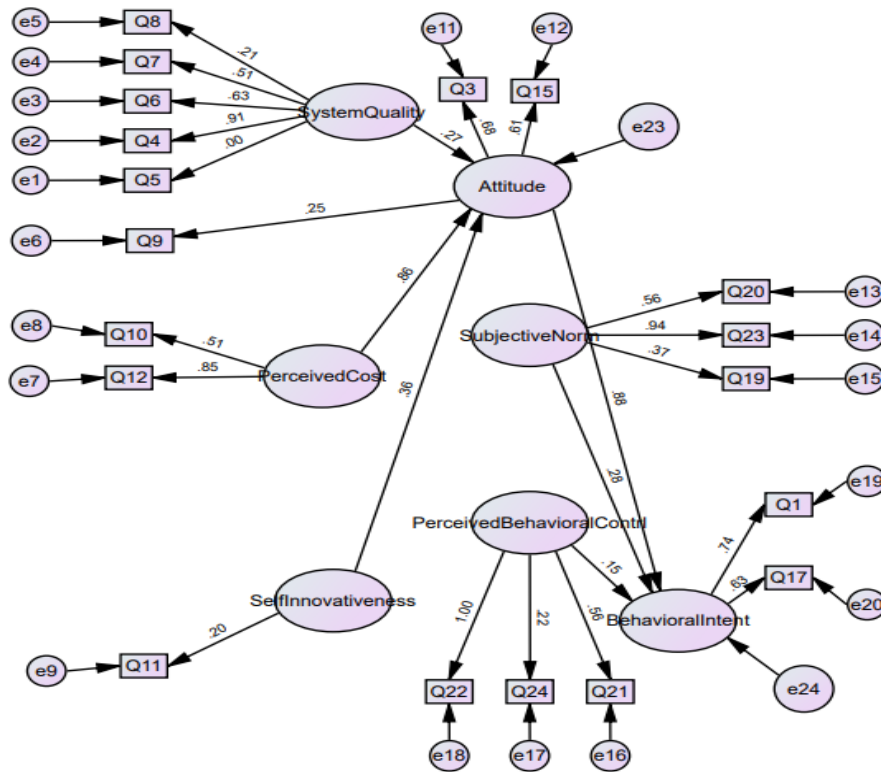
Model	RMR	GFI	AGFI	PGFI	FMIN	F0	LO 90	HI 90
Default model	.229	.695	.616	.552	4.511	2.986	2.384	3.665
Saturated model	.000	1.000			.000	.000	.000	.000
Independence model	.284	.430	.367	.387	8.049	6.321	5.473	7.246

#### RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.141	.126	.156	.000
Independence model	.192	.179	.206	.000

The result shown in Figure1 below indicate that all the predictor variables like attitude, subjective norm and perceived behavioural control have a direct and positive effect on the outcome variable behavioural intention.

Figure 1: Measurement Model and Structural Model



## 7 Managerial Implications:

Understanding consumer behaviour and its predictors can help managers in better planning and designing of products and services, especially technology products like voice assistants. The marketing strategies need to be upgraded and updated regularly to meet the fast-changing needs and expectations of consumers. In the process of improving services, insights about what matters to consumers and what shapes their behaviour will go a long way in helping managers.

**Theoretical Implications:** This research will fill the gap that exists in the existing literature when it comes to Adoption of Voice Assistants by Indian Consumers. The research will also provide a solid research model that sheds light on the factors that influence Consumers' Intention to Adopt Voice Assistants in India.

**Practical Implications:** This research will give Product Managers some insights to optimize the Smart Speaker products to adapt to the needs of the Indian User, and will help Marketing Managers shape their Marketing Communication to touch Indian Audiences efficiently.

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