The Gravity of Demographic Pendulum in an Era of Internet of Things: An Empirical Assessment of Smart Speakers Adoption from Indian perspective

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Abstract

Internet of Things (IoT) as an efficient and novel technological system has revolutionized the consumer market. IoT has provided ease of living and convenience to consumers through its innovative offerings. Over the years, scholars have focused extensively on several domains concerning IoT products, while the domain of "smart" speakers with embedded IoT technology has been less explored. Moreover, such studies have been confined to the Western and developed regions, and less focus has been on emerging markets. Therefore, the objective of this study is to identify the factors influencing the adoption of "smart" speakers in India. This study proposes a unique framework combining constructs from the UTAUT-3 framework in addition to privacy, security, and trust dimensions of technological adoption. Besides, the moderating role of age, income and education were analyzed employing SPSS 26, AMOS 25 analytical tools. The sample size of 330 respondents was incorporated for the study. The results reveal significant moderation of the education, age, and income in the association between users' adoption intentions towards smart speakers and ten antecedents identified for the framework. The study contributes theoretically to the growing body of research on IoT adoption along with practical implications for marketers from the Indian consumer's perspective.

Keywords: *Internet of Things (IOT), Smart home services, UTAUT3 model, Smart Speakers, Smart Living*

1. Introduction

Contemporary technological literature often employs the term “smart” as a broader expression denoting innovative systems characterised by artificial intelligence (AI) structures (Marikyan et al., 2019; Pal et al., 2021). This underlying novel technology, generally referred to as the “Internet of Things” (IoT), is one of the driving factors behind the Industrial revolution 4.0 and aims to enhance work efficiency and improve consumers' quality of life (Naveed et al., 2018; Pal et al., 2021).One of the inherent elements of smart systems technology is the competence to retrieve data from the adjacent systems and respond subsequently(Balta-Ozkan et al., 2015). Smart technological systems were developed to enhance people's comfort, which eventually evolved into the fundamental structures underlying the novel concept of “smart homes” (Arunvivek et al., 2015; Hong et al., 2016). The rapid transformation of products has led to the enhancement of appliance inter-operability and augmented smart home technologies worldwide(Khedekar et al., 2017). In essence, IoT has led to the augmentation of smart homes as this technology “enables a residence to have multiple sensors, smart devices and appliances that are remotely operable by the users and controllable via smartphone applications or personal computers” (Balta-Ozkan et al., 2015).
Consequently, consumer utilities concerning IoT-enabled “smart” homes have attracted the curiosity of scholars and practitioners. Contemporary scholars have attempted to examine the consumer’s perspective concerning such services (Marikyan et al., 2019) .Nevertheless, the lower levels of consumer acceptance concerning the smart-homes in the prevailing times signify users' resistance towards such systems (Pal et al., 2021), which makes it essential to investigate this domain by scholars. Technological systems for fitness and social care have been extensively studied by some of the scholars (e.g., Liu et al., 2016; Martin et al., 2008), however less consideration has been given to recognition and implementation of “smart” home technologies concerning households (Nikou, 2019).Although researchers in the past have examined the constructs that influence the adoption of IoT related “smart” home services, some aspects still need to be investigated (Gupta et al., 2021). Furthermore, researchers believe it is vital to explore factors detailed to the Indian context to elucidate the intent to use IoT (Mital et al., 2018).Also, the Indian “smart” home marketplace is expected to grow considerably and reach nine billion US dollars sales-wise (Statista, 2021a).
Amongst countless IoT devices, smart speakers continue to become extremely popular amongst people (Hayashi et al., 2020). Features such as hands-free communication and flexibility in executing user commands provides multiple advantages (Matarneh et al., 2017). As per one study, approximately 200 million smart speakers were sold and transported globally in 2019 (Canalys, 2019). With the maximum share of devices sold belonged to Amazon and Google (Statista, 2017). In 2020, the Indian market for smart speakers continued to proliferate, with Amazon gaining a staggering market share of 79 per cent in India (Statista, 2020). Although express growth in the sale of smart speakers has been witnessed, research concerning it is still in its preliminary phases (Hoy, 2018; Smith, 2020). Only limited research has been undertaken, especially in the social science realm (Brause & Blank 2020; Pridmore et al. 2019). And interestingly enough, a survey conducted in India revealed that almost 51 per cent of selected respondents were hesitant to buy a smart speaker and majority of them

stated that they do not possess a smart speaker (Statista, 2021b). This should induce scholars to conduct more in-depth research in this domain concerning the Indian context.
Given the growth in the smart home segment, especially in smart speakers, both in India and worldwide, it is of the essence to explore the aspects that propel its acceptance amongst the users. Thus, this study undertaking makes a valuable addition to the current marketing realm by investigating the factors influencing the adoption of IoT enabled Smart Speakers through a methodical literature review regarding IoT. In addition, the research has also considered the moderating role of demographic variables (age, income and education) in the current research framework.

The manuscript is organised as follows: Initially, a systematic literature review on IOT and smart speakers is presented followed by research framework and hypotheses formulation. Next, the theoretical framework and the methodology for the research has been discussed. After that, the results of the study are presented in context of factors influencing the consumer's adoption intentions towards smart speakers. Lastly, the discussion , practical and theoretical implementations of the study followed by the limitation and indications for future research directions have been discussed.

2.Systematic Literature Review

2.1 Method Employed

This work focuses on the variables influencing the adoption of IoT enabled smart home services, in specific services provided by smart speaker . Therefore, the objective was to recognise all the appropriate dimensions influencing the adoption intention towards smart speakers. Thus, the researchers scanned for the relevant manuscripts in databases like "Google Scholar", "Scopus" and "Web of Science". This search was conducted from 15th September 2021 to 15th December 2021. The pertinent studies were distinguished in the literature using exact keywords, i.e., "internet of things", "smart home", "smart speakers", "smart home services", "antecedents of IoT", and "antecedents of IoT enabled smart home services". The following steps were followed concerning the systematic literature review in this work (Gough et al., 2017).

a) Identification of the relevant studies

The most crucial phase involves the scrupulous scanning of papers by the researcher regarding the related topics that were completely available in the chosen databases. Based on the search queries initiated by the researcher in the selected virtual resources, 653 manuscripts were accessible.

b) Screening of the articles

The following action was related to the scanning of the articles based on only pre-selected keywords, i.e., “internet of things”, “smart home”, “smart speakers”, “smart home services”, “antecedents of IoT” and “antecedents of IoT enabled smart home services”. Three hundred ninety-three articles didn’t match the pre-selected criterion (keywords) and were eliminated from the ensuing screening.

c)Qualification of the articles

After the initial screening by the researchers was completed, an appraisal of some portions of the selected studies was done. The researchers evaluated manuscript sections like their abstract, introductory chapter, and conclusion chapter. This assessment was done keeping in view the pertinent keywords only. Thus, 169 articles that didn't match the study objectives were left out from any further analysis in this phase. As a result, 93 papers selected by the researchers were kept for inclusion.

d)Final Eligibility

During the eligibility phase, only 45 articles (English only) published in outstanding journals were finally examined by the researchers, and the remaining 48 articles were excluded.

Inclusion Norms:

- Peer-reviewed English articles (publications).
- The selection of papers was only dependent on the pre-selected keywords.
- Studies published over the last two decades (2001-2021) were considered for this work as this period witnessed tremendous growth in IoT and related work.

Exclusion Norms:

- Foreign language articles were excluded.
- Articles were eliminated if not based on constructs (keywords) needed for this work and,
- Editorials, reports, letters, research data, academic discussions and book reviews were utterly excluded.

Ethical concerns:

- The researcher avoided any redundant articles, non-evident results and plagiarism.
- Only recognised and reputed resources were accessed for obtaining the required information.
- Articles without any ethical approval or “no conflict of interest” declaration were not selected by the researcher.

2.2 Internet of Things (IoT) and Home IoT Services

Scholars have often debated the conventional characterisation of IoT. Still, some have illustrated IoT as a broader term that stands for the interconnectedness regarding material objects and tools, for instance, IoT-driven “smart” homes (Mocrii et al., 2018) and “smart” cars/vehicles (Athanasopoulou et al., 2019). IoT has also been described as the informational

and communication technological system, allowing intelligent utilities via interactivity between entities connected through both connected and wireless networking (Park et al., 2018). Home-based IoT services are often considered the most representative type (Lau et al., 2018). As per the work of Balta-Ozkan et al. (2015), Home IoT is "a residence equipped with a high-tech network, linking sensors and domestic devices, appliances, and features that can be remotely monitored, accessed or controlled, and provide services that respond to the needs of its inhabitants". In precise terms, the realm of Home IoT includes:

i. A dwelling system that enhances resident's well-being via effective monitoring of their health (Demiris & Hensel, 2008),
ii. A home system equipped with innovative technology which predicts the resident's requirements (Aldrich, 2003),
iii. A dwelling structure fitted with detectors which are inter-connected to network systems to gather data required for subsequent action (Balta-Ozkan et al., 2015), and
iv. A dwelling system augments independence and maintains residents' health via effective scrutiny (Chan et al., 2009).

2.3 Smart Speakers

Smart speakers have been described as voice-controlled portable tools that employ AI as well as natural speech processing to run utilitarian and hedonic tasks, like music playing, acquiring information and setting reminders for consumers (Lau et al., 2018). They are usually located inside the home dwellings and can be occasionally integrated with a more prominent "smart home" network, and thus, smart speakers are rapidly turning into conventional devices (Lutz & Newlands, 2021). In the USA alone, approximately 66 million smart speakers were sold in 2018, with Amazon as the market leader, followed by Google and Apple (Feiner, 2019; Lutz & Newlands, 2021). Smart speakers show dissimilarity with other interactive devices like virtual browsing or even video games as the user predominantly interacts via natural language-based audio directives that emulate person-to-person contacts (Guzman, 2017).

3. Research Framework and Hypotheses formulation

This work, in essence, explores the demographics and other influencing dimensions regarding the adoption of IoT enabled Smart speakers. In addition to the factors adopted from the UTAUT-3 model, other unique factors were adopted from other studies in order to examine the relationship between IoT adoption and its antecedents. Ten dimensions were recognised from several studies and their relationship is shown in the Figure 1.

a) Performance expectancy (PE)

Venkatesh et al. (2003) define PE as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (pp. 447–453). It can also be defined as a fundamental construct that influences approval and resultant usage of the pertinent technological system. From the current perspective, PE concerns the user's

conviction that the IoT enabled Smart Speakers will augment his or her effectiveness and will improve their quality of life (Venkatesh et al., 2015). Thus, it can be hypothesised that;

H1 "Performance expectancy" influences user's intention to adopt Smart Speakers.

b) Effort expectancy (EE)

Venkatesh et al. (2003) define EE as "the degree of ease associated with the use of the system" .It has also been considered one of the strong determinants of individual intention concerning the application of a novel technology (Venkatesh et al., 2015). In the background of the current work, EE signifies the user's conviction that IoT-enabled Smart Speakers would be effortless to use in the background of the current work. Thus, it can be hypothesised that;

H2 "Effort expectancy" influences user's intention to adopt Smart Speakers.

c) Social Influence (SI)

Venkatesh et al. (2003) define SI as "the degree to which an individual perceives that important-others believe he or she should use the new system" .From the current framework, SI signifies outside force (peer or family pressure) that may influence users' perception of using IoT-enabled Smart Speakers. Thus, it can be hypothesised that;

H3. "Social influence" influences user's intention to adopt Smart Speakers.

d) Hedonic motivation (HM)

It could be explained as the user's amusement or delight, which involves using a specific technological structure. Hedonic component concerning the contemporary consumer behavioural research is significant in terms of its business impact. Moreover, HM directly affects users' inclination towards technological acceptance (Venkatesh et al., 2015). Thus, it can be hypothesised that;

H4 "Hedonic motivation influences user's intention to adopt Smart Speakers.

e) Habit (HB)

Habit can be best characterised as the extent to which a person behaves instinctively or involuntarily due to earlier occurrences (Venkatesh et al., 2015). Habit in essence, produces a cognitive dedication concerning an explicit behaviour and regularly hinders any alteration to the authentic behaviour (Murray & Häubl, 2007). Many scholars also believe that habit influences both user intent and genuine technology usage (Gunasinghe et al., 2019). Thus, it can be hypothesised that;

H5 "Habit" influences user's intention to adopt Smart Speakers.

f) Facilitating conditions (FC)

Venkatesh et al. (2003) define SI as "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system".

Alternatively, it is also considered as the user's faith regarding the required support system and framework needed to aid her/him in the utilisation of concerned technological structure (Venkatesh et al., 2015). In general, technological support systems and framework that aid usage fall under FC construct. Thus, it can be hypothesised that;

*H6 "Facilitating conditions" influences user's intention to adopt Smart Speakers***.**

g) Personal innovativeness in IT (PIIT)

The "personal innovativeness in IT" has been referred to as an unwavering individual characteristic which induces people to adopt novel technologies. Scholars are of the opinion that PIIT not only impacts user's intention but also technological usage behaviour (Gunasinghe et al., 2019). Furthermore, the findings of some studies also suggest that individualistic traits like PIIT affect technological adoption in IT domain as well (Dutta et al., 2015; Farooq et al., 2017). Thus, it can be hypothesised that;

H7 "Personal Innovativeness" in IT influences user's intention to adopt Smart Speakers.

h) Privacy

It is considered a significant challenge within the IoT setting due to various sensory implements (Weinberg et al., 2015). Any kind of compromise concerning privacy may lead to problems (Tan et al., 2010). Hence, privacy is vital in adopting IoT-enabled services (Alraja et al., 2019). Thus, it can be hypothesised that;

H8 "Privacy" influences user's intention to adopt Smart Speakers.

i) Security

Security is another essential pr-requisite within the IoT environment as it protects the resources (hardware/software) from any damages, disturbances, misuse, break down or unlawful access (Alraja et al., 2019). Thus, many researchers have proposed many solutions concerning such security challenges in the form of intrusion recognition, cryptography, and stenography (Bandyopadhyay et al., 2011). Hence, security is another critical factor in implementing and accepting IoT services/devices .Thus, it can be hypothesised that;

H9 "Security" influences user's intention to adopt Smart Speakers.

j) Trust

An important study concerning trust done by Farahani et al. (2018) examined trust in IoT services concerning examination of machine behaviours, machine identification, connection standards and the link processes with the devices. Another crucial study showed that trust concerning a specific technology was a critical factor affecting user's intent to accept the IoT system (Gao & Bai, 2014). Ferraris et al. (2018) also proposed that designing a trust-based framework is imperative in an IoT entity as it guarantees high-quality service delivery. Thus, it can be hypothesised that;

H10 "Trust" influences user's intention to adopt Smart Speakers.

***k*) Age, Income and Education as moderators**

Age, income and education are considered as critical demographic variables in consumer behaviour research and adoption of virtual services (Kasilingam & Krishna, 2020 ; Tsourela & Nerantzaki (2020); Lopes & Moori (2021); Lee & Han (2015)). Even in the context of IoT research, these variables have been included in the research framework. Scholars already have considered gender as a moderating factor concerning technological acceptance and usage (Borrero et al., 2015). However, studies that have included three variables (age, income and education) as moderators in the relationship between users' intention to adopt IoT enabled Smart Speakers and its antecedents seem to be missing in the literature. Thus, this work has hypothesised that:

H11 Age moderates the association between "user's adoption intentions" towards Smart Speakers and (a)Performance Expectancy (b) Effort expectancy (c)Social Influence (d) Hedonic motivation(e)Habit (f)Facilitating Conditions (g)Personal Innovativeness in IT (h)Privacy (i)Security (j)Trust.

H12 Income moderates the association between "user's adoption intentions" towards Smart Speakers and (a)Performance Expectancy (b) Effort expectancy (c)Social Influence (d) Hedonic motivation(e)Habit (f)Facilitating Conditions (g)Personal Innovativeness in IT (h)Privacy (i)Security (j)Trust.

H13 Education moderates the association between "user's adoption intentions" towards Smart Speakers and (a)Performance Expectancy (b) Effort expectancy (c)Social Influence (d) Hedonic motivation(e)Habit (f)Facilitating Conditions (g)Personal Innovativeness in IT (h)Privacy (i)Security (j)Trust.

3.2 Theoretical Framework

The theory of "behavioural reasoning" implies that the users' intention to accept IoT-based devices will increase if the marketing tactics employed include rationale concerning their use as well as arguments against their use (Alraja et al., 2019; Sivathanu, 2018). Another work assessed the factors for IoT adoption based on the Technology adoption model (TAM) (Gao & Bai, 2014). The authors considered factors such as enjoyment, perceived ease of use ,trust and usefulness. They also included the social aspects concerning technology usage as well as privacy and security. The current work included seven determinants of IoT adoption based on the unified theory of acceptance and use of technology "UTAUT-3" framework proposed by Farooq et al. (2017). The seven factors included "performance expectancy", "facilitating conditions", "habit", "effort expectancy", "hedonic motivation", "social influence" and "personal innovativeness in IT". These factors were adopted as "UTAUT-3" model which has a 66 per cent explanatory power as suggested by the authors. In addition, three more

factors identified from the systematic literature review (privacy, trust and security) were included in the current research framework. Moreover, the moderating role of three important demographic factors (age, income and education) in the relationship between IoT adoption and its antecedents was tested in the research framework, which will contribute to the existing literature on IoT.

The present work has thus delved deep into the IoT enabled smart home segment (smart speaker category) in the Indian market by including ten determinants of IoT adoption (Figure1).

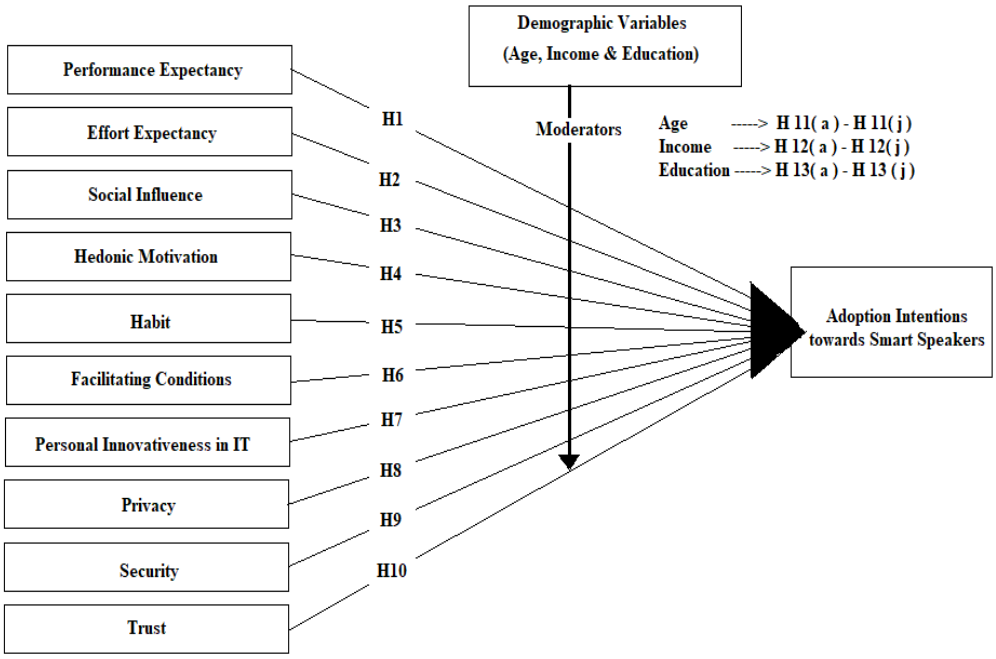

Figure 1. Conceptual Framework

3.3 Methodology

This research work concerning smart speakers involved quantitative and causal research design as the collected data was quantified to assess the association amongst the constructs.

a) Sampling:

The sample size computed was on the itemized sampling (No. of items*5-10) procedures that Hair et al. (2012) recommended. The total number of items in the instrument was 46 in relation to the eleven constructs. Based on the expert advice a middle approach was taken in order to calculate sample size (No. of items*7) which is 322. The total number of responses received through “Google Docs” was 393, but, only 330 useful responses remained subsequent to the data cleaning methods.

b) Questionnaire:

The questionnaire had incorporated five options concerning smart speaker brands for the respondents to choose from. The first four options are popular smart speaker brands which were chosen based on their market share in India [Amazon (79%), Google (11%), Xiaomi (8%) and Apple (2%)] (Statista, 2021c). This work had also used screening criteria concerning respondents for validating their smart speaker familiarity prior to the undertaking of the survey. In total, the questionnaire incorporated four questions for screening the study respondents:

- have the respondents been using smart speakers prior to the survey undertaken;
- smart speaker brand (s) they were using;
- respondent's usage rate; and
- respondent's usage duration.

c) Measures:

Trust was evaluated using 4-items adapted from the studies of Gao and Bai (2014), and Pitardi and Marriot (2021). Performance Expectancy was measured using 3-items which were retrieved from the work of Pal et al. (2021). Effort Expectancy was measured using 3-items which were adapted from the work of Gao and Bai (2014). Social Influence was measured using 4-items adapted from the work of Le Chu (2019). Facilitating conditions was measured using 4-items which were retrieved from the work of Ronaghi and Forouharfar (2020). Habit was measured using 3-items which were retrieved from the work of Dhiman et al. (2019). Hedonic Motivation was measured using 3-items which were retrieved from the work of Moorthy et al. (2019). Personal Innovativeness in IT was measured using 4-items which were retrieved from the work of Le Chu (2019). Adoption intentions towards IoT enabled smart speakers was assessed using 3-items which were retrieved from the work of Alam et al. (2020). Security was measured using 4-items which were retrieved from the work of Paquet (2013). Privacy was measured using 4-items which were retrieved from the work of Hsu and Lin (2016).

4. Result

4.1 Respondent Profile

The following Table 1 shows the profile of the chosen respondents concerning their gender, age, occupation, marital status, internet usage, smart speaker usage, smart speaker brand currently using and frequency of usage. Interestingly, 60.9% of the total sample (330) opted for the Amazon brand smart speakers(Figure 2) .

Table 1. Profile of the Respondents

Variable	Category	Frequenc	Percentag
Gender	Female	183	55.5
	Male	147	44.5
Age	18-25 years	35	10.6
	26-35 years	91	27.6
	36-45 years	150	45.5
	46- 59 year	46	13.9
	60 and abov	8	2.4
Marital Status	Married	225	68.2
	Single	105	31.8
Occupation	Employed	239	72.4
	Homemake	30	9.1
	Others	16	4.8
	Self-Employ	33	10
	Student	12	3.6
Daily Internet Usage (in Hrs)	> 6	65	19.7
	0-2	2	0.6
	2 to 4	125	37.9
	4 to 6	138	41.8
Daily Smart Device usage at your hom hours)	>6	43	13
	0-2	33	10
	2 to 4	131	39.7
	4 to 6	123	37.3
Smart Speaker (Brand)	Amazon	201	60.9
	Google	63	19.09
	Xiaomi	37	11.2
	Apple	17	5.1
	Others	12	3.6
Frequency of smart speaker usage	Monthly	37	11.2
	Weekly	143	43.3
	Daily	150	45.5

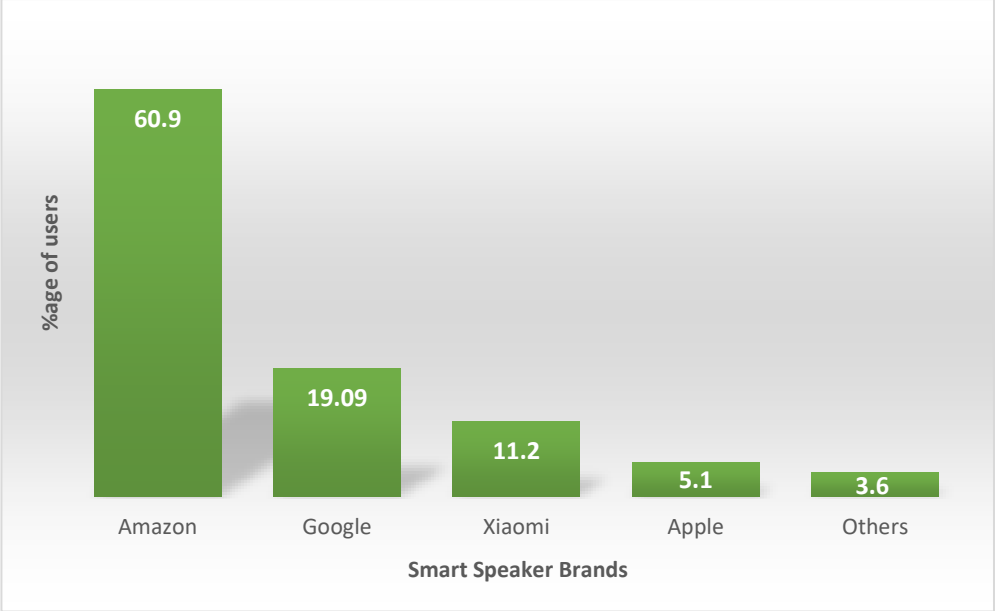

Figure 2. Percentage of Smart Speaker users (Brand-wise)

a) Factor analysis:

Using SPSS, factor analysis revealed that all the measures of sampling adequacy were above threshold limits (KMO> 0.50 and Bartlett Test of Sphericity was significant)as presented in Table 2 . Factor analysis extracted eleven components with a variance of 74.69%. All items had factor loadings of more than 0.7 and were considered for further analysis.

Table 2. Factor Analysis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.813
Bartlett's Test Sphericity	Approx. Chi-Square	7891.4(
	df	741
	p-value	.0001*

b) Reliability statistics:

The reliability concerning this study's instrument was determined through "Cronbach's alpha" (α) scores. The cronbach's alpha concerning this research work's instrument ranged from 0.702 to 0.860 indicating that the values are good (Hair et al., 2012).

4.2 Confirmatory Factor Analysis (CFA)

Subsequent to "EFA", "CFA" was run by using "AMOS 25.0" to again confirm the earlier factor structure based on the underlying theory. The preliminary measurement model results show satisfactory values concerning the model fit indices including CMIN/DF value of 2.454, CFI value of .875 , NFI value of 0.807 and GFI value of 0.811 reflecting good model fit.

4.3 Validity

The constructs incorporated within "CFA" had suitable cronbach's alpha (> 0.8) and composite reliability above 0.60 which establishes reliability concerning the measures adopted in the work of (Hair et al., 2012). Moreover, the factor loadings concerning each item was also adequate (>0.7) which indicates "convergent validity" in the study represented in Table 3. The "discriminant validity" was determined using the procedures recommended by Fornell and Larcker (1981) method.

Table 3. Factor Loading, Average Variance Extracted(AVE) and Construct Reliability(CR)

Constructs	Items	Standardized Loadin	CR	AV
Performanc Expectancy α = 0.818)	PE1. Using smart speakers wi enable me to accomplish tasks quickly.	0.797	0.82	0.6
	PE2. I feel IOT based smart s services will improve my wor performance	0.727		
	PE 3. I think using the IOT technology-based services wil my everyday life easier.	0.811		
Effort Expectar (α = .798)	EE1. Learning how to operate smart speakers is easy for me	0.715	0.77	0.5
	EE2. I find my interaction wit smart speakers clear and understandable.	0.727		
	EE3. I think it is easy to conve smart speakers what I want it t	0.744		
Social Influen (α = .801)	SI1: People who are important recommend smart speakers.	0.777	0.84	0.5
	SI2: People who are important use smart speakers.	0.707		
	SI3: I heard successful experie about using smart speakers fro other individuals.	0.760		
	SI4: The mass media talks a lo about smart speakers.	0.783		
Hedonic Motiva (α = .799)	HM1. Using smart speakers is	0.702	0.77	0.5
	HM2.I feel entertained using c smart audio speakers.	0.756		
	HM3.I enjoy using smart audi speakers.	0.725		

Habit (α = .791)	H1. The use of smart speakers become a habit for me.	0.707	0.78	0.5
	H2:I prefer to use smart home speakers instead of convention audio speakers	0.724		
	H3: I must use smart technolo smart speakers are beneficial f various personal uses.	0.797		
Facilitating Cond (α = .865)	FC1. I have steady internet connection for using the smart speakers	0.762	0.89	0.6
	FC2. I have the basic knowled how to use the IoT based smar speakers.	0.843		
	FC3.IoT technology is general compatible with the other technologies which I use curre	0.860		
	FC4. I can get a help from oth when I have difficulties using IoT based smart speakers.	0.837		
Personal Innovati in IT (α =.861)	PIIT1. I perceive myself as ar adopter with new technology.	0.841	0.86	0.6
	PIIT2. I consider myself knowledgeable about the new of technology.	0.711		
	PIIT3. I will not try new technological devices before c use them.	0.721		
	PIIT4. I don't care about new in technology, I just follow oth	0.840		
Privacy (α =.877)	P1. There is a considerable pri risk involved in using smart speakers.	0.859	0.90	0.6
	P2.There is too much uncertai associated with using IoT serv	0.748		
	P3.My decision to use IoT bas smart speaker services expose to privacy risks.	0.870		
	P4. Using an IoT service woul to a loss of privacy.	0.852		
Security (α =.871)	S1.I find smart home speakers secured means of entertainmer	0.827	0.86	0.6

	S2.I think smart audio speaker maintain required security of	0.710		
	S3.I think IoT technology is a secured medium for smart hor speakers.	0.860		
	S4.I find smart technologies secured.	0.732		
Trust (α = .832)	TR1. I find the smart audio sp trustworthy	0.823	0.86	0.6
	TR2. I trust the usefulness of audio speakers.	0.791		
	TR3. I trust the IoT technolog for smart audio speakers.	0.814		
	TR4. I do not trust the smart technologies and the smart ho devices.	0.718		
Adoption Inten towards Smart Sp (α = .866)	AISS1.I have a pleasant exper using smart speakers.	0.703	0.79	0.5
	AISS2: I use Smart speakers regular basis.	0.817		
	AISS3: I experience no proble using IoT technology-based d	0.737		

4.4 Structural model

After CFA, the path analysis is the second step in "Structural Equation Modelling" (SEM) to determine the weights of path coefficients among the variables. The structural model shows satisfactory values concerning the model fit with the CMIN/DF value comprising of 2.999 , CFI value 0.815 , NFI value of 0.748 and GFI value of 0.730 reflecting a good fit.

The regression analysis reveals that relationships between nine predictor construct i.,e effort expectancy, social influence ,hedonic motivation, habit, facilitating conditions, privacy , security ,personal innovativeness in IT ,trust and an outcome variable i.,e adoption intentions towards smart speakers in the context of Indian consumers are statistically significant (Table 4).

Table 4. Regression Results

Independe Variable	**Dependent Variabl**	**Standard**	**P-val**	**Hypothes**
Performanc expectancy	Adoption Intentions tow Smart Speakers	.080	.093	H1 Reject
Effort expecta	Adoption Intentions tow Smart Speakers	.141	.002*	**H2 Accep**

Social Influe	Adoption Intentions tow Smart Speakers	.121	.003*	**H3 Accep**
Hedonic Motiv	Adoption Intentions tow Smart Speakers	.157	.001*	**H4 Accep**
Habit	Adoption Intentions tow Smart Speakers	.135	.002*	**H5 Accep**
Facilitating conc	Adoption Intentions tow Smart Speakers	.144	.001*	**H6 Accep**
Personal Innovativeness	Adoption Intentions tow Smart Speakers	.139	.001*	**H7 Accep**
Privacy	Adoption Intentions tow Smart Speakers	.198	.0001	**H8 Accep**
Security	Adoption Intentions tow Smart Speakers	.146	.003*	**H9 Accep**
Trust	Adoption Intentions tow Smart Speakers	.080	.050	**H10 Accep**
Note: Critical P-Value *p< = .05,p<.01**				

4.5 Moderation Effect of Age, Education & Income

The present study included three demographic variables as moderators (age, income and education) in the research framework involving "adoption intentions towards smart speakers" and its ten predictor variables (Aldossari & Sidorova (2020); Chatterjee (2020); Hayes (2018)). Concerning age, it was found out that two relationships out of ten moderating relationships are significant (P-values less than 0.05). The results show that, age moderate the relationship between "adoption intentions towards smart speakers" and "habit" and "security". (Table 5).

Table 5. Moderation Effect (Age)

Independent Vari	**Dependent Varia**	**Standard E**	**P-va**	**Hypothes**
Performance expec	Adoption intentions to Smart Speakers	0.0948	0.17	H13a Rejec
Effort expectanc	Adoption intentions to Smart Speakers	-0.0123	0.82	H13b Rejec
Social Influenc	Adoption intentions to Smart Speakers	0.0878	0.17	H13c Rejec
Hedonic Motivat	Adoption intentions to Smart Speakers	-0.0347	0.63	H13d Rejec
Habit	Adoption intentions to Smart Speakers	0.1276	0.03	H13e **Accep**
Facilitating condit	Adoption intentions to Smart Speakers	0.0373	0.71	H13f Rejec
Personal Innovativer IT	Adoption intentions to Smart Speakers	0.0296	0.69	H13g Rejec

Privacy	Adoption intentions to Smart Speakers	0.0734	0.34	H13h Rejec
Security	Adoption intentions to Smart Speakers	0.2539	0.00	H13i **Accep**
Trust	Adoption intentions to Smart Speakers	-0.163	0.74	H13j Rejec

Concerning income, it was found out that income moderates the relationship between "adoption intentions towards smart speakers" and "security"(β=0.253 , p-value = .009) . However, the results show that income do not moderate the association between "adoption intentions towards smart speakers" and its remaining nine antecedent variables i.,e "performance expectancy", "effort expectancy", "social influence", "habit", "hedonic motivations", "facilitating conditions", "privacy", "personal innovativeness in IT" and "trust" (P-values more than 0.05).

Concerning education, it was found out that five relationships were significant (P-values less than 0.05). Education does moderate the relationship between "adoption intentions towards smart speakers" and its 5 antecedents i.e., "social influence", "hedonic motivations", "personal innovativeness in IT", "privacy" and "trust"(Table 6).

Table 6. Moderation Effect (Education)

Independent Varial	**Dependent Variab**	**Standard**	**P-va**	**Hypothes**
Performance expectar	Adoption intentions tov Smart Speakers	0.063	0.1	H15a Rejec
Effort expectancy	Adoption intentions tov Smart Speakers	0.002	0.3	H15b Rejec
Social Influence	Adoption intentions tov Smart Speakers	0.293	0.0	H15c **Accep**
Hedonic Motivatio	Adoption intentions tov Smart Speakers	0.181	0.0	H15d **Accep**
Habit	Adoption intentions tov Smart Speakers	0.077	0.0	H15e Rejec
Facilitating conditio	Adoption intentions tov Smart Speakers	0.117	0.0	H15f Rejec
Personal Innovativeness	Adoption intentions tov Smart Speakers	0.214	0.0	H15g **Accep**
Privacy	Adoption intentions tov Smart Speakers	0.141	0.0	H15h **Accep**
Security	Adoption intentions tov Smart Speakers	0.065	0.0	H15i Rejec
Trust	Adoption intentions tov Smart Speakers	0.178	0.0	H15j **Accep**

4. Discussion

The study empirically analysing the demographic factors affecting the adoption of IoT enabled smart speakers is an important work concerning IoT technology in the Indian context. This research included ten determinants of IoT adoption concerning smart speakers i.e.," performance expectancy", "facilitating conditions", "habit", "effort expectancy", "hedonic motivation", "social influence", "personal innovativeness in IT", "privacy", "trust" and "security". In addition, the moderating role of three important demographic factors (age, income and education) in the relationship between adoption intentions towards smart speakers and its antecedents was tested in the research framework.

Initially, the scales adapted for this work were subjected to factor analysis which revealed the underlying factor structure involving eleven constructs. The scales were tested for dependability and validity during initial construct (factor) analysis. The measures of sampling adequacy were also determined. Subsequent to that, factor structure was confirmed through the measurement model using AMOS. The validity and reliability were again tested using different measures. The hypotheses testing revealed that associations among effort expectancy, social influence , hedonic motivation, habit, facilitating conditions, personal innovativeness in IT , privacy , security , trust and adoption intentions towards smart speakers were significant in context of Indian users .Also, the percentage of female respondents were 55.5% reflecting the proliferating adoption of smart technology amongst the Indian women. Additionally, the study results reveal 45.5% of respondents comes from the 36-45 years age category , with 72.4 % of them being employed signifies the emerging acceptance of smart technology amongst the working Indian class keeping pace with the revolutionary digital gravity.

The research structure had also incorporated three variables as moderators (age, income and education). The results show that age variable moderates the association between "adoption intentions towards smart speakers" and "habit" and "security". In context of age, the study results significantly demonstrated Indian's perception, that the association between habits and security and adoption towards new technology is moderated by age. With age , the educated working class have recognised the importance of smart-technology in their personal (habits) and professional(data security) lives (Aldossari & Sidorova ,2020); Chatterjee ,2020; Baudier et al., 2020; Upadhyay et al., 2019). Thus, providing ease of living and convenience to the consumers through its innovative offerings. However, in context of Indian consumers the dimension of performance expectancy in association to the smart speakers fails to significantly influence the adoption intentions of consumers, primarily due to lack of awareness(Upadhyay et al., 2019; Chatterjee,2020).However, income variable moderates the association between "adoption intentions towards smart speakers" and "security" . On the other hand, education variable moderates the association between "adoption intentions towards smart speakers " and its 5 antecedents, i.,e. "social influence", "hedonic motivations", "personal innovativeness in IT", "privacy" and "trust" in context of Indian users. The educated working Indians have presented the significant dynamics towards the adoption of smart technology , accelerated with the dimensions of social influence , personal innovativeness in

IT and data privacy & security as supported in the study by Baudier et al.(2020) aimed towards French students and review of literature in Indian context by Upadhyay et al.(2019).

5. Implications

This work has mostly contributed theoretically to the growing body of research on IoT study. Foremost, this study has provided scholar a major perspective concerning the "behavioural reasoning" and "TAM model" by broadening their dimensions. Earlier research on IoT has mostly focussed on other IoT devices and mostly ignored the technological aspects of smart speakers from its usage dimensions. This study has identified a unique framework by combining constructs from UTAUT-3 framework as well as additional 3 constructs recognised from the systematic review of studies. Prior research had been centred on the utilitarian attributes of IoT technology and had ignored the societal aspects of such technology. This work has included the social dimensions of the technological adoption in this framework in addition to the hedonic constructs.Furthermore, the moderating role of demographic variables has also been integrated in the current research structure which can guide the future academicians.

Concerning practical implications, the study has also some suggestions for business managers. With, few of the relationships proved to be insignificant; this is in contrast to similar studies conducted on IoT adoption. The possible explanation can be that the sample size was not large enough. The other possible reason could have been that sample size chosen was not diverse. There is also a possibility that the association between predictor variables is mediated or moderated by factors not incorporated in this work. Since IoT devices are novel and some of the consumers may not be fully averse to its use. This calls for the scholars to explore more predictors of IoT usage, especially smart speakers. Thus, business managers in newer markets where the adoption of this technology is still in the preliminary phase can increase awareness amongst the consumers. They can also communicate the features of this technology to improve its adoption. Marketers must improve their brand image by focussing on key differentiating attributes while communicating the brand. Concerning demographic variables, it was found that some of the demographic variables moderating the relationships of IoT adoption among users and its predictors. Thus, marketers need to focus on such demographic variables in order to target their consumers. They can differentiate and market their products based on consumer characteristics like their education, age and income. Apart from these suggestions, marketers must focus on all ten antecedents in order to improve user's intent to adopt this technology.

6. Limitations and future research

The sample size was limited , and thus, future scholars can enhance its size in order to achieve better results. The study has included respondents only from the India region and thus, in the future, subjects can be selected from different regions of the world in order to enhance the generalizations of the findings. Some aspects of the research concerning technological adoption like cultural dimensions can also be studied in the future. Future research can test

this model by including consumers from diverse cultural backgrounds and conducting studies across multiple world regions. Some studies have pointed out that audio cues can influence technological adoption of many devices. Future scholars can include dimensions such as audio cues and media richness concerning the adoption of smart speakers. Future works can also adopt experimental design or cross-sectional studies to enhance the study's findings.

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Conflicts of Interest

"The authors report there are no competing interests to declare."

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