ISSN 2278-3091
Volume 8, No.1, January – February 2019
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse02812019.pdf
https://doi.org/10.30534/ijatcse/2019/02812019

Intelligent Interactive Voice Response Systems and Customer Satisfaction

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ABSTRACT

This study intends to investigate the customer satisfaction on "Intelligent Interactive Voice Response Systems" which are the extension of the traditional "Interactive Voice Response Systems (IVRS)", and play important role in many organizations to provide more complex and personalized customer service. A theoretical model is developed basing on literature. Data are collected from 239 people with a survey questionnaire for testing the proposed model. Structural equation modelling is used as the statistical method in order to analyze data. As a result, the constructs which can affect the customer satisfaction are specified for the improvement of IVRS and guiding companies.

Keywords: Customer satisfaction, interactive voice response systems, service quality, structural equation modeling

1. INTRODUCTION

1.1 Interactive Voice Response Systems

Human-computer interaction (HCI) lets humans interact with computers. In addition to word input, single keypresses, touch and mouse clicks, and voice also can be taken as input, and they are more faster ways of communication. Interactive voice response systems (IVRS) provide communication between human and machine by taking voice, touch-tone as an input, processing it and return a result. IVRS can use in-built application programming interfaces or web services to fetch data from database and deliver the data to users [1]. IVRS are used by many organizations in order to answer customer questions, handle customer requests or orient customers in the right direction without an employee. Automated speech recognition supports the interactive voice response (IVR) applications.

IVRS are used by many organizations in business process automation to provide some form of customer service under the customer relationship management. They have an important role in improving customer relationship in organizations. The typical applications of IVRS can be used in nearly all industries such as banking, telecommunication, manufacturing and marketing, media, insurance, travel, entertainment, etc. The customer services being provided may include technical support, processing reservations, balance information, payments, transfers, transaction history, the availability and prices of stocks, ordering, order status, tracking shipping status of orders, the current account balance, subscriptions transactions, automated sample preparation of bidding, pricing, policy status, damaged file state, airline schedules, ticket booking, processing reservations, flight information, check-in, movie schedules, etc.

Companies can both reduce cost by getting rid of the cost of a live agent and save time by not spending time on the basic inquires or routine tasks thanks IVRS. Moreover, companies may increase customer satisfaction by utilizing from the benefits of IVRS. For example, IVRS allow customers to access 24/7 for some services, to save time by finding solutions to their queries without queuing, and to have a prioritization if they have a special status.

Despite the benefits of IVRS, there are some limitations of IVRS. Firstly, many people simply dislike talking to machines. These systems may not recognize customer request or misinterprets customer speech. In addition, some IVRS have irrelevant, long or unclear content. Older adults may have a hard time following these menus and messages. On the other hand, younger callers get frustrated with the slowness of multiple phone menus.

As a result, since the IVRS have some disadvantages, customer satisfaction and their attitude to use of these systems are problem especially for the companies which give customer support services.

1.2 Intelligent Interactive Voice Response Systems

Intelligent IVRS (IIVRS) are the extension of the traditional IVRS by the use of expert systems. IVRS have been used for more than a decade; however, the emergence of artificial intelligence (AI) features have been enhancing IVR

interactions as the latest innovation in IVR technologies [2]. AI enables a wider range of input to be analyzed. Sentiment analysis is used for detecting emotion in many studies [3, 4] and IVRS can be developed using sentiment analysis [5]. Therefore, emotion detection from speech is also applicable, and customers can enter more complex responses rather than selections. Traditional IVRS could not response to the increasing user demands, and have some deficiencies about dynamism, recovery of failures, and context enabled services [1]. The IIVRS detect the user's activities, and sense the needs of user; maintains the previous sessions of the user, and in future refers the previous history, options and the frequency of the options to generate dialogue; and present options according to the context [1]. These systems have abilities to be flexible, adaptive, and human error-tolerant [6].

Early commercial spoken dialogue systems are not adopted by user, but now, machines are more capable to understand and do a lot of things. In the coming years, it is foreseen that IIVRS usage will increase and customer evaluations of the service encounter will change with the improvements in speech algorithms, and natural language processing and modeling [7]. Therefore the usage of IIVRS by companies for customer service operations probably will be also increase.

In this study, an integrated model is developed for understanding the relationship among the IIVRS related constructs which are personal innovativeness, perceived social presence and service quality, and their relationship with customer satisfaction on and attitude towards more intelligent IVRS. In order to understand these relationships, an investigation is conducted using a survey questionnaire with persons have an experience in automated dialog with IVRS. Structural Equation Model (SEM) is used for data analysis.

1.3 Theoretical Background

In order to understand the customer satisfaction and attitude towards IVRS, services and self-services marketing, and IVR literature are examined.

1.4 Impact of Personal Innovativeness on Perceived Social Presence, Perceived Service Quality, and Attitude

Innovativeness is explained as “a tendency to be a technology pioneer and thought leader” [8]. The author [8] developed the Technology Readiness Index which has innovativeness factor as one of the drivers of technology. It is defined in the reference [9] as “the degree to which an individual adopts new ideas earlier than other members of a system”. Personal innovativeness is essential for understanding novel information technology diffusion [10]. There is no much study about the personal innovativeness and social presence relation; however, the significant relations between personal innovativeness and perceived interactivity [11], and innovativeness and social engagement [12] lead us such a foresight.

The author [13] studied on campus portal effectiveness, and personal innovativeness has significant impact on service quality according to the study. In addition, there are several researches that point out the importance of personal innovativeness on individual perceptions, attitudes and intentions about a new information technology [14-18]. The users’ attitude to use mobile phone-based IVRS for seeking healthcare is investigated by the researchers [19] and it is found that lack of familiarly with the technology has negative effect on the attitude of users. Therefore, such hypotheses can be developed basing on the studies above.

H1: Personal innovativeness has significant effect on perceived social presence of IVRS.

H2: Personal innovativeness has significant effect on perceived service quality of IVRS.

H3: Personal innovativeness has significant effect on attitude towards IVRS.

1.4 Impact of Perceived Social Presence on Perceived Service Quality and Customer Satisfaction

Social presence theory discusses the social effects of mediums [20]. It is “the degree to which a person is perceived as a real person in mediated communication” [21]. It is seen as an important concept in computer-mediated communication studies. For this reason, it is thought as important in this study. According to the reference [20], social presence is related with the medium quality so it can be related with service quality.

The studies [22, 23] have shown that social presence has a strong relation with satisfaction. Moreover, the study [24] argues that virtual community members’ desire for social presence influence their satisfaction with the use of an avatar. In last years, this relationship is found significant for mobile instant messaging and virtual customer service agents [25, 26]. In addition, IVRS has social barriers like lack of human interaction and infrastructural challenges [19]. Therefore, such hypotheses can be developed basing on the studies above.

H4: Perceived social presence has significant effect on perceived service quality of IVRS.

H5: Perceived social presence has significant effect on customer satisfaction of IVRS.

1.5 Impact of Perceived Service Quality on Customer Satisfaction

Service quality is defines as "a comparison of expectations about a service with performance" [27]. Most service quality researches covering different service settings have been influenced by the study [28]. Their refined multi-dimensional service quality assessment instrument is called SERVQUAL which includes 22 items consist of five service dimensions.

In literature, service quality significantly affects customer satisfaction [29-31]. Similarly, service quality has significant relation with customer satisfaction according to the self-service technology and IS studies [32-37]. Therefore, such hypotheses can be developed basing on the studies above.

H6: Perceived service quality has significant effect on customer satisfaction of IVRS.

1.6 Impact of Customer Satisfaction on Attitude

Attitude is "a person's relatively consistent evaluations, emotional feelings, and tendencies towards some object or idea" [38]. Customer satisfaction is defined as "a summary of cognitive and affective reaction to a service incident" [39]. Previous studies have pointed out that customer satisfaction influence an overall attitude. According to the study [40], satisfaction with a service influences customer's attitude towards the service. In addition, attitude is influenced by satisfaction in the research model of the study [41]. These constructs have significant relation also in self-service studies [37]. Therefore, such hypothesis can be developed basing on the studies above.

H7: Customer satisfaction has significant effect on attitudes towards IVRS.

As a summary, the seven hypotheses are developed based on the literature, and the theoretical model is proposed for customer perception towards IVRS (see Figure 1).

2. METHODOLOGY

Understanding of relationships among the constructs personal innovativeness, perceived social presence, perceived service quality, user satisfaction and, user attitude towards IVRS is aimed in this study. A quantitative research method is used as data collection method in order to comprehend the relationships. A survey questionnaire is conducted with persons have an experience in automated dialog with IVRS. The survey has two sections (APPENDIX A). The first section involves three questions for obtaining the respondents' demographic information like gender, age, and education level, and a question for checking the IVRS experience. The second section consists of three items for personal innovativeness, five items for social presence, ten items for service quality, three items for each construct customer satisfaction, and attitude. The 7-point Likert agreement scale is used for all items in the second section. Totally, 384 completed responses have been obtained. However, 239 of the respondents stated an interaction with an IVRS previously. Therefore, only their responses are included in testing the proposed model.

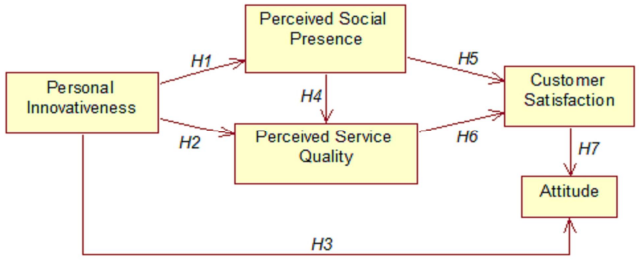


Figure 1: Theoretical Model

Structural Equation Modeling (SEM) is used for statistical modelling. Analysis of Moment Structure (AMOS) IBM SPSS is used to fit the structural equation model as a software program.

3. RESULTS

3.1 Descriptive Analysis

According to descriptive analysis, 62% of the respondents have an experience with IVRS. The demographic information summary can be seen in Table 1. According to the summary, the age of 75% of the respondents is between 25 and 40. Female and male percentages are 56% and 44% respectively. The percentages are close to each other. As educational level, 57% of the respondents have an associate level. Moreover, the percentage of master and PhD degrees is 22%.

3.2 Structural Equation Modeling

SEM is used as a multivariate method. It includes confirmatory factor analysis and regression analyses for testing hypotheses. In this study, these analyses are performed by using the tool AMOS.

3.2.1 Measurement Model and Validation

The data normality is analyzed in order to understand the distribution of data. It checks the validity of the confirmatory factor analysis. Since the values of skewness and kurtosis are higher than -2 and lover than 2, the variables satisfy the normality requirement. The maximum likelihood technique is used as the estimation method. It is used usually in SEM. In this study this technique is selected.

Measurement model validation requires admissible goodness-of-fit (GOF) levels for construct validity [42]. Appendix B shows the measurement model.

The GOF levels of the model are given in Table 2. The chi-square is 546,431 and the degrees of freedom is 220. Normed chi-square is calculated as 2.48. It is lower than 3.00. Therefore the admissible fit indices are met.

Table 1: Demographic Information

Age	**<24**	**25-29**	**30-39**	**39<**
	51	90	89	9
	21%	38%	37%	4%
Gender	**Female**	**Male**		
	133	106		
	56%	44%		
Education	**Secondary/ High School**	**Associate/ Bachelor's Level**	**Graduate Level**	
	49	137	53	
	21%	57%	22%	

Table 2: The Measurement Model GOF Indices

GOF Indices	**Measurement Model**	**Admissible Values**
Absolute Fit Measures		
RMSEA	.079	between .05 and .08
Chi-Square (normed)	2,48	≤ 3
Incremental Fit Indices		
CFI	.94	between .90 and .95
Parsimony Fit Indices		
PCFI	.8	

Then the absolute fit measure is checked. The RMSEA value should be higher than 0.05 and lower than 0.08. The value for the proposed model is met this indices with the value 0.079. CFI is one of the incremental fit indices. PCFI is a parsimony fit indices. They also satisfy the admissible values (Table 2). Therefore, a good fit is provided by the model.

The constructs and their relationships base on previous studies. In order to demonstrate construct validity, convergent and discriminant validity are tested.

First the factor loadings are examined for convergent validity. They should be ideally 0.7 or higher [42]. The standard loadings of confirmatory factor analysis for the proposed model meet the suggested loading value with significant p value (Table 3).

Furthermore, average variance extracted (AVE) is calculated for convergent validity. Ideally, 0.5 or greater AVE is required in order to demonstrate convergent validity. In addition, 0.7 or greater construct reliability is required for internal consistency [42]. As seen in Table 4, AVE, construct reliability, and Cronbach's Alpha values are adequate for suggested values and satisfy the reliability of the instrument. Therefore, the convergent validity is validated.

On the other hand, square of the correlation values are calculated to demonstrate the discriminant validity of a proposed model. They should be lower than the AVE values of the constructs.

According to values in Table 5, the requirement for discriminant validity is satisfied. Therefore, the discriminant validity is also validated.

In addition to these validities, nomological and face validity are also met since the hypotheses are developed basing on the theoretical background.

Table 3: Factor Loadings

Construct	**Indicator**	**Loadings**	**p- Value**
Personal Innovativeness	PI1	.864	-*
	PI2	.801	.001
	PI3	.904	.001
Social Presence	SP1	.888	-*
	SP2	.898	.001
	SP3	.961	.001
	SP4	.953	.001
Service Quality	SQ1	.79	-*
	SQ2	.761	.001
	SQ3	.789	.001
	SQ4	.722	.001
	SQ5	.841	.001
	SQ6	.819	.001
	SQ7	.751	.001
	SQ8	.796	.001
	SQ9	.813	.001
	SQ10	.713	.001
Customer Satisfaction	CS1	.908	-*
	CS2	.905	.001
	CS3	.869	.001
Attitude	A1	.85	-*
	A2	.967	.001
	A3	.941	.001

*not estimated

Table 4: Construct Reliability and AVE Values

Construct	Cronbach's Alpha	AVE	Construct Reliability
PI	.89	.735	.750
SP	.959	.857	.800
SQ	.939	.609	.909
CS	.923	.800	.750
A	.943	.848	.749

3.3.2 Structural Model

Structural model is applied in second part of SEM. The structural model is given in Appendix C. Absolute fit indices are examined first. Whereas chi-square is 596,183, degrees of freedom is 266 according to GOF indices (Table 6). Therefore, the normed chi-square is lower than the acceptable level 3. In addition, the RMSEA is between 0.05 and 0.08. Therefore the admissible values are met. On the other hand, CFI value is 0.90, and the PCFI value is 0.8. As a result, it can be said that all values are met the model fit. When the weights for regression and p-values are examined in Table 7, it is seen that they have alpha level significance.

AMOS provides also the modification indices. Additional relation was not suggested by the result. The analysis results support the literature. Therefore, this study contributes the literature with this new model which proposed for more intelligent IVRS.

Table 5: Discriminant Validity

Construct 1	Construct 2	Correlation	Square of Correlation	AVE of C1	AVE of C2
Personal Innovativeness	Social Presence	.42	.17	.75	.80
Personal Innovativeness	Service Quality	.31	.09	.75	.91
Personal Innovativeness	Customer Satisfaction	.66	.43	.75	.75
Personal Innovativeness	Attitude	.34	.11	.75	.75
Social Presence	Service Quality	.35	.12	.80	.91
Social Presence	Customer Satisfaction	.59	.35	.80	.75
Social Presence	Attitude	.36	.13	.80	.75
Service Quality	Customer Satisfaction	.45	.20	.91	.75
Service Quality	Attitude	.36	.13	.91	.75
Customer Satisfaction	Attitude	.59	.35	.75	.75

Table 6: The Structural Model GOF Indices

GOF Indices	Structural Model	Admissible Values
Absolute Fit Measures		
RMSEA	.078	between .05 and .08
Chi-Square (normed)	2.45	≤ 3
Incremental Fit Indices		
CFI	.94	between .90 and .95
Parsimony Fit Indices		
PCFI	.8	

DISCUSSION AND CONCLUSION

Although there are many studies about IVRS, they are constantly evolving and becoming more intelligent. Therefore, specifying the constructs which can affect the customer satisfaction and attitude is important for improvement of IVRS. In this study, literature is reviewed and the constructs personal innovativeness, perceived social presence, perceived service quality, customer satisfaction, and attitude are found related with IVRS. For hypotheses testing, a survey questionnaire is conducted with person about IVRS. SEM is used as a statistical analysis technique to understand the relationship of the model constructs of IVRS and validate the proposed model.

According to results, personal innovativeness significantly affects service quality and perceived social presence of IVRS. In addition, it influences also customer attitude toward IVRS.

Table 7: Regression Weights

H	Relationships			Regression Weight	p-value
H1	Social Presence	←	Personal Innovativeness	.219	.001
H2	Service Quality	←	Personal Innovativeness	.273	***
H3	Attitude	←	Personal Innovativeness	.152	***
H4	Service Quality	←	Social Presence	.608	***
H5	Attitude	←	Social Presence	.097	.047
H6	Customer Satisfaction	←	Service Quality	.909	***
H7	Attitude	←	Customer Satisfaction	.738	***

Perceived social presence is significantly related with perceived service quality of IVRS. Both perceived social presence and perceived service quality of IVRS have a direct effect on the customer satisfaction. Finally, customer

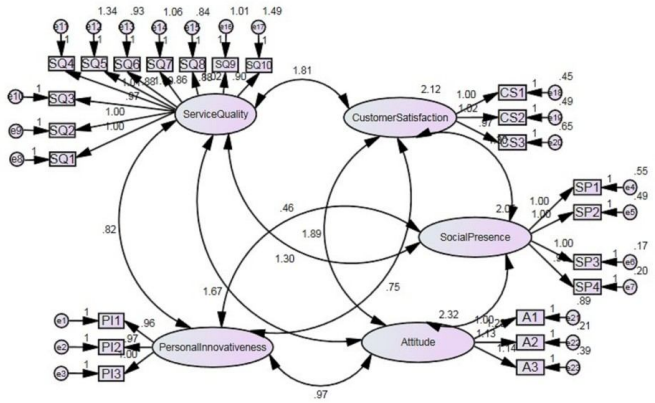
satisfaction has positive significant effect on customer attitude toward IVRS.

In future studies, other related constructs in literature can be added to the model. Statistical sampling techniques can be selected for increasing generalizability. In addition, the model can be supported also by the interviews or experimental research techniques.

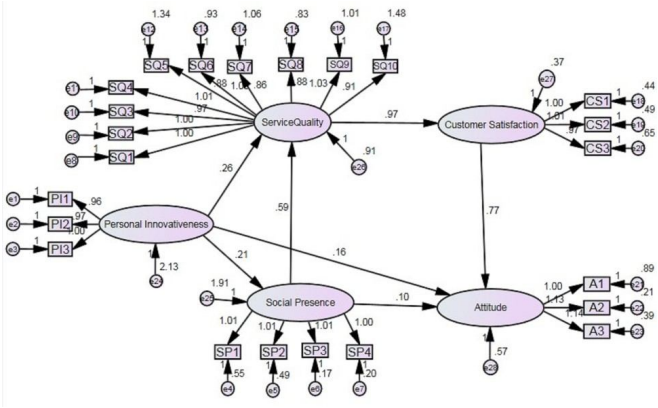
APPENDIX A – SURVEY ITEMS

Personal Innovativeness ([10])
Social Presence ([43])
Service Quality (adapted from [44])
SQ1 I can get my service done with the interactive voice response systems in a short time
SQ2 The service process of the interactive voice response systems is clear
SQ3 Navigating the interactive voice response systems requires little effort
SQ4 Each service item/function of the interactive voice response systems is error-free
SQ5 I feel good being able to use the interactive voice response systems
SQ6 The interactive voice response systems have interesting additional functions
SQ7 I feel safe in my transactions with the interactive voice response systems
SQ8 The interactive voice response systems appear to use up-to-date technology
SQ9 It is easy and convenient to reach the interactive voice response systems
SQ10 The interactive voice response systems have features that are personalized for me
Customer Satisfaction (adapted from [45])
CS1 Overall, I am satisfied with the services provided by interactive voice response systems
CS2 The services provided by interactive voice response systems exceed my expectations
CS3 Interactive voice response systems are close to my ideal SSTs
Attitude (adapted from [46])
A1 I feel good about the interactive voice response systems service
A2 I feel pleasant about the interactive voice response systems service
A3 I like the interactive voice response systems service

APPENDIX B – MEASUREMENT MODEL



APPENDIX C – STRUCTURAL MODEL



ACKNOWLEDGMENT

This study is realized at the Information Systems Research and Application Center of Bogazici University, Istanbul, Turkey.

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