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Kawal Kapoor
Swansea University, kawalkap@gmail.com

Yogesh Dwivedi
Swansea University, ykdwivedi@gmail.com

Michael Williams
Swansea University, m.d.williams@swansea.ac.uk

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ROLE OF INNOVATION ATTRIBUTES IN EXPLAINING INTENTION AND ADOPTION: A CASE OF THE IRCTC MOBILE TICKETING APPLICATION IN THE INDIAN CONTEXT

Kawaljeet Kapoor

School of Business, Swansea University, UK

Email: kawalkap@gmail.com

Yogesh K. Dwivedi

School of Business, Swansea University, UK

Email: ykdwivedi@gmail.com

Michael D. Williams

School of Business, Swansea University, UK

Email: m.d.williams@swansea.ac.uk

Abstract

This study aims at presenting an investigation on the role of innovation attributes in significantly influencing consumers' behavioural intentions and actual adoption of Indian Railway Catering and Tourism Corporation's mobile ticketing application. Both, the adopters and non-adopters of this technology were targeted to attain the suitable data for empirically testing the proposed model for this study. A series of tests were performed using the SPSS analysis tool. These findings suggested that relative advantage, compatibility, trialability, and observability considerably influenced consumers' use intentions. The Findings also helped reveal that affordable cost and low risk associations to this technology significantly favoured the adoption intentions, and in turn, the actual adoption of this application. With no earlier publications on this technology yet, this study offers the researchers an insight into the behaviour of different attributes that considerably impact its overall adoption. The tests bring to light its low adoption rate and the lack awareness of its positives amongst its potential consumers, indicating the increased need for its effective promotion to attract more consumers.

Keywords: Adoption, Diffusion of Innovations, Innovation, IRCTC, Mobile ticketing

1.0 Introduction

The IRCTC mobile ticketing service is a secure transaction solution provided by the *IRCTC* to book railway tickets from a mobile phone. To use the IRCTC mobile application, users need to register themselves using their mobile phone number, and then download and install the IRCTC mobile application on their GPRS activated mobile phones. A point to be noted here is that other forms of railway booking like over-the-counter ticketing and e-ticketing continue to exist. E-ticketing and mobile ticketing are more or less same in terms of functionality, that is consumers can pull up train schedules, confirm bookings and make payments; the only difference between the two comes where mobile ticketing is available in the form of a mobile application, that can be accessed from anywhere, anytime using the phone's network data. There are three providers of this application – Paymate, ngpay, and Atom. The application has now undergone recent upgrades, which make it usable on CDMA phones. Different mobile companies are also collaborating with IRCTC to serve as providers, in addition to the three existing providers. Despite considerable dwelling, it has not been very clear if all of the above mentioned providers will continue to provide/are providing currently for IRCTC. Given that this mobile application is still evolving and undergoing continuous changes and upgrades, our study chooses to acknowledge the presence of only the three service providers present at the time at which our survey began.

IRCTC claims that the payment system is completely secure, and that both the transmitted data and stored data on the mobile are fully encrypted. There is no charge, as such, associated to making bookings using this application. However, since this application uses mobile data from the phone network providers, there may be different charges associated depending upon different mobile operators (IRCTC, 2013).

Indian railway is one of the most used services by the people in India; being very affordable, and having access to interiors of Indian villages and towns, it is a popular means of travel (Patel and Grover, 2010). With the introduction of a facility of booking railway tickets on-the-run using mobile phones, a factor of convenience has been introduced. A key attraction of using services on mobile phones is the capability of maintaining access to these services ubiquitously, on the go (Liang et al., 2007).

With the IRCTC mobile ticketing application, bookings can be made 24/7, which is time and cost effective.

Although, there are plenty studies available on mobile payment and mobile commerce (Wu and Wang, 2005; Siau and Shen, 2003), there are hardly any studies on the IRCTC mobile ticketing application. Our search for such publications revealed that very few studies had considered to discuss or merely mention its existence from different aspects of mobile commerce, a few of which were available as theses online (Sreekumar, 2007; Srivastava et al., 2007; Singh and Yammiyar, 2008; Ammourah and Yahia, 2009; Patel and Grover, 2010; Raman and Wig, 2010; Chandra and Malaya, 2011). None of these publications discuss the adoption of the IRCTC mobile ticketing application. It is a recent and evolving technology in India. Unfortunately, there aren't any official reports on the factors that encourage consumers to use this mobile application, either. As the low adoption rate of this application will be addressed and further discussed later in this paper, how can this poor adoption rate of this application be justified? Do consumer backgrounds or some kinds of societal influences play a role in making such an adoption decision, or is it simply the consumer unawareness of technology? In order to address these questions, there exists a need to empirically examine this application to gain insights into the factors that both attract and repel the consumers from the use of this mobile application.

Hence, this study aims to empirically investigate the role of innovation attributes in the adoption of the IRCTC mobile ticketing application in the Indian context. Bringing to light the effect these influential attributes may serve in providing the stakeholders with a directive view for formulating competitive strategies that may further assist in encouraging a wider adoption of this application. Also, given that most of the technologies in today's world are being made available on a mobile platform as applications on a mobile phone that can be conveniently used from anywhere at any time, the results from this study will serve as a literary contribution in terms of presenting the behaviour of the chosen set of attributes in reference to the adoption of mobile applications in general, and mobile ticketing applications, in particular. In achieving this aim, the effect of Rogers' five innovation attributes on the consumers' intention to adopt the IRCTC mobile ticketing application will be studied. The effect of factors like cost and risk on the adoption of this mobile application will also be analysed via suitable statistical tests.

The immediate following section is the theoretical basis, proposing conceptual model and hypotheses; discussed next is the research method, briefly explaining the survey instrument, pilot study, and data collection process; succeeding is the section with findings detailing on the tests conducted using SPSS to generate statistics; the proposed hypotheses are then validated in the discussion section; the paper finally highlights key conclusions, limitations, future research directions.

2.0 Theoretical Basis and Development of Conceptual Model

To explain the diffusion process of any innovation, Rogers recognized five attributes—*Relative Advantage, Compatibility, Complexity, Trialability, and Observability*. There are many models available for studying an innovation's diffusion, like Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) and Technology Acceptance Model (TAM). TRA (Ajzen and Fishbein, 1980) concentrated only on the influence of intention on adoption. TAM (Davis et al., 1989) also only studied the effect of behavioural intention on adoption. The decomposed TPB (Taylor and Todd, 1995) focussed on the influences of intention and perceived behavioural control on adoption. TPB (Ajzen, 2006), chose to study the effects of intention and behavioural control on the actual adoption. All these models use similar type of attributes. The innovation of diffusion theory, on the other hand, is comparatively more established, using a competent set of innovation attributes very different from the ones in use by the above mentioned models. The past studies (Tornatzky and Klein, 1982; Greenhalgh et al., 2004; Legare et al., 2008; Hester and Scott, 2008) are proofs that different innovations have been frequently studied using Rogers' innovation attributes.

The existing literature houses numerous publications on mobile commerce and mobile ticketing, for instance, Mallat et al. (2009) in studying the acceptance of mobile ticketing found that while compatibility and ease of use significantly influenced the users' adoption intention, relative advantage remained insignificant. Another study by Mallat et al. (2008) on mobile ticketing service adoption, combined TAM and diffusion of innovations attributes to show that ease of use and usefulness have a statistically significant effect on adoption, and that compatibility has the strongest effect on adoption intention. Chen (2008) examined consumer acceptance of mobile payments to find that perceived use, ease of use, risk, and compatibility significantly

determine adoption. Schierz et al. (2010) found that compatibility, individual mobility and subjective norm were important predictors of m-payment services adoption. Koenig-Lewis et al. (2010) found compatibility, relative advantage, and risks to significantly predict m-banking services adoption. An m-commerce adoption study on Indian consumers found that perceived usefulness, perceived enjoyment and self efficacy significantly influenced adoption intention (Dwivedi et al., Forthcoming in IJICBM).

The aforementioned exemplifications are proof that although many studies on mobile commerce and mobile payments exist, not many studies focussed on the adoption of the mobile ticketing services. Also, there has been no study conducted particularly on the adoption of the IRCTC mobile ticketing application in the Indian context. In introducing such innovations, one of the commonest hurdles for most organizations is of speeding the diffusion rates (Rogers, 2003). In addressing this concern for the IRCTC mobile ticketing application, we therefore choose to use Rogers' five *innovation attributes* in addition to two other attribute, *cost* and *riskiness* which were deemed appropriate from the mobile ticketing perspective.

Since IRCTC mobile application may involve a transaction *cost*, and it also requires a payment to be made by the users over their phones, there is an element of *risk* involved from the users' perspective, hence both these variables were considered appropriate to be included in our study. The past publications on mobile payments have given *cost* a good deal of consideration. Any hidden and obvious costs associated with an m-commerce innovation are often perceived to have a significant negative influence on adoption (Hung et al., 2004; Wu and Wang, 2005). Researchers have found that costs such as transaction fees/premium pricings tend to act as barriers of adoption (Dahlberg et al., 2007; Mallat, 2007). A study on the mobile banking adoption in the UK found riskiness had a negative impact on adoption (Lee et al., 2003). Mallat et al. (2008) collated and listed various risks that could be associated to m-commerce adoption – device breakdown, network connection/coverage issues, limited/short phone battery, loss/theft, any of which could potentially come in the way of a successful mobile transaction, and hence the users' apprehensions of the risks associated with transacting over mobile applications.

Figure 1 represents the conceptual model for our study. The model proposes seven attributes which will have considerable influence on the behavioural intentions of the users, and also that behavioural intention and riskiness will have a significant influence on the adoption of this mobile ticketing application.

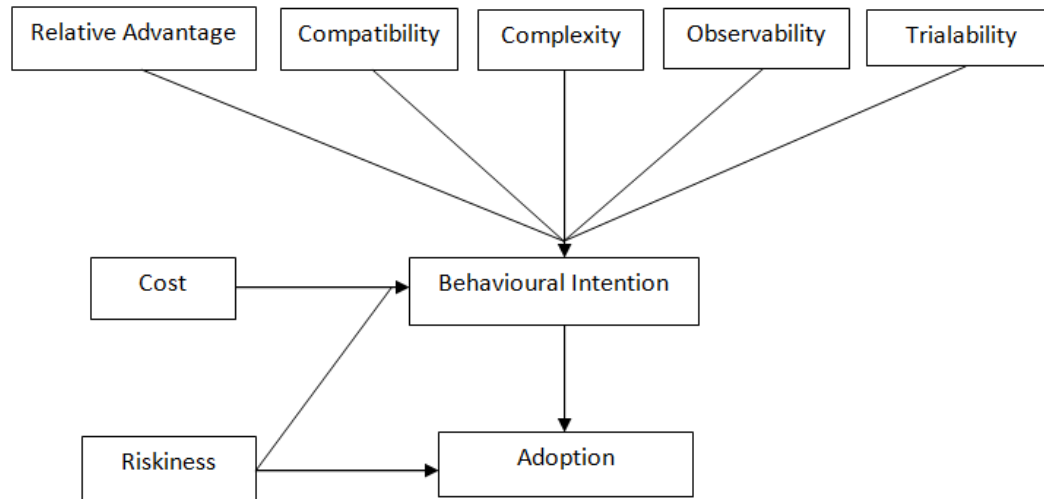


Figure 1. Proposed conceptual model for examining intention and adoption of IRCTC mobile ticketing application

2.1 Relative Advantage

Relative advantage is seen as the degree to which an innovation is considered to be better than the idea that it is superseding (Rogers, 2003). Studies on mobile internet (Hus et al., 2007), mobile banking services (Koenig-Lewis et al., 2010) have reported a positive effect of relative advantage on behavioural intention. Booking railway tickets on mobile is an enhanced alternative provided by IRCTC for the convenience of the users, to book tickets on-the-go. This mobile application thus supersedes over-the-counter ticketing and e-ticketing.

H1: *Relative Advantage is posited to significantly influence behavioural intentions of potential users.*

2.2 Compatibility

Compatibility is seen as the degree to which an innovation is considered to be consistent with the past experiences, existing values and needs of the prospective adopters of a technology (Rogers, 2003). Studies on mobile network (Hsu et al.,

2007), mobile internet (Shin, 2010) and mobile ticketing services (Mallat et al., 2008) have shown that compatibility has a strong positive influence on the consumers' use intentions. Booking railway tickets on mobile phones allows consumers to book tickets on-the-go, which is much quicker and efficient than the over-the-counter or internet booking.

H2: *Compatibility is posited to positively influence behavioural intentions of potential users.*

2.3 Complexity

Complexity is seen as the degree to which an innovation is perceived as difficult to understand and use (Rogers, 2003). Higher complexity retards the innovation acceptance. Hence, there exists a negative association between complexity and use intention. Lu et al. (2008) studied determinants of mobile data services in China to find that the reduced complexity associated with the use of these services positively influenced the use intentions. Tanakinjal (2010) studied adoption of mobile marketing to conclude, complexity has a direct influence on the consumers' use intentions. Thus, different users may have different perceptions of the effort involved in making railway bookings on a mobile phone.

H3: *Reduced complexity is posited to positively influence the behavioural intentions of the potential users.*

2.4 Trialability

Trialability is seen as the degree to which an innovation is available to the users for use over a limited trial period, before users make final adoption decisions (Rogers, 2003). While, Hsu et al. (2007) did not see a significant relationship between trialability and adoption intentions in their mobile internet study, Arts et al. (2011) studying consumer innovation adoption, found trialability to negatively affect the adoption behaviour.

H4: *Trialability is posited to significantly influence behavioural intentions of potential users.*

2.5 Observability

Observability is seen as the degree to which the results of using an innovation become clearly visible to others (Rogers, 2003). There has been very limited usage of this attribute in the literature. However, Vishwanath and Goldhaber (2003) in their study on technology products found that this attribute had a significant effect on the adoption intention. Arts et al. (2011) also confirmed a similar behaviour for this attribute.

H5: *Observability is posited to significantly influence behavioural intentions of potential users.*

2.6 Cost

Higher costs are often seen to have a negative association with the adoption of an innovation (Tornatzky and Klein, 1982). This effectively implies that lower costs linked with using a technology will serve in the favour of that technology being easily accepted. Shin (2010) while studying the mobile virtual network found cost to be negatively influencing consumers' use behaviour.

H6: *Reduced costs are posited to positively influence behavioural intentions of potential users.*

2.7 Riskiness

Riskiness is viewed as a multidimensional component consisting aspects of financial, psychological, performance, social, physical, time loss risks (Rijsdijk and Hultnik, 2003). Studies on mobile ticketing (Mallat et al., 2008) and marketing (Tanakinjal et al., 2010) have been observed to focus on the security and privacy risks which were found to significantly affect use intentions, and in turn the innovation use. Risk is often hypothesized to negatively impact adoption. Hence riskiness was considered to be explored in our context for its influences on both, the intention and adoption variables.

H7: *Reduced riskiness is posited to significantly influence behavioural intentions of potential users.*

H8: *Reduced riskiness is posited to positively influence adoption of IRCTC mobile ticketing application.*

2.8 Behavioural Intention

Behavioural intention is the measure of the likelihood of a potential user being involved in a given behaviour, which acts as an immediate determinant of actual use of an innovation (Ajzen and Fishbein, 1980). Increased behavioural intention is a direct indicator of higher probability of an innovation's actual use. Evidences from the literature confirm a positive significant impact of this attribute on the actual use of an innovation (Ajzen, 1991; Chen et al., 2002; Ajjan and Hartshorne, 2008; Gumussoy and Calisir, 2009).

H9: *Behavioural Intention is posited to positively influence adoption of IRCTC mobile ticketing application.*

3.0 Research Model

3.1 Survey Instrument

The questionnaire employed for data collection purposes comprised 40 questions, eight of which were demographic. While all of these eight questions were multiple-choice by design, four of them were directed at respondents' personal profile such as their *age, gender, education* and *occupation*, and the other four were directed at their experience with the use of the IRCTC application, such as, *adoption decision, choice of provider, duration of adoption, and usage frequency*. The questionnaire used a seven-point likert scale to measure the attitude of the respondents towards the remaining 32 questions. Four questions per innovation attribute went into building these 32 questions (Table1). The responses to these questions were then interpreted to test the proposed hypotheses and conceptual model for this study. The range of responses was spread across these seven points – 1*extremely disagree*, 2*quite disagree*, 3*slightly disagree*, 4*neutral*, 5*slightly agree*, 6*quite agree*, 7*extremely agree*.

Constructs	Questions	Source(s)
Behavioural Intention	BI1: I plan to continue using/use IRCTC mobile application.	Karahanna et al. (1999); Teo and Pok (2003); Shih and Fang (2004)
	BI2: My willingness of using/continuing to use IRCTC application is high.	
	BI3: I intend to use/continue using IRCTC mobile application.	
	BI4: The likelihood that I'll use/continue using IRCTC application is high.	
Triability	T1: IRCTC mobile application is easily available to get familiar with.	Moore and Benbasat (1991)
	T2: I know the provider who allows trying services on this application.	
	T3: A proper tryout of its different features is/was not possible.	
	T4: I do/did not have adequate opportunities to try the IRCTC application.	
Relative Advantage	RA1: IRCTC mobile app allows quick access to the railway tickets I need.	Moore and Benbasat (1991)
	RA2: IRCTC mobile app improves quality of railway ticketing.	
	RA3: IRCTC mobile app makes booking tickets easy.	
	RA4: IRCTC mobile app makes booking tickets faster.	
Compatibility	CT1: IRCTC app is/will be compatible with all railway booking needs.	Moore and Benbasat (1991)
	CT2: IRCTC app will fit/fits well with the type of bookings I need to make.	
	CT3: Using IRCTC mobile app fits/will fit well with my lifestyle.	
	CT4: My mobile phone is compatible with the IRCTC mobile application.	
Complexity	CP1: Using IRCTC mobile app will be/is challenging and frustrating.	Moore and Benbasat (1991); Shih and Fang (2004); Yang et al. (2006); Richardson (2009)
	CP2: Learning to use IRCTC mobile app will be/is easy for me.	
	CP3: Easy to operate mobile ticketing app is important to me.	
	CP4: I find it easy for me to be skilful at using the IRCTC mobile app.	
Cost	C1: IRCTC mobile app is inexpensive.	Mallat et al. (2008); Koenig-Lewis et al. (2010)
	C2: The cost of making a railway booking with IRCTC app is reasonable.	
	C3: Buying a phone compatible with this IRCTC application is expensive.	
	C4: IRCTC railway booking is the affordable single booking type for me.	
Observability	O1: Being seen as a user of IRCTC mobile app is good for my image.	Meuter et al. (2005); Richardson (2009)
	O2: People who use IRCTC app are not very visible in my social circle.	
	O3: I have seen others using IRCTC mobile app.	
	O4: I do not know anyone who uses IRCTC mobile app.	
Riskiness	R1: Mobile phones are reliable for performing railway bookings.	Tan and Teo (2000); Mallat et al. (2008)
	R2: In using IRCTC app, I'm concerned of the consequences of a mistake.	
	R3: My financial information given during booking will be known to others	
	R4: My financial information given during booking can be tampered.	

Table 1. Attributes-Questions Mapping

3.2 Pilot Study

The questionnaire was required to undergo a pilot test with a small respondents' sample to arrive at any improvements in the questionnaire, if necessary, before the questionnaire could be circulated to the target respondent population. The sample size for the pilot study was finalized at 30 respondents. It was made certain that the members of this pilot study belonged to varying age groups to ensure the understandability and ease of completing the questionnaire by all. The feedback from the respondents of pilot study was positive, in that, they confirmed that the questionnaire was clear and simple to understand. However, some comments were made on the element of repetitiveness and the length of time consumed in completing them. Other minor suggestions made were addressed and amended, but elimination of any or few questions was considered inappropriate, and thus the final questionnaire, after the pilot test, continued to consist of all of the 40 questions.

3.3 Data Collection

The data collected was from respondents resident in different cities across India. The citizens were randomly reached out to, irrespective of them being adopters or non-

adopters of this technology, and were asked in a question on the questionnaires if they were adopters or non-adopters to measure the diffusion awareness of this technology in the Indian context. The questionnaires were carefully designed that allowed both parties to provide responses from their adopter/non-adopter perspectives without any difficulty. To arrive at the all India data, four cities were targeted from the *northern (Delhi)*, *eastern (Kolkata)*, *western (Mumbai)* and *southern (Bangalore)* regions of India. The target number set for each city was at least 80 responses each, bringing the final total to 330 respondents. A critical note to be made here is that the data collection is still ongoing, and from the purposes of this paper, it was decided to utilize only the responses that have been collected until date. We have received 185 fully completed questionnaires currently.

The SPSS data analysis software was chosen to produce results from the collected data, the results from which have been presented in the section4. The findings section is richly populated with statistics from the various tests listed here - *frequency tests* on the eight demographic factors; *reliability test* measuring the internal consistencies of four items/questions per innovation attribute; *descriptive test*; *regression analyses (linear and logistic)* for testing the postulated hypotheses; and lastly, the *multicollinearity test* to check for correlation amongst the predictor attributes.

4.0 Findings

4.1 Demographics

Table2 below has been populated with the demographic characteristics- age, gender, and education of the respondents that participated in this study.

Variable	Group	Frequency	Percentage
Age	18-24	66	35.7
	25-34	56	30.3
	35-44	29	15.7
	45-54	21	11.4
	55-64	12	6.5
	65-74	0	0
	Above 75	1	0.5
	Total	185	100.0
Gender	Male	98	53.0
	Female	86	46.5
	Total	185	100.0
Education	Secondary School	9	4.9
	Higher Secondary	24	13
	Diploma	11	5.9
	Graduate	96	51.9
	Postgraduate - Taught	28	15.1
	Postgraduate - Research	14	7.6
	Other	3	1.6
	Total	185	100.0

Table 2. Demographic Characteristics

Table3 shows demographic information particular to the use of the IRCTC mobile application. It is of importance to note here that out of the total 185 respondents, there are 129 non-adopters and only 56 adopters of this application. Therefore only 30.3% of the respondents were recorded as the adopters of this application.

Variable	Group	Frequency	Percentage
Application Type	Paymate	32	17.3
	Ngpay	12	6.5
	Atom	12	6.5
	Non Adopters	129	69.7
	Total	185	100
Usage Duration	<=12 Months	25	13.5
	12-24 Months	16	8.6
	25-36 Months	7	3.8
	>36 Months	5	2.7
	Other	2	1.1
	Non Adopters	129	69.7
	Total	185	100
Usage Frequency	Several times a day	5	2.7
	Once a day	16	8.6
	1-2 days a week	6	3.2
	3-5 days a week	5	2.7
	Once every few weeks	7	3.8
	Less often	17	9.2
	Non Adopters	129	69.7
	Total	185	100

Table 3. Application Specific Demographic Characteristics

4.2 Reliability Test

Reliability test was run to test the internal consistencies of the items that were used in forming the innovation attributes for this study. Table 4 shows the *Cronbach's alpha* values for all of the individual innovation attributes. Every attribute was made up of four items initially, and eventually, four of the attributes underwent an item deletion each, to arrive at a better alpha value. The reliability classification provided by Hinton et al. (2004) was used, where the alpha values could be interpreted across four different reliability types – equal or higher than 0.90 = excellent; 0.70-0.90 = high; 0.50-0.70 = moderate, and less than or equal to 0.50 = low. Out of the eight constructs, there were two attributes with excellent, five with high, and one with moderate reliabilities. A greater Cronbach's alpha value is indicative of a greater internal consistency of the individual items that it is made up of.

Constructs	Sample Size	Number of Items	Cronbach's Alpha (α)	Number of Items	Improved Alpha (α)	Reliability Type
Behaviuoral Intention	185	4	0.927	4	0.927	Excellent
Trialability	185	4	0.678	4	0.678	Moderate
Relative Advantage	185	4	0.908	4	0.908	Excellent
Riskiness	185	4	0.778	3	0.833	High
Compatibility	185	4	0.893	4	0.893	High
Complexity	185	4	0.764	3	0.802	High
Cost	185	4	0.814	3	0.864	High
Observability	185	4	0.654	3	0.705	High

Table 4. Reliability Test

4.3 Descriptive Statistics

Table5 below descriptive test results with the attributes being listed in the descending order of their means.

Constructs	N	n	Mean	Std. Deviation
Relative Advantage	185	4	4.37	1.572
Complexity	185	3	4.34	1.492
Behaviuoral Intention	185	4	4.22	1.669
Compatibility	185	4	4.21	1.544
Cost	185	3	4.15	1.520
Riskiness	185	3	3.94	1.542
Trialability	185	3	3.79	1.261
Observability	185	3	3.69	1.424

Table 5. Descriptive Statistics

4.4 Regression Analysis

This study will be undertaking both, linear regression and logistic regressions. Allen (2004) describes regression analysis as a statistical technique that attempts to predict the dependent variables' values by using the values of one or more independent variables.

4.1.1 Linear Regression

Table6 is populated with linear regression results to learn the influence of the seven innovation attributes (independent variables) on the *Behavioral Intention* (dependent variable). The resultant model of this regression run was found to significantly predict

the behavioral intention of the respondents towards the IRCTC application ($F(7, 185) = 37.884, p=0.000$).

Independent Variables	Standardized Coefficients (Beta)	t	Sig	Collinearity Statistics (VIF)	Hypotheses Support
(Constant)		.733	.464		
Relative Advantage	.169	2.021	.045	3.097	H1: Supported
Compatibility	.220	2.441	.016	3.607	H2: Supported
Complexity	-.026	-.299	.765	3.440	H3: Not Supported
Trialability	.221	3.154	.002	2.172	H4: Supported
Observability	.143	2.151	.033	1.956	H5: Supported
Cost	.273	3.209	.002	3.207	H6: Supported
Riskiness	-.145	-2.412	.017	1.606	H7: Supported

Table 6. Linear Regression

The model explained 58.4% of the variance (adjusted R square = 0.584). Six of the total seven attributes were significant predictor variables. Relative advantage, compatibility, trialability, observability, cost, and riskiness behaved as the significant predictor variables of consumers' behavioral intentions. On the other hand, complexity displayed no significant influence over behavioral intention.

4.1.2 Multicollinearity Test

A multicollinearity test was also undertaken to ensure that our dataset was free of the multicollinearity problem. Multicollinearity is referred to a situation where a high correlation exists amongst the predictor attributes (Brace et al., 2006). This problem can come in the way of meaningfully interpreting the contribution of individual predictor attributes towards the success of the model in use. It can be seen that the VIF values fall in the range of 1.6-3.6 (Table6). These values are considerably lower than the maximum value of ten (Irani et al., 2009) rendering the predictor attributes of this study to be free of this problem, in turn, increasing the possibility of the variance explained by these attributes to be near to the real situation.

4.1.3 Logistic Regression

A logistic regression run was also undertaken where adoption was the dependent attribute, and behavioural intention and riskiness were the predictor attributes. In logistic regression, the dependent variable is required to be dichotomous, that is, it is required to have two possible outcomes (Worster et al., 2007). The study's model

significantly predicted the consumers' adoption decisions (omnibus chi-square = 37.961, df = 2, p = 0.000). The model accounted for between 18.6% and 26.4% of the variance in the respondents' adoption decision. 96.9% of the non-adopters and 54.5% of the adopters were successfully predicted. Overall, 84.3% of the predictions were found to be accurate (table9).

		Chi-square	df	Sig.
Step 1	Step	37.961	2	.000
	Block	37.961	2	.000
	Model	37.961	2	.000

Table 7. Omnibus Tests of Model Coefficients

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	187.205	.186	.264

Table 8. Model Summary

	Observed	Predicted			
		Installed or Not		Percentage	
		Yes	No	Correct	
Step 1	Adoption	Yes	30	25	54.5
		No	4	126	96.9
	Overall Percentage				84.3

Table 9. Classification Table

Both, behavioural intention and riskiness succeeded in reliably predicting the adoption decisions of our respondent profile (table10).

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)		Hypotheses Support
							Lower	Upper	
Behavioural Intention	.338	.113	9.021	1	.003	1.403	1.125	1.749	H8: Supported
Riskiness	.496	.127	15.113	1	.000	1.641	1.279	2.107	H9: Supported
Constant	-2.345	.593	15.610	1	.000	.096			

Table 10. Variables in the equation

5.0 Discussion

5.1 Hypotheses Testing

Our empirical data extends a strong support to the structure of the proposed research model for this study. The hypotheses testing results (tables6&10) show that a total of

nine hypotheses were formulated to be tested in order to examine the influences of the eight predictor attributes on the two dependent variables, behavioural intention and adoption. Eight of these nine hypotheses were supported by the gathered data (H1, H2, H4, H5, H6, H7, H8 and H9).

As hypothesized, the data confirmed that relative advantage and compatibility have significant influences on the *behavioural intentions* of the potential consumers towards the IRCTC mobile application. Owing to feature where booking railway tickets has become mobile, without requiring to go to a specified ticket counter, or look for an internet connectible area where one could book tickets using laptops and personal computers, the mobile application surpasses the other ticket booking alternatives. This idea justifies the users' perception of this mobile ticketing application being relatively advantageous to its existing alternatives. In extension to this argument, this mobile application is compatible with the ideas of the aforementioned alternatives, in that, it allows the user to lookup and book tickets. In addition, this application is compatible with all GSM and CDMA mobile phones leading support to the view of users finding it to be compatible with their railway booking needs. Literature also supports the significant behaviour of relative advantage and compatibility on the use intentions – In a multimedia messaging service study, Hsu et al. (2007) use the innovation diffusion theory, and find that these two attributes place a significant impact on the users' behavioural intentions. A few of the many other studies on mobile commerce that have established similar relationships for relative advantage and compatibility on intention are – Chen (2008); Mallat et al. (2008); Grepott (2011).

Trialability and observability also succeeded in explaining the users' adoption intention towards the IRCTC mobile application. For an application like this where there isn't any installation cost or use contract involved, trialability can be assumed to be very subjective. In simpler words, the users may choose to use or give up this application at any time without any usage binding. Hence, it can be perceived as having an unlimited trial period. This supports the behaviour of our dataset in showcasing a significant impact of trialability of the users' adoption intentions. Meuter et al. (2005) conclude for trialability to be an attribute that helps the potential users in evaluating their ability to use a given innovation, in turn positively fuelling the user readiness towards that innovation. Similar significant behaviour was observed

in the case of observability. Jung et al. (2011) in their study on e-book readers also established a significant positive relationship between observability and behavioural intention.

Tornatzky and Klein (1982) identify high cost as a potential inhibitor of a user's intention to adopt any innovation. As emphasized in section 2, the existing literature provides similar evidences with respect to the high costs associated to an innovation. Dahlberg et al. (2007) in reviewing the studies on mobile payment environment found that cost was an attribute of importance. The empirical data is very apparent in supporting the fact that the consumers find the charges associated to making a railway booking on a mobile phone, very affordable. That is, they perceive this application to be inexpensive, and hence the positive intentions.

An interesting deviation from the traditional results, seen with our empirical data was the insignificant effect of complexity on the use intentions. Although most studies in the literature have supported a significant relationship between the two, there are studies like - mobile banking study by Koenig-Lewis et al. (2010), online banking study by Pikkarainen et al. (2004) that have arrived at a non-significant relationship between complexity and intention, which is in line with the findings from our study. As seen from table 2, majority adopters of this mobile application were aged 18-34. This is the young, tech-savvy generation who are well acquainted with using high-end technology products. Using a simple railway booking application, clearly, has not been perceived as a challenge by these adopters, and also by the rest of our respondents. This may be thought of as a reason as to why the responses have not produced any constructive results with respect to this attribute.

Moving on to the predictor attributes, it was found that riskiness and behavioural intention significantly influenced adoption. The effect of riskiness on behavioural intention was also measured, which was found to be negatively significant. Chen (2008) states that it is important to study riskiness to account for the uncertainty in an m-payment environment; in their study they reported for its negative influence on use intentions. The same negative relationship was observed in a mobile banking services study by Koenig-Lewis et al. (2010). This indicates that the literature is in accordance with the findings of our study. Significant results for behavioural intention have also been consistent with past publications – a study on mobile virtual network by Shin in

2010 also showed a significant influence of intention on the behaviour. Time and again the publications (Taylor and Todd, 1997; Hartshorne and Ajjan, 2009) have supported for intention to be a strong significant predictor of the actual adoption, which was again concluded true in our case of mobile ticketing adoption.

5.2 Validated Conceptual Model

Figure 2 represents the validated conceptual model for this study. The influences of the shortlisted innovation attributes on the behavioural intention and the adoption of the IRCTC mobile application have been depicted in the figure. The relationship between complexity and behavioural intention has been represented using a dotted line to indicate an insignificant influence. The asterisk marks against the β values show significant effect of that particular predictor attributes on the two dependent attributes.

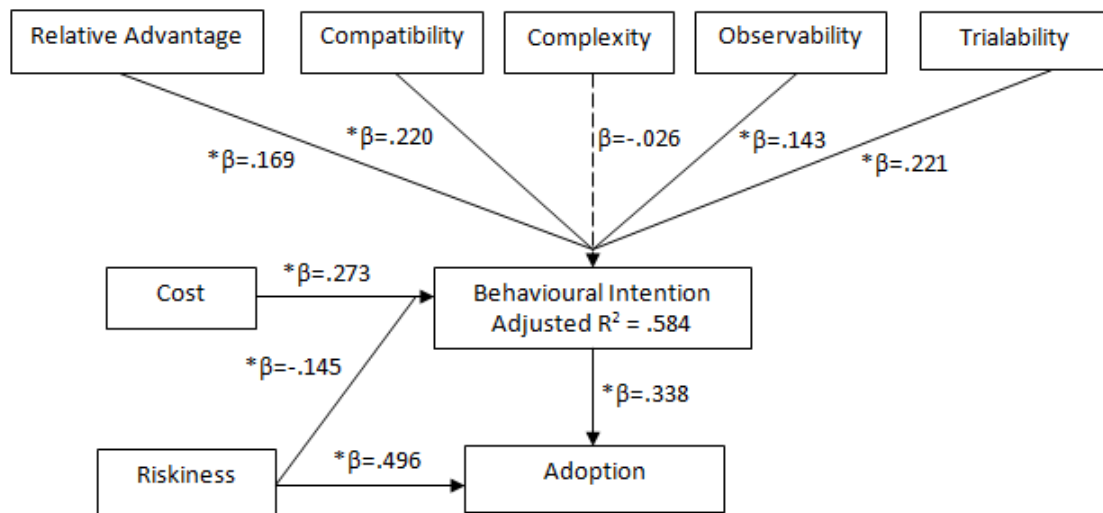


Figure 2. Validated model for the attribute influences on the intention and adoption of IRCTC mobile ticketing application

In measuring the performance, R^2 values were used as references. While behavioural intention was measured against an adjusted R^2 value from the linear regression run, adoption was measured using two values, Cox and Snell R^2 and Nagelkerke R^2 , both coming from a logistic regression run. The adjusted R^2 value for behavioural intention was 0.584 which was found to be much higher than some of the adjusted R^2 values reported by the earlier studies – for instance an adjusted R^2 value of 0.437 by Ajjan and Hartshorne (2008), 0.35 by Lin (2008), 0.14 by Gumussoy and Calisir (2009), 0.269 by Hartshorne and Ajjan (2009),. These values very clearly show that the adjusted R^2 value (0.584) for our study is good, and that our validated model well

explains the variance whilst delivering satisfactory performance. Similarly, the R^2 values for adoption were - Cox and Snell $R^2 = 0.186$ and Nagelkerke $R^2 = 0.264$. Contrastingly, the R^2 values for adoption were lower than the values reported by the publications in the existing literature – for instance, 0.479 and 0.648 by Urgan (2004), 0.419 and 0.583 by Gounaris and Koritos (2008), 0.142 and 0.550 by Ramamurthy et al. (2008), 0.51 and 0.69 by Wang et al (2010). This evidently shows that the variance for adoption is not very well explained by our validated model.

6.0 Conclusions

Our study develops and tests a mobile ticketing adoption model which significantly predicts its adoption. The theoretical background is adopted from the diffusion of innovations theory. We incorporate two additional attributes, cost and riskiness in order to develop an integrated model for predicting, both behavioural intention and adoption of mobile ticketing in an Indian context. The study confirms the established notions for the aforementioned innovation attributes in the IRCTC ticketing application context. The highlights emerging from our results affirm that consumers' intention to use the application has a direct positive influence on its adoption. Being a low risk technology also considerably favours its adoption. While being relatively advantageous in terms of its mobility, ubiquitous accessibility, cost effectiveness, compatibility and flexible usability (in terms of trialability) significantly influenced its behavioural intention, complexity, interestingly was concluded insignificant on the adoption intentions.

6.1 Research Contributions and Practical Implications

Our paper contributes to the existing literature on Rogers' innovation attributes in a whole new context - *IRCTC mobile ticketing application*. Owing to its recent presence in the Indian context, no research publications studying the adoption of this technology were found to be present. Hence, the results and conclusions from our study should succeed in providing the researchers with the first insights into the behaviour of Rogers' innovation attributes, cost and riskiness on the behavioural intention and adoption of the IRCTC mobile application. Both adoption intention and adoption have been exclusively explored in our study to arrive at broader results. It also provides the researchers with a base point from where they can consider alterations in the model used in our study for better evaluation of the IRCTC mobile

application adoption. From the practitioners' perspective, our study attempts to offer the key drivers that propagate the adoption of this ticketing application. This information can be better utilized by the practitioners to increase the consumer attraction towards this application.

Our results suggest that compatibility, trialability and cost act as the strongest predictors of use intentions, and riskiness and intention act as the strong predictors of adoption. From the practical perspective, the developers of this application should build upon the benefit of this service being usable on the run. The instances when this service has a high usage probability need to be determined and enhanced features for increased convenience of the users should be made available at very minimal or affordable prices. From the managerial perspective, the tests revealed that the relative advantage of using mobile ticketing ubiquitously helped solve contextual problems such as queuing, use of paper money, presence of personnel at a service location, and so on. Keeping in view the fact that the mobile application is presently only another alternative to physical booking and internet booking of railway tickets, attractive and compatible application feature enhancements could succeed in making this ticketing application a substitute to the other existing options, hugely increasing its adoption rate, and in return offer solutions to the aforementioned contextual issues.

Finally, our statistics in table3 revealed that out of the 185 respondents, only about 30% formed the adopter group for this application. It cannot be denied that the IRCTC ticketing application is recent and still evolving in the Indian context, and in a way competing with the already established media of railway ticket booking (over-the-counter booking, e-booking) with which the consumer population is already comfortable. For the mobile ticketing to overpower these systems, the standing challenge for IRCTC is to promote this application on wider scale, making more consumer population aware of the benefits and convenience that it has to offer in comparison to the pre-existing systems. The positives of this mobile ticketing application need to be advertised in a way that the potential users begin to perceive this application to fit easily well with their lifestyles and transaction patterns. Lastly, as the research and practice in the mobile ticketing area in the Indian context is still in its formative/early years, research opportunities in terms of this technology, its business processes and the consumer behaviours are rich, today. The conceptualization and testing of a model for user acceptance of mobile ticketing in

this paper moves forward the theory and research on this important and progressive topic.

6.2 Limitations and Future Research Directions

Our study concentrates on mobile railway ticketing, alone. The model tested in our study could be extended to similar such mobile applications in the Indian context. The modern day technologies are being made available on a mobile platform to augment these technologies on an alternate channel for the convenience of the users. Most physical technologies are now being offered as mobile technologies. Our future research aim would thus be to focus on the other recent mobile applications; for instance, the interbank mobile payment service (IMPS) - a mobile wallet initiative recently launched in India, and similar other upcoming technologies of m-commerce.

As already discussed in the paper, riskiness is made up of several different components. Gupta and Xu (2010) emphasize that different types of risks are associated to a technology. Riskiness, in our study, was studied on a very generic level. Breaking this attribute into specific components such as technology, product, security, social, financial, performance and other types of risk should allow us to attain a constructive understanding into the behaviour of this construct.

Although the current research aims studying the diffusion of the IRCTC mobile application in an Indian context, the data collection remained restricted to only four cities in India. Different cities bear cultural differences that may differently steer the diffusion of a considered innovation. Future researchers may want to concentrate on data from more number of cities to account for the effect of different cultural factors on adoption.

To add further, the data collection is still ongoing. Only half of the target response number (185) has been used in this study. Almost 145 more responses are awaited. As a part of our future research, we will be adding these remaining responses to bring up the total to 330 responses which will then be analysed and investigated, overall.

The diffusion of innovations theory being the anchor of our study saw only the Rogers' innovation attributes, alongside riskiness and cost, being utilized. However, the existence of other relevant innovation attributes cannot be ignored; for instance - voluntariness, result demonstrability, communicability, image, social approval,

visibility and so on. Noteworthy studies such as meta-analysis by Tornatzky and Klein (1985), instrument development for adoption perceptions measurement by Moore and Benbasat (1991) have identified a handful of useful innovation attributes that may remarkably serve as predictors of intention and adoption. In our future research, we therefore will invest more attention in identifying and studying these other innovation attributes.

It was found from the logistic regression run (table8) that variance for adoption was not very well explained by the model for this study. Low R^2 values for Cox and Snell and Nagelkerke were reported. For improvement in the performance of the adoption model, the future researchers may want to consider the incorporation of more adoption attributes. Lastly, it can be reiterated that IRCTC mobile ticketing application is still a recent and evolving technology in the Indian context which is bound to diffuse differently over time. Thus, to attain a more collective understanding of the adoption of this ticketing application, it needs to undergo periodical empirical investigations at different points in time.

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