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User Acceptance of New Technology in Mandatory Adoption Scenario for Food Distribution in India

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ABSTRACT

Ubiquitous utilization of information and communication technologies (ICTs) has led the governments of various countries to use ICTs in public administration and social welfare initiatives. Direct use of e-governance technology by citizens in developing countries is hindered by lack of training, education and infrastructure. This makes it inevitable to employ intermediary users who can bridge this gap between technology use and beneficiaries. Analyzing the technology adoption behavior of intermediaries could help policy makers and designers of e-governance technologies to create devices, processes and training programs that target the factors that inhibit as well as encourage the use of ICTs among technology users. We study the effect of technology characteristics and users' internal traits on technology satisfaction of intermediaries who are mandated by the government to use android tablets in order to provide efficient services to end-users in the Indian food security supply chain. We further translate the results into tangible recommendations in context of infrastructure, users' traits, business performance, and technology and policy design. The research model proposes that certain technology characteristics (screen design, technology relevance and terminology) and users' internal traits (resistance to change, technology anxiety, trust in internet and result demonstrability) influence their technology satisfaction, either directly or indirectly through UTAUT constructs. Results indicated that resistance to change, technology anxiety, trust in internet, screen design and terminology had an impact on ICT users' technology adoption behavior. Result demonstrability and technology relevance were found to have no effect on technology satisfaction in case of mandatory use.

Keywords: *Technology adoption; E-governance; Information and communication technologies; Technology characteristics; Users' internal traits; Food security.*

1 Introduction

Governments of various countries are focusing on the use of information and communication technologies (ICTs) to bridge the gap between citizens and government by implementing various e-government initiatives (Bhuiyan, 2011; Grover and Chopra, 2017). This heightened emphasis on technology implementation in public administration by governments, especially in developing countries, face a key challenge of providing access of implemented technology to general population who remain deprived of its benefits due to lack of technology literacy, limited infrastructure, and social, cultural and gender disparities (Chopra and Rajan, 2016; Weerakkody et al., 2013). Therefore, government institutions are compelled to enlist the services of intermediaries to provide technology access and minimize the gap between government and citizens (Chhabra et al., 2016). Intermediaries are often primary users of ICTs in public administration who are assigned the responsibility to provide required services to citizens (Chopra and Rajan, 2016).

Practice of employing intermediaries to provide e-government services to citizens is widely accepted and implemented in India. Key objective of most of these e-government initiatives is to alleviate poverty, optimize rural development and growth to create effective social safety nets, and to look after the social, physical and economic well-being of the country's poor (Masiero, 2014).

Public Distribution System (PDS) is the biggest poverty alleviation program run by federal government with the support of state governments of India. PDS serves an estimated 160 million beneficiary households but India still accounts for one-fourth of the 795 million undernourished in the world (Chopra et al., 2017; Grover and Chopra, 2017). Under PDS scheme, the below poverty line households are provided physical as well as economic access to food grains and essential commodities through the world's largest food distribution network of more than 535,000 Fair Price Shops (FPSs) (Chhabra et al., 2016).

Effectiveness of the PDS food supply chain has been curtailed by inefficiencies like grain leakages, diversions and black mar keting (Rajan et al., 2016). The proactive utilization of ICTs by certain states in India have led to considerable improvements in increasing transparency and empowering beneficiaries to reduce corruption. With more than 11,000 FPSs and end-to-end computerization of PDS supply chain early in 2007-08, the state of Chhattisgarh has been dynamic in introducing administrative and technological reforms (Chopra and Rajan, 2016). The state introduced centralized online real time electronic public distribution system (COREPDS) in 2012. Establishing this reform led to implementation of point of sale devices in all FPSs and food distribution was done by inserting beneficiary owned chip-enabled smartcards into these devices. Rajan et al. (2016) implicitly explained the working and intended benefits of COREPDS. FPS salespersons, who are the intermediaries between government and beneficiaries, are the users of these point of sale devices (Chhabra et al., 2016).

Substandard network strength, imperfect design and high maintenance cost led the government to replace these point of sale devices with android tablets in 2015 (Chhabra et al., 2018). Introduction of these tablets started from rural areas where installation of point of sale devices led to major issues due to substandard network (Chhabra et al., 2018). Government agencies are currently working on this technology transition in urban areas too. With the advent of new technology in 2012 and its expeditious replacement after three years, the adoption of technology has been very challenging for the intermediary users (Chhabra et al., 2018). Many FPS salespersons surveyed for the current study had a direct transition from manual food distribution system to tablet based food distribution system whereas some of them used point of sale devices prior to using tablets. Therefore, this study takes into consideration the perception of first-time users of technology in food distribution as well as users who learnt and unlearnt the point of sale device-based food distribution process and relearnt a new process of distributing food by android tablets.

Increased focus of governments on ICTs have led the researchers to examine various streams of research in technology implementation (Rota, Zanasi and Reynolds, 2014). One of the substantially focused area of information systems (IS) research is to apprehend and investigate into the driving factors that influence individuals to use any technology (Chopra and Rajan, 2016; Venkatesh et al., 2003). Although e-governance is becoming a highly-preferred practice for government institutions to connect with their constituents, yet various lingering issues remain regarding the way e-government initiatives can be adopted by their target audience. Therefore, emergence of intermediaries as facilitators of governments' transition to e-government and their adoption of ICTs being implemented warrants further investigation.

Technology adoption behavior of intermediaries is distinct from beneficiaries mainly because of their technology use purpose. Major objective of implementing e-government systems is to improve the

information and service delivery methods, thereby providing efficient services to citizens. Intermediaries are not the end beneficiaries of implemented technologies and their purpose of utilizing the implemented systems is to provide service to the end constituents of supply chain. Studies have examined the technology adoption in supply chains in which end-users are forced to adopt a new technology (Kumar and Best, 2006; Kuriyan, Toyama and Ray, 2006. We study technology adoption in a public administration supply chain in which the lead actor (government) introduced a new entity (intermediary FPS salespersons) in the supply chain to provide better services to end users and then mandated the introduced entity to adopt and utilize a new technology to conduct daily business. This distinction between the motivation to use these technologies makes the study of intermediaries' technology adoption different from those of citizens.

Technology adoption by intermediary users is influenced by various internal traits of the users as well as characteristics of the technology being implemented. Users' personal convictions and emotional response to introduced technology constitute their internal traits that effect their adoption behavior (Weerakkody et al., 2013). Personal convictions include characteristics like trust in internet and resistance to change, whereas technology anxiety is an emotional response that effects users' technology adoption (Kavanagh et.al., 2012; Weerakkody et al., 2013). Characteristics of technology comprises of system characteristics like relevance and interface characteristics like screen design and terminology (Jeong, 2011).

Purpose of this study is to investigate the effects of these internal traits and technology characteristics on intermediary users' technology adoption behavior in mandatory adoption scenario. Plethora of IS literature is available on a users' intention to adopt technology (Cho and Choi, 2019; Laumer, 2011). Adoption of technology is generally studied as intention to use technology in case of voluntary adoption. In case of mandatory technology adoption scenario, intention to use technology is not a relevant outcome variable to study and degree to which the technology user is satisfied with its implementation takes on heightened importance (Brown et al. 2002).

Various technology adoption models have been developed, modified and extended to understand user's behavior while adopting new technology (Laumer, 2011). However, the effect of users' personal believes and emotional response as well as that of characteristics of technology on "technology satisfaction in mandatory adoption scenario remains understudied." Chopra and Rajan (2016) studied the FPS salespersons' satisfaction with mandatory adoption of point of sale devices and concluded that the perceived gains or losses in salespersons' daily job performance, perceived ease of use, and social influence have a significant and positive effect on technology satisfaction. The current study attempts to extend this study by investigating into various internal and technological attributes that determine the aforementioned factors affecting technology satisfaction.

Understanding the effect of these internal and technological attributes on technology satisfaction is vital for theoretical as well as practical purposes. The results of this study will add to IS literature by proposing an extension of the Unified Theory of Acceptance and Use of Technology (UTAUT) model that studies the critical influence of both human and technological factors on users' perception of adopting new technology. Most of the existing literature examined the case of voluntary adoption of technology. We study the interaction of both individual and technology characteristics on users' degree of satisfaction with new technology in mandatory adoption setting. There are certain considerations of technology adoption that would manifest under mandated technology use setting but not volitional ones (Cho and Choi, 2019). Mandatory technology adoption setting specific considerations are discussed with their respective hypothesis in research model and hypothesis section to explicate the effect of mandatory adoption on various constructs in developing the proposed model.

Theoretical implication of this study is that it will allow IS researchers to utilize the proposed results to understand the factors affecting technology adoption behavior of the users who have no option but to use the provided technology. In practice, policy makers and government agencies will be able to utilize the findings of this study to better analyze the technology acceptance by the users which in turn can be used as a blueprint to develop more appropriate technologies leading to easier adoption by users and ultimately to providing better services to beneficiaries. Furthermore, the findings of this research will help prepare the technology users for the mandated e-government ICTs by getting a better understanding of their personal traits. In context of food security in India, the results of this study could serve as a guide for other states of the country to implement the technological interventions in their food supply chains.

The remainder of the paper is structured as follows. Next section discusses the research model with hypotheses regarding the effect of users' internal traits and technology characteristics. In this section, we

also review literature related to each characteristic being considered for this study. The third section contains a discussion of instrument development, research location selection, sample selection, data collection and data analysis. The fourth section describes the results of model validity and reliability as well as the results of hypotheses testing. The fifth section provides a detailed insight into the significance of these findings and compares it in light of literature. We conclude the paper by providing a synthesis of key points and recommending new areas for future research.

2 Research Model and Hypotheses

The research model for this study is a synthesis of two models. First model is the UTAUT model that was constructed to help the managers understand the factors that drive the acceptance of new technology by users (Venkatesh et al., 2003). One of the purposes of proposing the model was to proactively design technologies for successful adoption by the users who might not otherwise be inclined towards using it (Venkatesh et al., 2003). The second model was constructed to explore the influence of resistance to change on the adoption of digital libraries (Nov and Ye, 2009). In addition, Nov and Ye (2009) studied the effect of personal differences and system characteristics on intention to adopt digital libraries. The results of this study showed the effect of personal differences and system characteristics on intention to adopt technology in voluntary adoption scenario in a developed nation. The current study adds to the ICT literature by studying the effect of these characteristics in mandatory adoption scenario in a developing nation. Also, the results will also help in getting an insight into the effect of personal traits of a low literate group on their level of technology satisfaction. Figure 1 depicts the proposed research model.

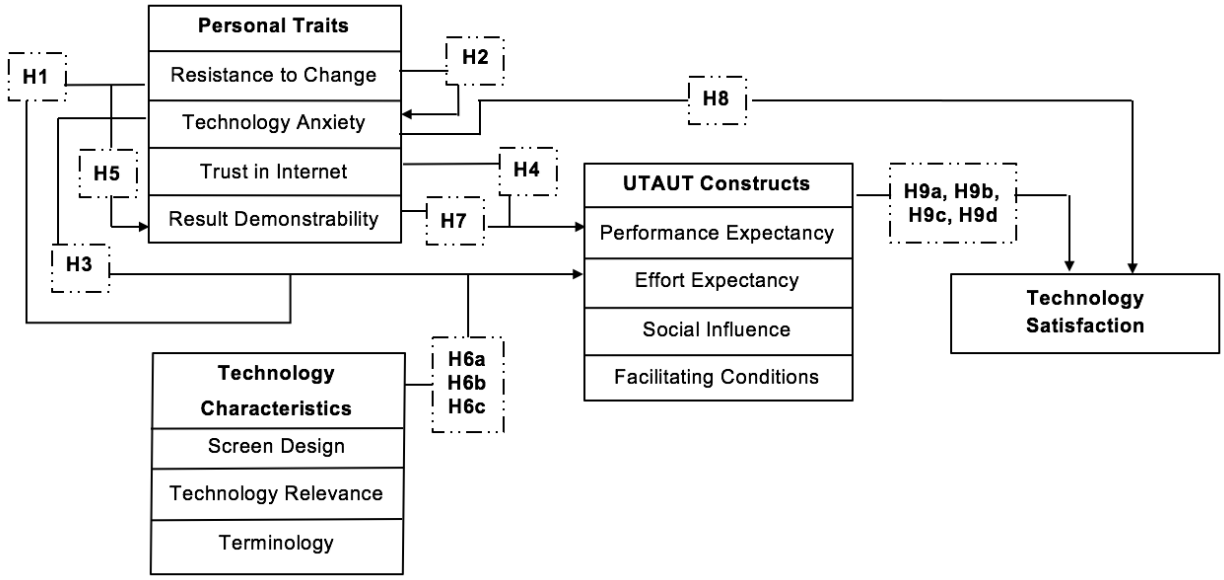

Figure 1. Research Model

Implementation of ICT initiatives lead to various changes in processes as well as users' attitudes and knowledge requirements (Cho and Choi, 2019). Users' attitude towards technological changes affect the degree to which they believe that technology is easy to use. Venkatesh et al. (2003) defined effort expectancy (EE) as the degree to which users perceive that technology is easy to use. We measured effort expectancy as FPS salespersons' perception of effort required to learn the use of android tablets and perceived ease in carrying out their daily work using tablets. Resistance to change (RTCD) is individuals' predisposition to resist change that effects their reaction to the implemented technological system (Sargent et al., 2012). In voluntary adoption case, users are not bound to use the implemented technology leading to reduced change resistance compared to mandatory adoption case in which users are required to carry out tasks at hand by utilizing the implemented technology. Nov and Ye (2009) established that users with higher resistance to change have a lower degree of ease associated with the use of new technology. Since the users who resist change have a perception that any change from the existing process will increase the effort employed in their work, therefore it is difficult for them to overcome their inclination against the change.

We expect that FPS salespersons having higher resistance to change are likely to have a higher perceived degree of effort required to learn and use the tablets and hence have a lower effort expectancy.

H1: *Resistance to change will negatively influence intermediary users' effort expectancy.*

Technology anxiety (ANX) is users' emotional response that is an outcome of the fear that they experience while using a new technology (Callum et al., 2014). It results either from the fear of making an error or from the fear of damaging the equipment (Thatcher and Perrewe, 2002). We measured technology anxiety as the salespersons fear of making an error while carrying out transactions, damaging the tablets or the fear of data loss from the android tablets. Nov and Ye (2009) found that users who have higher resistance to change also have higher apprehension when faced with the possibility of using computers. Anxiety, a negative emotional response, is a major aspect of understanding resistance to change (Nov and Ye, 2009). Therefore, we hypothesize that salespersons who resist change may have higher anxiety.

H2: *Resistance to change will positively influence intermediary users' technology anxiety.*

Callum et al. (201s4) explored the impact of ICT anxiety on the adoption of mobile learning and found that technology anxiety has a strong negative impact on perceived ease of use which makes adoption of technology harder for users. Similarly, Nov and Ye (2009) also established that users with higher technology anxiety tend to perceive a new technology to be difficult to use. These previous studies show that users with a higher fear of making an error or damaging the equipment are less likely to believe that the technology is easy to use and it will reduce their effort to perform their daily tasks. Therefore, we hypothesize that:

H3: *Technology anxiety will negatively influence intermediary users' effort expectancy.*

Performance expectancy (PE) is defined as the degree to which an individual believes that using technology will help him/her in improvement of job performance (Venkatesh et al., 2003). For this study, performance expectancy is referred to as salespersons' perception of improved productivity through time saving, better stock monitoring and reduced transaction errors after the implementation of tablets. Trust is defined as users' perception of confidence to rely on an agent, in this case internet, to act in a manner that is best suitable for them, regardless of their ability to control that agent (Chaouali et al., 2016). In case of mandatory technology adoption, users' opposition to introduced technology is inversely proportional to their trust level (Chan et al., 2010). If users are mandated to carry out transactions in a manner that requires them to upload information online then their low trust in internet use is likely to lead to poor performance. Kurfali et al., (2017) studied the adoption of e-government services in Turkey and investigated the effect of trust in internet (TI) on performance expectancy. Results suggested a positive relationship between the two variables (Kurfali et al., 2017). Similar result was found while studying the effect of motivation, social influence and trust in customers' intention to adopt internet banking (Chaouali et al., 2016). Based on these results, we hypothesize that:

H4: *Trust in internet will positively influence intermediary users' performance expectancy.*

TAM2 consists of result demonstrability (RSD) as one of the system characteristics that effect technology adoption (Nov and Ye, 2009; Venkatesh and Davis, 2000). Result demonstrability is defined as the "tangibility of the outcomes of using new technology" (Venkatesh and Davis, 2000). It is the degree to which users perceive that they can comprehend and communicate the advantages, disadvantages and results of using a technology (Karahanna et al., 1999). Acquiring information and knowledge from peers is one of the most common forms of information transfer in India. Therefore, it is important for salespersons to be able to understand and explain the results of using tablets so that they can pass on this knowledge to other salespersons as well as provide satisfactory responses to beneficiaries who are curious about the use of tablets. Nov and Ye (2009) found that the users of digital library who had higher resistance to change had lower result demonstrability. Therefore, we hypothesize that:

H5: *Resistance to change will negatively influence intermediary users' result demonstrability.*

Interaction between the users and the system comprises of interface characteristics (Jeong, 2011). The interface of technology defines the interaction between users and technology, thus effecting the ease by which users can use the device. Chhabra et al. (2018) found that size of device and its screen was one of the challenges reported by FPS salespersons in adopting the point of sale devices. Similarly, terminology (TERM) used in the device is another interface characteristic that effect users' ability to comprehend the instructions and steps that they need to follow to carry out any transaction (Jeong, 2011). Previous studies have shown that better screen design (SCDE) and terminology clarity leads to higher degree of effort expectancy among users (Jeong, 2011; Nov and Ye, 2009). Besides interface characteristics, another

component of technology attribute is the system characteristics. Focus of this component is on the interaction between the system and its organizational context (Jeong, 2011). Relevance (RELE) of technology is a vital system attribute that indicates its potential to smoothly integrate into users' job duties (Jeong, 2011). Introduced technology must be relevant to perform the tasks for which it is meant for. Degree to which intermediary users perceive that the resources available in tablets are related to their work and are sufficient to perform their daily job duties were considered as the measure of technology relevance. Previous studies have shown that a more relevant technology leads to higher effort expectancy among the users (Jeong, 2011; Nov and Ye, 2009). Therefore, we hypothesize that:

H6a: *Screen design will positively influence intermediary users' effort expectancy.*

H6b: *Technology relevance will positively influence intermediary users' effort expectancy.*

H6c: *Terminology will positively influence intermediary users' effort expectancy.*

Venkatesh and Davis (2000) established a positive relationship between result demonstrability and performance expectancy. Similar results were observed while studying the adoption of digital libraries (Nov and Ye, 2009). Therefore, we expect that salespersons who can easily demonstrate the results of using tablets are more likely to have a higher degree of perceived increase in job performance. It becomes vital to study this relationship in mandatory adoption scenario. Various users are forced to use the implemented systems leading to an increased resistance to effectively comprehend and communicate the result of using them, which could lead to a weaker relationship between the two constructs as compared to voluntary adoption case of technology use.

H7: *Result demonstrability will positively influence intermediary users' performance expectancy.*

In voluntary adoption scenario, trust in internet has been tested to have a positive effect on users' intention to use technology (Boateng et al., 2016). We expect to obtain a similar relationship in mandatory adoption case of tablet implementation in the PDS of Chhattisgarh. Therefore, we hypothesize that intermediary users with higher trust in internet will have a higher satisfaction with the use of android tablets to distribute food.

H8: *Trust in internet will positively influence intermediary users' technology satisfaction (SAT).*

Relationship between effort expectancy, performance expectancy, social influence (SI) and facilitating condition (FC) has been studied by various researchers in the past (Chopra and Rajan, 2016; Venkatesh et al., 2003). In case of mandatory implementation and use, performance expectancy and effort expectancy help to create positive attitude towards technology use by performance improvement and effort reduction in using the implemented technology (Chan et al., 2010). We hypothesize that effort expectancy will positively influence technology satisfaction because users who find the technology easy to use are likely to be more satisfied using technology. Similarly, we hypothesize that performance expectancy will have a positive effect on technology satisfaction because users who believe that technology will lead to improvement in their daily job performance are likely to be more satisfied with technology. We also expect social influence to have a positive effect on users' technology satisfaction because users who perceive that important persons in their social circle believe that they should use the implemented technology are more likely to be satisfied with using it. This relationship is expected to be stronger in mandatory technology adoption scenario because of users' tendency to get influenced by the orders of higher authority, which in this case is state government (Chan et al., 2010). We further hypothesize that facilitating conditions will have a positive influence on ICT users' technology satisfaction because users who believe that adequate infrastructure and support exists for using technology as well as resolving any technical issues area more likely to be satisfied with using the implemented technology. Extent of access to facilitating resources received by users of mandated technology varies across the state leading to a stronger relationship between facilitating conditions and technology satisfaction in mandatory adoption scenario.

H9a: *Effort expectancy will positively influence intermediary users' technology satisfaction.*

H9b: *Performance expectancy will positively influence intermediary users' technology satisfaction.*

H9c: *Social influence will positively influence intermediary users' technology satisfaction.*

H9d: *Facilitating conditions will positively influence intermediary users' technology satisfaction*.

3 Research Methodology

3.1 Instrument Development.

To validate the proposed model, a questionnaire-based survey was conducted among those FPS salespersons in Chhattisgarh who were mandated to use android tablets for distributing commodities. The questionnaire was constructed in Hindi language to make it easier for the respondents to comprehend and respond. It consisted of 93 questions grouped into five categories: participant information, experience with android tablets, comparison between android tablets and point of sale devices, perception of portability and perception of cash transfer. Introduced along with COREPDS, portability allowed beneficiaries to buy entitlements from any FPS rather than from one particular FPS to which they were linked. Cash transfer is a scheme in trial phase under which the state government is planning to transfer subsidies to buy entitlements directly to the beneficiaries' bank accounts. Data collected from "experience with android tablets" category of the questionnaire was utilized to study the effect of users' internal traits and technology characteristics on the adoption of android tablets. The construct measures were obtained from already validated technology adoption questionnaire items and are exhibited in Appendix A (Chopra and Rajan, 2016; Nov and Ye, 2009; Weerakkody et al., 2013). Data associated to these construct measures was collected on a seven-point Likert scale ranging from highly dissatisfied (-3) to highly satisfied (3).

Content validity is an essential measure to draw conclusions about the quality of a newly developed questionnaire (Polit and Beck, 2006). It is the degree to which a data collection instrument has adequate sample of construct measures to define the constructs under study (Polit and Beck, 2006). Content validity of this questionnaire was evaluated by its subjective assessment conducted by (i) three fair shop salespersons using android tablets for daily transactions, (ii) two engineers who were directly working on the implementation of android tablets in Chhattisgarh, and (iii) a senior scientist managing the android tablet implementation at state level. These individuals were chosen because of their direct involvement with the project since its beginning and could comprehend and describe the degree to which the data collection instrument defined the constructs.

3.2 Research Locations

Data was collected from 176 FPS salespersons from Raipur, Mahasamund and Dhamtari districts of the state of Chhattisgarh. Raipur was selected for data collection because it is the capital of the state and all major government offices are based there. Furthermore, it is one of the most populous districts of the state and tablets were first introduced at this location. Therefore, most of the data was collected from Raipur. As mentioned earlier, this study adds to the research conducted by Chopra and Rajan (2016) to investigate the FPS salespersons' satisfaction with mandatory adoption of point of sale devices. Hence, Raipur and Mahasamund were chosen to extend and compare the data collected from these districts in December 2013 regarding adoption of point of sale devices with the data collected to study the adoption of android tablets. Chopra and Rajan (2016) chose Mahasamund for data collection because that district had the first rural location point of sale use. Dhamtari was chosen because of two reasons. Firstly, biometric authentication of beneficiaries was implemented in Dhamtari and therefore information related to salespersons' experience and challenges with using fingerprint authentication was collected from this area. Secondly, the cash transfer scheme was tested in some of the FPSs in this region and therefore salespersons' response to this scheme was also explored.

3.3 Sampling and data collection.

Salespersons using android tablets for distributing essential commodities were selected to participate in the survey. Every district had an assistant programmer responsible for solving any technical problem related to android tablets or point of sale devices faced by FPS salespersons. List of FPSs where android tablets were employed was available with assistant programmers and based on that list, salespersons from various villages of respective districts were contacted to participate in the survey. The potential participants were given a consent form to inform them about the purpose of the study and take their consent to participate in the survey. They were also informed that their identity would be kept anonymous during every phase of the research and participating in the survey would not lead to any loss to them or their business.

Questionnaires were provided to FPS salespersons who were comfortable in completing the survey by themselves. With other participants, interviews lasting approximately an hour were conducted wherein

the author read out the questions to participants and marked their responses to every questionnaire item. Out of approximately 205 salespersons contacted, usable responses were available from 176 FPSs. Table 1 shows the sample descriptive statistics of salespersons from 176 FPSs whose responses were usable for this study.

Table 1.
Sample Descriptive Statistics.

Variable	Range	Number	Percentage
Age	20 – 29	47	26.70
	30– 39	70	39.77
	40 – 49	38	21.59
	50 – 59	18	10.23
	60 and above	2	1.14
	Missing values	1	0.57
Education Level	Primary (Upto 5th)	3	1.70
	Secondary (Upto 8th)	8	4.55
	Senior Secondary (Upto 10th)	27	15.34
	Higher Secondary (Upto 12th)	73	41.48
	College or higher	62	35.23
	Missing values	3	1.70
Gender	Female	8	4.55
	Male	168	95.45
Experience with FPSs (Years)	0 – 4	61	34.66
	5 – 9	52	29.55
	10 – 14	28	15.91
	15 – 19	10	5.68
	20– 24	14	7.95
	24 or more	9	5.11
	Missing value	2	1.14
Experience with tablets (Months)	0 – 9	116	65.91
	10– 19	50	28.41
	20 – 29	6	3.41
	30 or more	4	2.27
Experience with cellphones (Years)	0	9	5.11
	1 – 4	30	17.04
	5 – 9	78	44.32
	10 – 14	50	28.41
	15 -19	7	3.98
	Missing values	2	1.14

3.4 Data Analysis.

The collected data was analyzed using partial least squares structural equation modeling (PLS-SEM) methodology implemented in SmartPLS (Ringle et al., 2015). SEM is a multivariate statistical analysis tool that helps to understand and incorporate variables which are indirectly measured by indicator variables (Hair et al., 2017). PLS-SEM is used for prediction and explanation of target constructs when the theory is in developing stage (Hair et al., 2017). Complex models can be studied using PLS-SEM technique without putting substantial restrictions on sample size, data distribution, missing values and number of items in each construct (Chopra and Rajan, 2016; Hair et al., 2017).

First step to analyze the data was to evaluate the measurement model for internal consistency reliability, convergent validity and discriminant validity. Internal consistency of a model is an indicator of the ability of items measuring the same construct to produce consistent scores (Tang et al., 2014). Composite reliability is an appropriate measure of internal consistency reliability (Hair et al., 2017). Indicator variables with composite reliability values above 0.7 are acceptable measure of the construct (Hair et al., 2017). Convergent validity is the degree to which two measure of the same construct correlate positively

with each other (Hair et al., 2017). Convergent validity of a model is evaluated by measuring the outer loadings of indicator variables and the average variance extracted (AVE). Measures of a construct with outer loadings of more than 0.7 and AVE of more than 0.5 are correlated (Hair et al., 2017). Discriminant validity is the degree to which a construct is different from another and therefore represents the uniqueness of constructs (Hair et al., 2017). Cross loadings and the Fornell-Larcker criterion are the two measures to assess discriminant validity. The cross-loading measure necessitates that outer loading of a construct should be greater than any of its cross loadings. Fornell-Larcker criterion requires the square root of AVE of each construct to be greater than the off-diagonal correlation with any of the constructs (Chopra and Rajan, 2016; Fornell and Larcker, 1981; Hair et al., 2017).

After analyzing measurement models, the subsequent step was to evaluate the structural model results. This assessment helps to understand the model's power to predict target constructs (Hair et al., 2017). Coefficient of determination (R^2) was used to evaluate the structural model. Lastly, the hypothesis testing to examine the statistical significance of various path coefficients was conducted by running a bootstrap procedure with 500 samples (Chopra and Rajan, 2016).

4 Results

The results section is divided into two subsections. In the first section, we examine validity and reliability of the proposed model and in second section, we discuss the results of hypotheses testing.

4.1 Model Reliability and Validity.

Figure 2 exhibits that the composite reliability of all constructs was above the threshold level of 0.7. This shows that all constructs have high internal consistency reliability levels. AVE values were more than 0.5 (Figure 3) and outer loadings of all constructs were above 0.7 (Table 2). These results show that all the constructs had high level of convergent validity. Also, the outer loadings of all the constructs were greater than cross loadings. Furthermore, table 3 exhibits that the condition of Fornell-Larcker criterion is also satisfied, thereby providing adequate support to establish discriminant validity.

Abovementioned results provide adequate evidence to establish the model's internal consistency reliability, convergent validity and discriminant validity. Also, the R^2 value of 0.563 indicates that 56.3% of variance in technology satisfaction is explained by all the exogenous constructs linked to it (Hair et al., 2017).

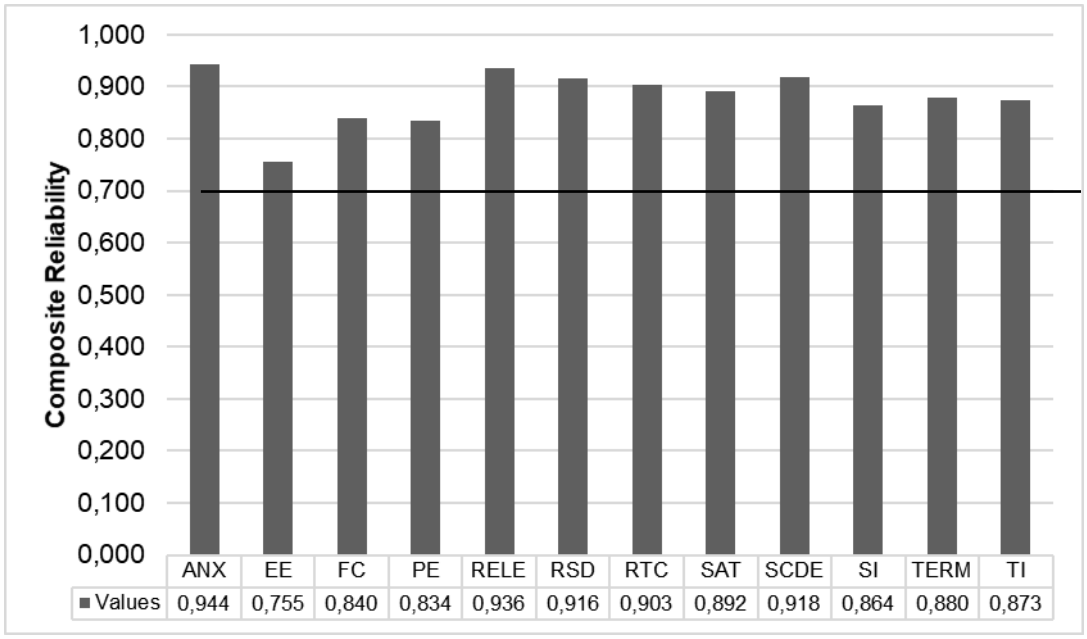

Figure 2. Composite Reliability

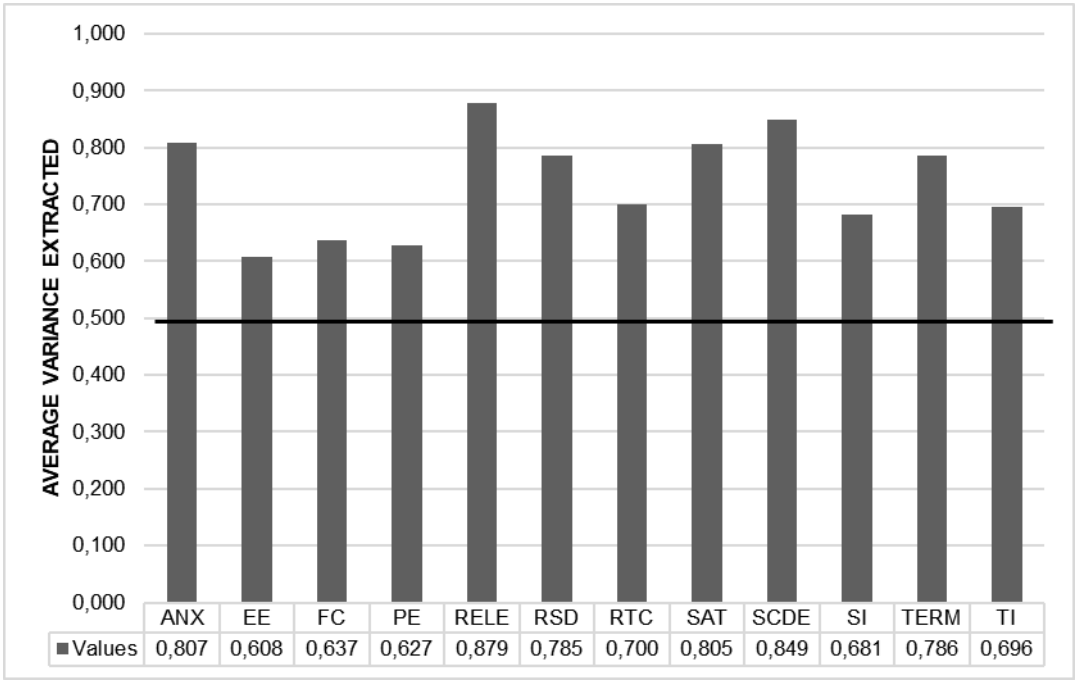

Figure 3. Average Variance Extracted

Table 2.
Outer Loadings

	ANX	EE	FC	PE	RELE	RSD	RTC	SAT	SCDE	SI	TERM	TI
ANX1	**0.833**											
ANX2	**0.885**											
ANX3	**0.943**											
ANX4	**0.930**											
EE4		**0.832**										
EE6		**0.724**										
FC1			**0.727**									
FC2			**0.820**									
FC4			**0.843**									
PE1				**0.862**								
PE3				**0.804**								
PE4				**0.701**								
RELE1					**0.956**							
RELE2					**0.919**							
RSD1						**0.862**						
RSD2						**0.895**						
RSD3						**0.900**						
RTCD1							**0.817**					
RTCD2							**0.777**					
RTCD3							**0.854**					
RTCD4							**0.895**					
SAT1								**0.914**				
SAT2								**0.881**				
SCDE1									**0.952**			
SCDE2									**0.890**			
SI1										**0.737**		
SI2										**0.881**		
SI3										**0.851**		
TERM1											**0.898**	
TERM2											**0.875**	
TI1												**0.859**
TI2												**0.803**
TI3												**0.840**

Table 3.
Fornell-Larcker Criterion

	ANX	EE	FC	PE	RELE	RSD	RTC	SAT	SCDE	SI	TERM	TI
ANX	**0.899**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EE	-0.188	**0.780**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FC	-0.022	0.302	**0.798**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PE	-0.147	0.390	0.272	**0.792**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RELE	-0.195	0.129	0.110	-0.051	**0.938**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
RSD	-0.441	0.212	0.181	0.136	0.359	**0.886**	0.000	0.000	0.000	0.000	0.000	0.000
RTC	0.279	-0.294	-0.052	-0.041	-0.163	-0.285	**0.837**	0.000	0.000	0.000	0.000	0.000
SAT	-0.276	0.473	0.242	0.513	0.279	0.195	-0.329	**0.897**	0.000	0.000	0.000	0.000
SCDE	-0.173	0.347	0.271	0.118	0.345	0.374	-0.226	0.240	**0.922**	0.000	0.000	0.000
SI	-0.004	0.210	0.269	0.424	0.100	-0.155	-0.032	0.486	-0.083	**0.825**	0.000	0.000
TERM	-0.218	0.282	-0.037	0.102	0.480	0.282	-0.295	0.161	0.353	-0.014	**0.886**	0.000
TI	-0.424	0.208	0.117	0.327	0.380	0.226	-0.271	0.597	0.234	0.383	0.352	**0.834**

4.2 Hypotheses Testing.

Table 4 shows the statistical significance of path coefficients.

Table 4.
Hypothesis Testing

HYPOTHESIS	HYPOTHESIZED RELATIONSHIP	PATH COEFFICIENT (β)	T STATISTIC	P-VALUE
H1	RTC -> EE (Negative)	-0.180	2.562	0.011
H2	RTC -> ANX (Positive)	0.279	3.255	0.001
H3	ANX -> EE (Negative)	-0.073	0.988	0.324
H4	TI -> PE (Positive)	0.312	4.443	1.094×10^{-5}
H5	RTC -> RSD (Negative)	-0.285	3.678	2.602×10^{-4}
H6a	SCDE -> EE (Positive)	0.266	3.000	0.003
H6b	RELE -> EE (Positive)	-0.082	0.980	0.328
H6c	TERM -> EE (Positive)	0.158	2.255	0.025
H7	RSD -> PE (Positive)	0.066	0.958	0.338
H8	TI -> SAT (Positive)	0.404	6.550	1.436×10^{-10}
H9a	EE -> SAT (Positive)	0.271	4.814	1.967×10^{-6}
H9b	PE -> SAT (Positive)	0.192	3.088	0.002
H9c	SI -> SAT (Positive)	0.191	3.070	0.002
H9d	FC -> SAT (Positive)	0.009	0.182	0.855

We considered 5% significance level for the analysis. As hypothesized, resistance to change was negatively related to effort expectancy (β=-0.180, p=0.011) and positively related to technology anxiety (β= 0.279, p=0.001); trust in internet was positively related to performance expectancy (β=0.312, $p=1.094 \times 10^{-5}$); resistance to change was negatively related to result demonstrability (β=-0.285, $p=2.602 \times 10^{-4}$); screen design was positively related to effort expectancy (β=0.266, p=0.003); terminology was positively related to effort expectancy (β=0.158, p=0.025); trust in internet was positively related to technology satisfaction (β=0.404, $p=1.436 \times 10^{-10}$); and effort expectancy (β=0.271, $p=1.967 \times 10^{-6}$), performance expectancy (β=0.192, p=0.002) and social influence (β=0.191, p=0.002) were positively related to technology satisfaction. Therefore, hypotheses H1, H2, H4, H5, H6a, H6c, H8, H9a, H9b and H9c were supported. However, the data did not support hypotheses H3, H6b, H7 and H9d related to the effect

of technology anxiety and relevance on effort expectancy, result demonstrability on performance expectancy and facilitating conditions on technology satisfaction.

5 Discussion

Results demonstrated the influence of various aspects of technology characteristics and intermediary users' internal traits on adoption of android tablets in the public distribution system of Chhattisgarh, India. Consistent with past findings (Nov and Ye, 2009), the results established that users who resist change believed that introduction of android tablets increased the effort employed in their daily work. It can be inferred that if users who inherently resist change are mandated to use new technology, their perceived effort to perform their daily tasks increases.

Relationship between resistance to change and technology anxiety was also consistent with literature (Nov and Ye, 2009). Users who tend to resist change had higher apprehensions when mandated to use newly introduced android tablets. These users had the fear of making an error and damaging tablets while carrying out transactions. Higher technology anxiety among users who resist change is their state of mind that specifically effects their desire to use technology (Meuter et al., 2003). This suggests that the fear of making errors while using a new technology or damaging the device being used is a resultant of degree to which users' resist change and this anxiety is one of the reasons of their unwillingness to update to a new daily job performing technique.

The results also suggested that users' resistance to change was found to have a negative impact on result demonstrability. Users who resisted change had a higher tendency to encounter difficulty in understanding and explaining the results of using a technology. This result supports the findings of the literature (Nov and Ye, 2009). High result demonstrability is of vital importance in case of public administration, especially in rural areas of India where peer to peer information transfer is a common phenomenon.

Results related to users' resistance to change demonstrated that there appears to be a gap between the expectations of users who tend to resist change and the technologies being implemented. Adding resistance to change to a model that studies the effect of system and personal characteristics on technology adoption behavior of users enhance the interpretive capability of the model (Nov et al., 2009). Therefore, designers of ICTs and government agencies responsible for their implementation should try to reduce this gap. This can be done by designing and implementing new systems that retain as many characteristics of older systems as possible to make sure that users are able to relate the new technology with its previous version (Nov and Ye, 2009). For instance, in the PDS of Chhattisgarh, this can be realized by designing COREPDS application in a manner that the user interface depicts the computerized version of POS devices so that the design of new technology is not perceived to manifest a major change. Furthermore, the in-built training module in COREPDS application could include a detailed comparison with POS features. Training provided by government agencies to technology users should contain information on comparison between existing and new systems and point out the major similarities between the two to make sure that prospective users are aware of the effect of technology implementation on their expected change in effort to execute their daily duties. Utilization of Lewin's change model with an emphasis on the unfreezing phase could be another approach to reduce resistance to change (Lewin, 1947). Unfreezing does not simply mean breaking the status quo by terminating existing processes and technologies, but also deals with readiness for change by overcoming certain constrains including resistance to change (Bakari, Hunjra and Niazi, 2017).

Result depicts that technology anxiety does not affect effort expectancy. The fear experienced by users while using a new technology had no effect on their perception of ease of using it. This contradicts the findings of literature which suggests that technology anxiety negatively influences intermediary users' effort expectancy (Callum et al., 2014; Nov and Ye, 2009). This could be because of the mandatory nature of technology implementation in public administration. This suggests that users who are bound to use a technology to carry out their quotidian tasks have a perception of the effect of using the system on the change in degree of effort employed which does not depend on their level of technology anxiety. Results also established that users' ability to demonstrate the benefits and results of using a technology does not affect their perceived degree of change in job performance if they are mandated to use any technology. Although result demonstrability does not seem to have any direct or indirect influence on technology adoption behavior of users but it is still an important personality trait to be studied. Result demonstrability do not show any significant interaction with performance expectancy but users need to be able to demonstrate the advantages, disadvantages and results to beneficiaries for the new system to

be successful. Beneficiaries' communication is comparatively high with FPS salespersons than government representatives. Therefore, salespersons are the best resources to communicate the effects of employing new technology to end users.

As hypothesized, trust in internet had a positive and significant influence on performance expectancy. This indicates that users with higher trust in internet believed that using android tablets to receive and distribute food commodities improved their performance. Trust in technology plays a vital role in comprehending the technology adoption behavior of users (Casey and Wilson-Evered, 2012). With the use of android tablets, all data gets recorded on a central server and real-time information of all online transactions is uploaded and made visible at the PDS website of the state of Chhattisgarh. Trust in internet infrastructure is important to assure that salespersons believe that transaction data is securely being stored and used for their benefit. Government agencies need to make sure that users are aware of system transparency and their trust in secure data management using internet would lead to an increased performance of supply chain stakeholders. This could be achieved by creating awareness campaigns to educate ICT users on benefits of internet-based data management to improve their confidence on mandated technology. Similar to voluntary adoption scenario, trust in internet also had a significant positive impact on technology satisfaction of salespersons. Users tend to be more satisfied with using tablets for carrying out transactions if they have higher trust in internet. This makes it essential for the government agencies to have a reliable network and internet infrastructure to create better trust of internet among users of web-based technology. This could be accomplished by linking PDS to the "Digital India" initiative that focuses on strengthening internet connectivity, advancing network infrastructure, and electronic delivery of services (Verma, Rathore and Kumari, 2018).

Screen design, relevance of technology and terminology were the three system characteristics that were studied. Effort expectancy was positively and significantly influenced by screen design and terminology. Survey of salespersons using POS devices in Chhattisgarh's food supply chain revealed that various salespersons were dissatisfied with those devices due to small screen size and difficult to comprehend terminology (Chhabra et al., 2018). Implementing android tablets reduced the percentage of salespersons having small machine and screen size as a major challenge in adopting technology from 14.7% to 0%. This data demonstrates the importance of a user-friendly device interface to perform daily operations. Therefore, proper technology selection is a necessity to implement a new technology and its successful adoption by users. Contrary to findings of the literature (Jeong, 2011; Nov and Ye, 2009), relevance of technology did not affect the effort expectancy in mandatory adoption environment because users have no option but to use the provided technology without considering the degree to which it is relevant to perform tasks at hand. Technology developers can play a vital role by developing software with nomenclature analogous to existing technologies, POS devices in case of Chhattisgarh's PDS. Government agencies and decision makers must select ergonomic devices taking into account users' comfort and workplace efficiency.

Effort expectancy, performance expectancy and social influence had a significant positive influence on technology satisfaction. Therefore, ease of use and performance improvement need to be taken into account while designing and implementing a new ICT for public administration. Most of the new technology implementation related training material focuses on the working of system and its maintenance. In addition, trainings provided to users must contain a segment elucidating the way using new system would lead to an efficient work process. Tracking business performance prior to and following the implementation of new technology and informing the owners of developments in their daily activities so that their perception of performance improvement enhances leading to higher technology satisfaction and easier adoption. Furthermore, perception of peers, family and close friends also have an impact on users' satisfaction with using a newly implemented technology. This means that users care about the opinion of their social circle while formulating their view about a newly implemented system.

Facilitating conditions had no significant influence on technology satisfaction. These results coincide with the findings of Chopra and Rajan (2016) who studied the technology adoption of point of sale devices in mandatory adoption scenario. Chopra & Rajan (2016) proposed to adopt a buddy system to use salespersons with experience with implemented technology as mentors for new salespersons. The current study also emphasizes on implementing such an approach to harness the effect of social influence on technology adoption.

6 Conclusion, Limitations and Future Research

Analysis to study the effect of internal traits and technology characteristics suggests that both determinants play a vital role in users' technology adoption behavior. The study identifies resistance to change, technology anxiety and trust in internet as users' internal traits that directly or indirectly effect their adoption behavior. Result demonstrability does not influence technology satisfaction of users but it is an important factor to convey technology related information to beneficiaries. Proper screen design and terminology were the two technology characteristics that influenced users' technology adoption behavior.

Understanding the results of proposed model is beneficial for technology designers, policy makers as well as technology users. Analyzing technology adoption behavior using this model would help the designers to create a system that contains optimum characteristics that fit both technology and users' internal traits. These results can be used by government agencies and policy makers to develop ICT related policies. Policy makers could create an implementation and training program in a manner that all the characteristics having a direct or indirect influence on technology adoption behavior are assessed before the technology is employed. Developing and implementing technologies by taking into consideration the factors studied in the current research would lead to better technology adoption by users, hence increasing their degree of technology satisfaction. Beneficiaries of the PDS are mostly the below poverty line households with minimal experience with using technology. Therefore, highly satisfied salespersons would be able to convey the benefits of technology to these end users.

Data was collected from 176 FPSs mostly from the rural areas because implementation of tablets was still in progress in urban areas. Studying the effect of behavioral characteristics of salespersons in urban areas will provide detailed information on technology implementation requirements in these regions. A comparison between technology adoption behavior in rural and urban areas will equip policy makers to take decisions on implementing a common or separate system for the two. Also, the study does not take into consideration the moderating effects of demographic factors like age, education level, gender and experience with technology. Studying these factors will help in employing correct salespersons to utilize the technology and distribute food to beneficiaries. In addition, inclusion of questions related to effects of new technology implementation on FPS business and change in beneficiary experience will give an insight on the success of new system in rooting out non-performing shops. This will further help in studying the attributes of a model FPS. Future work on extending the results of this study would help in implementing appropriate technologies to be used by various state governments in India.

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Appendix A

Construct Item Measures

Constructs	Construct Codes	Items
Resistance to Change (Nov and Ye 2009)	RTCD1	I generally prefer to use a technology that I am familiar with, rather than starting to use a new technology.
	RTCD2	I find it exciting to try new technology like tablets, smartphones or computers.
	RTCD3	I often feel uncomfortable to try new technology (tablets, smartphones or computers), even though it may be beneficial for me.
	RTCD4	Once I start using certain technology (tablet, smartphone or computer), I am not likely to switch to another.
Technology Anxiety (Nov and Ye 2009)	ANX1	I feel apprehensive about using android tablets.
	ANX2	I feel scared that I can lose all information by pressing the wrong key.
	ANX3	I hesitate to use tablets for the fear of making mistakes that I cannot correct.
	ANX4	The system is somewhat intimidating to me.
Trust in Internet (Weerakkody et al. 2013)	TI1	I feel assured that legal and technological structures adequately protect me from problems on internet.
	TI2	I feel secure while sending information across the internet using android tablets.
	TI3	In general, internet and android tablets are safe and sufficient instruments for essential commodities' distribution.
Result Demonstrability (Nov and Ye 2009)	RSD1	I have difficulty explaining why using the android system may or may not be beneficial.
	RSD2	I could communicate the pros and cons of android system to others.
	RSD3	I have no difficulty telling others about the results of using android system.
Screen Design (Nov and Ye 2009)	SCDE1	Buttons and symbols are well depicted on android tablets.
	SCDE2	Layout of tablet screen is clear.
Technology Relevance (Nov and Ye 2009)	RELE1	Resources available in android tablets are related to my work.
	RELE2	Resources available in android tablets are sufficient for my requirements.
Terminology (Nov and Ye 2009)	TERM1	I understand the meaning of most of the terms used throughout the android system.
	TERM2	Terms used in android system are clear.
Performance Expectancy **(Chopra and Rajan 2016)**	PE1	Android tablet saves me time for finishing my task.
	PE2	Use of android tablet has improved my work efficiency.
	PE3	Android tablet is very helpful for performing everyday tasks.
Effort Expectancy **(Chopra and Rajan 2016)**	EE1	Using android tablets is entertaining for me.
	EE2	It is easy for me to become skillful at using android tablets.
Social Influence **(Chopra and Rajan 2016)**	SI1	People who are important to me (family, friends, other FPS salespersons) think that I should use android tablets.
	SI2	People respect me more since I use android tablets.
	SI3	People in my organization who use android tablets get more respect that people who do not.
Facilitating Conditions **(Chopra and Rajan 2016)**	FC1	It was useful to attend the training camp organized by government.
	FC2	Sufficient training is provided by government to use android tablets.
	FC3	Government provides clear instructions to use the android tablets.
Technology Satisfaction **(Chopra and Rajan 2016)**	SAT1	I am _____ with change in business process with the implementation of android tablets.
	SAT2	I am _____ regarding the continued implementation of android tablets.