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Technology adoption in the public distribution system of Chhattisgarh, India: Analysis of factors that facilitate the transition to technology utilization in food distribution

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Technology adoption in the public distribution system of Chhattisgarh, India: Analysis of factors that facilitate the transition to technology utilization in food distribution

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate college will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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DEDICATION

In the hope that this work may in some way contribute to the efforts being made to improve global food security, I would like to dedicate this thesis to various government and non-government organizations that are endeavoring to make sure that no one sleeps hungry, and to millions of sisters and brothers who do not have access to safe and nutritious food.

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NOMENCLATURE

ANX	Technology Anxiety
AVE	Average Variance Extracted
BPL	Below Poverty Line
COREPDS	Centralized Online Real-time Electronic Public Distribution System
CSC	Civil Supplies Corporation
EE	Effort Expectancy
EU	European Union
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IS	Information Systems
IT	Information Technology
FAO	Food and Agriculture Organization
FC	Facilitating Conditions
MIS	Management Information Systems
NeGP	National E-Governance Plan
NIC	National Informatics Centre
NGO	Non-Governmental Organization
PDS	Public Distribution System
PE	Performance Expectancy
PLS	Partial Least Squares
PLS-SEM	Partial Least Squares – Structural Equation Modeling

POS	Point of Sale
R^2	Coefficient of Determination
RELE	Technology Relevance
RSD	Result Demonstrability
RTCD	Resistance to Change
SAT	Technology Satisfaction
SCDE	Screen Design
SI	Social Influence
TERM	Terminology
TI	Trust in Internet
TQM	Total Quality Management
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTAUT	Unified Theory of Acceptance and Use of Technology
WFP	World Food Programme

GLOSSARY OF TERMS

Average Variance Extracted (AVE)	It is the average variation explained by a latent construct in the observed variables to which it is theoretically related (Farrell, 2008)
Coefficient of Determination (R^2)	Proportion of variance explained by the model i.e. proportion of variation in dependent variable that is explained by independent variables (Nagelkerke, 1991).
Convergent Validity	It is the degree to which two measures of the same construct correlate positively with each other (Hair, Hult, Ringle, & Sarstedt, 2017).
Cross Loadings	Cross loadings indicate how strongly each item loads on the other factors (Hair et al., 2017).
Discriminant Validity	It is the degree to which a construct is different from another (Hair et al., 2017).
E-government	E-government or electronic government is the utilization of information and communication technologies by government agencies for continuous optimization of service delivery, constituency participation, citizen empowerment, and efficient interaction with business and industry (Palvia & Sharma, 2007)
Effort Expectancy (EE)	Degree of ease associated with the use of system (Venkatesh, Morris, Davis, & Davis, 2003).
Facilitating Conditions (FC)	Degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system (Venkatesh, et al., 2003).
Fornell-Larcker Criterion	It is a measure of assessing discriminant validity that compares the square root of AVE values with the latent variable correlations (Hair et al., 2017).
Internal consistency reliability	Internal consistency of a model is an indicator of the ability of items measuring the same construct to produce consistent scores (Tang, Cui, & Babenko, 2014).
Outer Loadings	It is the relationship between reflective construct (constructs with direction of causality from construct to measure) and measured indicator variables.
Performance Expectancy (PE)	Degree to which an individual believes that using the system helps him/her to attain gains in job performance (Venkatesh, et al., 2003).

Result Demonstrability (RSD)	User's perception or judgement of his/her ability to discern the benefits of using a specific technology (Nov & Ye, 2009).
Resistance to change (RTCD)	Individual's dispositional inclination to resist changes as a fundamental personality trait (Nov & Ye, 2009).
Screen Design (SCDE)	The way information is presented on the screen (Hong et al., 2002).
Social Influence (SI)	Degree to which an individual perceives that important others believe that he/she should use the new system (Venkatesh, et al., 2003).
Technology Acceptance Model 2 (TAM2)	TAM2 is an extension of technology acceptance model that incorporates social influence (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use) (Venkatesh & Davis, 2000).
Technology Anxiety (ANX)	Apprehension or fear a user feels when he or she faces the possibility of using the technology (Nov & Ye, 2009).
Technology Relevance (RELE)	Degree to which the system matches tasks as carried out in the current environment and as specified in the task analysis (Hong, Wong, Thong, & Tam, 2002).
Technology Satisfaction (SAT)	Degree to which an individual is satisfied with the new system.
Terminology (TERM)	Words, sentences and abbreviations used by a system (Hong et al., 2002).
Trust in internet (TI)	Perception of users' confidence in enabling technologies which is network connectivity and internet infrastructure in this study.

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ABSTRACT

Information and communication technologies in public administration and social welfare initiatives are increasingly being used by various countries with an intent to augment transparency and provide better services to citizens. However, lack of infrastructure, education, technology literacy, and training keeps a major proportion of target population deprived of the benefits of these initiatives in various developing countries. Hence services of technology intermediaries are utilized to bridge this gap between the benefits of e-government technologies and citizens. The public distribution system (PDS) is the biggest poverty alleviation program in India that aims to provide subsidized food grains and other essential commodities to below poverty line households through a network of fair price shops. Under the centralized online real-time electronic public distribution system, the state of Chhattisgarh implemented various technological and administrative reforms to empower end-beneficiaries of the PDS supply chain. Fair price shop salespersons, who are the users of implemented technologies, face various challenges in making this transition from manual transactions to automated transactions. These intermediaries play a critical role in successful implementation of any technology-based policy change. It is also essential to analyze their technology adoption behavior due to the mandatory nature of technology use in e-governance. This research attempts to analyze and understand the adoption of mandatory e-governance technologies from intermediary users' perspective.

The first study aimed to identify and prioritize challenges faced by technology users in mandatory technology adoption of point of sale devices that were implemented in fair price shops of Chhattisgarh to replace the paper-based commodity distribution system. Data collected from 170 fair price shops were analyzed using the quality management tools of list reduction,

affinity diagram, and Pareto chart. The result of the list reduction technique established a final set of 33 challenges faced by fair price shop salespersons in adopting the mandated technology. This list of challenges was then organized and categorized into six priority areas that required improvement for easier technology adoption. A Pareto chart was then used to prioritize and identify the areas that required immediate attention. These priority areas, in order of their importance, included “lack of infrastructure,” “design of device hardware,” “process design,” “salespeople’ errors,” “government support,” and “software design”. Results of this study could help the government agencies to channelize their resources on areas that require immediate attention and to take into consideration the technology users’ perspective while expanding technology-based policy implementations.

Improper device design, high maintenance costs, and poor network strength led to replacement of point of sale devices with tablets. Although improvement in the areas identified in previous study would enable an easier transition to technology use, there are various other driving factors that could influence the technology adoption by intermediary users. Therefore, the second study aimed to analyze the effect of technology characteristics and users’ internal traits on the technology adoption behavior of fair price salespersons. The need for this analysis is underscored by mandatory nature of technology adoption in e-governance. Data collected from 176 fair price shops from 167 villages of three districts of state of Chhattisgarh were analyzed using partial least square structural equation modeling. Technology satisfaction, rather than technology acceptance, is a more relevant outcome variable to study in mandatory adoption scenario. Therefore, the effect of various characteristics of implemented technology and users’ internal traits on technology satisfaction was modeled using an extension of the unified theory of acceptance and use of technology (UTAUT). The proposed model established that technology

characteristics of “screen design” and “terminology” and users’ internal traits of “resistance to change,” “technology anxiety,” and “trust in internet” influenced their technology satisfaction either directly or indirectly through UTAUT constructs performance expectancy, effort expectancy, social influence, and facilitating conditions. However, “technology relevance” and “result demonstrability” had no effect on technology satisfaction in a mandated-use environment.

CHAPTER 1. GENERAL INTRODUCTION

Introduction

E-government aims to improve the relationship between people and their government by making public services more effective, accessible, and responsive to people's needs as well as by increasing the transparency of public institutions (United Nations E-government Survey, 2016). Effective implementation, adoption, utilization, and maintenance of information and communication technologies (ICTs) to provide services to their constituents is a major challenge faced by governments of various nations. This challenge is increased in developing countries due to lack of technology literacy, limited infrastructure, improper training, and social, cultural and gender disparities (Chopra & Rajan, 2016; Weerakkody, El-Haddadeh, Al-Sobhi, Shareef, & Dwivedi, 2013). This compels the government institutions to utilize the services of technology intermediaries who are often the primary users of ICTs in e-governance (Madon & Sahay, 2002; Sein & Furuholt, 2012). Services of intermediaries are widely used in India to provide a better access of e-governance initiatives to general population. One such program that utilizes the services of technology intermediaries is the public distribution system (PDS), specifically in the state of Chhattisgarh, India.

Food insecurity is a serious challenge worldwide. India accounts for one-fourth of the 795 million undernourished in the world and therefore any global impact on world hunger requires progress in food and nutrition security in the country (FAO, IFAD & WFP, 2015). PDS is India's largest poverty alleviation program under which the federal and state governments provide food grains and other essential commodities (like sugar, salt, kerosene, etc.) to below poverty line households through the world's largest food distribution network of more than

535,00 fair price shops (Ray & Ray, 2011). However, a major portion of available grain is lost in distribution due to leakages, diversion and black marketing (Khera, 2011; Rajan, Chopra, Somasekhar, & Laux, 2016). Distribution of entitlements is the responsibility of state governments who lift the grains from federal warehouses and allocate them to beneficiaries through fair price shops. The government of India aims to computerize the fair price shops for efficient commodity distribution. The state of Chhattisgarh has been proactive in implementing various administrative and technological reforms to empower beneficiaries, increase transparency, extend coverage of PDS and improve delivery of entitlements (Krishnamurthy, Pathania, & Tandon 2014).

Two major technological advances introduced in Chhattisgarh were the overall computerization of PDS supply chain in 2007-08 and implementation centralized online real-time electronic public distribution system (COREPDS) in 2012. Prior to the implementation of COREPDS, each beneficiary was linked to one fair price shop and had no option but to buy entitlements from that shop. This created a forced monopoly of fair price owners leading to exploitation of beneficiaries (Vaidya & Somasekhar, 2014). COREPDS aimed at empowering beneficiaries by providing them the right to choose the fair price shop from which they could purchase their entitlements. Since each fair price shop owner receives commission based on the quantity of commodities sold, therefore the fear of losing beneficiaries forced them to provide better services. In addition to this, all fair price shops were equipped with point of sale (POS) devices for easier commodity tracking, increased transparency, efficient beneficiary identification and real-time transaction recording. All beneficiaries were provided with smartcards that are swiped in POS devices for beneficiary authentication and automated receipt

generation. The POS devices are linked to a central server and each transaction is updated in real-time.

Fair price shop salespersons are the primary users of POS devices and therefore, act as intermediaries between government agencies and beneficiaries. Technology adoption by intermediary users is an important research topic in information systems study to ascertain a constructive government-citizen relation channeled through intermediaries and to design standardized devices that would enable them to provide better services to beneficiaries (Al-Sobhi, Weerakkody, & Al-Busaidy, 2010; Weerakkody et al., 2013). Fair price shop salespersons faced various challenges in transition from manual beneficiary authentication and transaction recording to an automated process. Therefore, the first study aimed to identify these challenges and analyze them using quality management tools. This analysis could help government agencies to determine the areas of improvement that would allow for better use of public resources and easier technology adoption by fair price shop salespersons.

The results of first study established poor network strength, small device size, faulty touch mechanism, device button malfunctions, and improper software and device display as major challenges that necessitated a change in technology. In addition, the high maintenance cost of point of sale devices added extraneous work load for Department of Food in the government of Chhattisgarh. This led to system remodeling by replacing POS devices with tablets. The state government began implementing tablets in fair price shops of rural Chhattisgarh in 2015 and is in process of extending it to urban areas. Effectiveness of tablets in mitigating the challenges faced in using point of sale devices requires a deeper understanding of factors that facilitate as well as impede adoption of new technology. These factors could be an outcome of (i) characteristics of technology and (ii) users' personal convictions and emotional response to

implemented technology. Hence the second study aimed to investigate the effect of these parameters on technology adoption in mandatory adoption case of tablets.

Use of this technology is mandated by government leading to a behavioral response of users that is distinct from the case of voluntary technology adoption environment. Users' internal traits and technology characteristics effect their satisfaction with implemented technology (Nov & Ye, 2009). Users' internal traits include resistance to change, trust in the internet, result demonstrability and technology anxiety (Callum, Jeffrey, & Kisnshuk, 2014). Technology characteristics include screen design, terminology and technology relevance (Jeong, 2011). The effect of these factors on users' technology adoption behavior in mandatory adoption setting remain understudied. Understanding the effect of human and technological characteristics on users' perception of new technology adoption would enable (i) information system researchers to comprehend intermediary users' technology adoption behavior, (ii) government agencies to create implement policies more effectively, and (iii) beneficiaries to receive their entitlements through a more transparent and convenient process.

Research Objectives

Primary objectives of the research were:

1. To identify and prioritize challenges faced by technology intermediaries in adopting point of sale devices in the centralized online real-time electronic public distribution system of Chhattisgarh, India.
2. To examine the effect of technology characteristics and users' internal traits on technology adoption behavior of intermediary users in mandatory adoption scenario.

Thesis Organization

The thesis follows format of journals where these manuscripts have already been accepted or submitted for review. Each chapter in this thesis is self-contained. Chapter 1 is a general introduction of the overall topic and highlights the research objectives and its implications. Chapter 2 includes an abstract, introduction along with literature review, methodology, findings, discussion, and future work. Chapter 3 includes an abstract, introduction along with literature review, research model and hypotheses, methodology, results, discussion, conclusion, limitations, and future research work. Lastly, chapter 4 highlights the final summary and conclusion of the thesis followed by appendices from both research topics.

Chapter 2, titled "Challenges in technology adoption in Indian public distribution system: A quality management approach," is a research paper modified from the manuscript already accepted to be published in "International Journal of Productivity and Quality Management." Chapter 3, titled "User acceptance of new technology in mandatory adoption scenario: Understanding the effect of users' internal traits and technology characteristics," is a research paper modified from the manuscript submitted to "Information Technology for Development" and is currently under review.

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CHAPTER 2. CHALLENGES IN TECHNOLOGY ADOPTION IN INDIAN PUBLIC DISTRIBUTION SYSTEM: A QUALITY MANAGEMENT APPROACH

Paper accepted for publication in *International Journal of Productivity and Quality Management*

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Abstract

Information and communication technologies are increasingly being used by various countries to provide faster and transparent services to their citizens through e-government initiatives. A large population in developing countries remain deprived of these services due to lack of skills, training and infrastructure. Local community intermediaries who have the necessary skills to use e-government technology are employed to provide services to beneficiaries. Purpose of this study was to identify and prioritize the challenges faced by intermediaries in adopting new e-government technology by studying technology adoption of point-of-sale devices introduced in the public distribution system of Chhattisgarh. Quality management tools of list reduction and affinity diagram were used to organize the data and categorize the challenges into various areas to be addressed by government. A Pareto chart was used to prioritize and identify the areas that required immediate attention. Utilization of quality management tools is an unconventional approach to problem solving in public administration sector. The six identified priority areas, in order of their importance, were lack of infrastructure, design of device hardware, process design, salespeople' errors, government support and software design. This research will help policy makers and government agencies to improve technology dissemination for easier adoption of existing as well as new e-government initiatives.

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Introduction

Utilization of information and communication technologies (ICTs) to provide better services to citizens by increasing transparency of the public administration system and to empower citizens has been the focus of various countries (Meijer, 2007; Palvia & Sharma, 2007; Puri, 2012). Use of ICTs by government agencies to bridge the gap between government and citizens is referred to as e-governance. There remains a huge gap between the planned and actual use of e-governance initiatives in developing countries. Heeks (2001) categorized these gaps as hard–soft gaps, private–public gaps, and country context gaps. Hard–soft gaps are those that occur due to lack of consideration of social factors such as culture and politics while designing ICT for e-government systems (Heeks, 2001). Private–public gaps lead to e-governance failures due to public sector implementation of ICTs designed for the private sector (Heeks, 2001). E-governance initiatives designed for one country but implemented by another country leads to country context gaps (Heeks, 2001).

According to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), e-governance is defined as the use of ICTs in public sector with improved information and service delivery; higher citizen participation in the decision-making process; and effective, transparent, and accountable governance as the aim of these interventions (Palvia & Sharma, 2007). Findings of the current study provided insight into ways to improve information and service delivery as well as to increase stakeholders' participation by studying technology adoption of users' in an e-government initiative in India.

Even in the 21st century, India struggles with widespread poverty and hunger, which accounts for more than 24% of the world's food insecurity (Food and Agriculture Organization of the United Nations, the International Fund for Agricultural Development, and World Food

Programme, 2014). The Indian government runs various food security programs, yet the problem remains quite striking. To create more accountability of such food security program, the Indian government has started using various e-government initiatives. One example of such an initiative is the use of ICTs in distribution of subsidized food grains under India's public distribution system (PDS) to below poverty line households (Chopra & Rajan, 2016). Technology implementation is not the sole factor influencing the comprehensive transformation of public administration in the country. It is the adoption of technological innovation by users that leads to attainment of intended objectives (Chigona & Licker, 2008). Benefits of implementing ICTs in public sector cannot be appreciated without understanding the challenges faced by intermediaries in adopting new technology.

Part of the population in developing countries remain deprived of the benefits of technological interventions in government initiatives due to lack of exposure and limited infrastructure (Weerakkody et al., 2013). Here, exposure refers to the experience of beneficiaries with technology and infrastructure refers to (a) social infrastructure, such as information access and education; (b) physical infrastructure, such as better roads; and (c) institutional infrastructure, such as facilities that institutions have established to provide ICT education and training.

Skills of "ideal intermediaries" are required to bridge the gap between government and beneficiaries (Rajalekshmi, 2007; Sein & Furuholt, 2012). An ideal intermediary is an individual or organization capable of using ICTs based on the requirements of members of the community to which the intermediary belongs (Rajalekshmi, 2007). Successful implementation and utilization of ICTs require involvement of various intermediaries with government organizations, private firms, and cooperative societies being the major ones (Chopra & Rajan, 2016; Janssen &

Klievink, 2009; Sein & Furuholt, 2012). Intermediaries often function as the primary users of ICT interventions by providing required services to secondary beneficiary users (Sein & Furuholt, 2012). Importance of studying the attitude of these intermediaries regarding technology is accentuated by the mandatory technology adoption scenario in e-governance (Chhabra et al., 2016). Mandatory adoption of technology in e-governance engenders various challenges specific to technology adoption by intermediaries, which makes this an important factor to study (Chopra & Rajan, 2016; Rana et al., 2013).

Weerakkody et al. (2013) emphasized the significance of studying technology adoption from the intermediary's perspective and ascertained a constructive citizen–government communication channeled through an intermediary. Understanding users' perceptions of technology within an entire process can help in providing better services by standardizing the design and use of ICTs (Al-Sobhi et al., 2010).

Traditionally, citizen utilization and adoption of ICTs was the focus of most of the research; recently, however, various researchers have emphasized on the importance of studying the role, technology attitudes, and technology adoption of intermediaries in e-governance (Al-Sobhi et al., 2009; Al-Sobhi et al., 2010; Cecchini & Raina, 2004; Chopra & Rajan, 2016; Janssen & Klievink, 2009; Kumar & Best; 2006; Weerakkody et al., 2013). Ejiaku (2014) identified that existing research did not directly capture the difficulties faced by intermediaries when exposed to new technology, and hence, there is a greater need to study intermediaries' experiences with technology.

This study employed quality management tools to identify various challenges faced by intermediaries in adopting new technology implemented in the food security system of Chhattisgarh, India. Quality management tools include various diagrams, charts, tables,

techniques, and methods used to manage and improve the quality of products and processes through continuous improvement (Grover et al., 2016; Ramesh & Ravi, 2013; Tague, 2005). These tools help to increase profitability as well as customer satisfaction by continuous improvement of processes (Singh & Singh, 2014). The processes considered for this were various tasks performed in fair price shops, including receiving commodities from government agencies, authentication of beneficiaries, distribution of correct quantity of commodities, providing requested information to beneficiaries, and maintaining records of transactions. Various industries traditionally have employed quality management tools and techniques with the objective of providing better products and services to their customers (Chiarini, 2013).

Identified challenges were then categorized into major priority areas. In the context of this study, priority area refers to various themes into which the identified challenges were grouped based on apparent similarities among them. These themes were decided upon in a manner such that each theme could act as an area of improvement on which government agencies can focus for easier adoption of technology by intermediaries. These themes were then prioritized to identify the ones requiring immediate attention to successfully implement ICTs in future e-government initiatives and improve existing e-government systems.

Rationale for using quality management tools

Employing quality management tools provide a novel approach for analysing ICT-related challenges in e-governance. In addition to providing solutions to a problem under consideration, data analysed using these tools are generally consolidated in a manner that can be easily transformed from theoretical information to actual practice (McQuater et al., 1995). The representation and terminology of the tools used are understandable by government stakeholders. Hence, the ease of understanding results would make the decision-making process less

challenging for policymakers. Maxwell (2013) pointed out categorizing strategies as one of the methods to analyse qualitative data. As the name suggests, categorizing strategies helps to organize the qualitative data by grouping it into various categories (Maxwell, 2013). Use of quality management tools allow more information to be obtained by systematically organizing the data and expanding thinking to create a variety of ideas or focusing ideas to the particulars (Reid & Cseko, 2006; Tague, 2005).

Following subsections provide detailed information on food security system adopted by India, major technological intervention in Chhattisgarh food supply chain, and literature reviewed on challenges in ICT adoption.

Food security situation in India and the public distribution system

Food and Agriculture Organization of the United Nations (FAO) defined food security as existing when "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2006). Currently in India, food access is a much bigger concern than is food availability (Khera, 2011).

The largest food security scheme of India is the PDS, which aims to provide physical and economic access to staple food grains (wheat and rice) and other essential commodities (sugar, salt, kerosene, etc.) to below-poverty-line (BPL) households (Khera, 2011). Access to food grains and other essential commodities is provided through a network of more than 535,000 fair price shops. Fair price shops are responsible for distribution of food grains and essential commodities at subsidized rates to beneficiaries. India's PDS is one of the largest logistical food programs operating in the world.

To make distribution efficient and overcome black marketing, hoarding e-governance is essential (Chopra & Rajan, 2016). Indian government aims to computerize more than 50% of fair price shops by March 2017. The state of Chhattisgarh in Central India became a role model for other states by computerizing the PDS food supply chain in 2007–2008 and implementing the Centralized Online Real-Time Electronic Public Distribution System (COREPDS) in 2012 (Chhattisgarh Department of Food, Civil Supplies and Consumer Protection, 2012). Computerization of fair price shops reduce corruption indirectly by increasing transparency (Bathla et al., 2015). Increased transparency is achieved by making information widely available to all the involved stakeholders in the supply chain. Other benefits of implementing ICTs include user-friendly processes, reduced transaction time, easier analysis of transaction data, and easier beneficiary authentication (Chopra & Rajan, 2016).

ICT in public distribution system of Chhattisgarh

Introduced in the PDS of Chhattisgarh in 2012, COREPDS aimed to empower beneficiaries, reduce commodity diversion, and provide better service to beneficiaries (Chopra & Rajan, 2016). Before the implementation of COREPDS, each beneficiary household was linked to one particular fair price shop. This created a forced monopoly of fair price shop owners leading to beneficiary exploitation and commodity leakage from the system (Chopra & Rajan, 2016). COREPDS aimed at overhauling the existing system by providing the option of portability to beneficiaries. With the introduction of portability, each beneficiary household was linked to all fair price shops and was given the right to choose the fair price shop from which they could buy their entitlements. The fear of losing beneficiaries created a competition between fair price shops and forced them to provide better services. Portability was bound to complicate commodity tracking, beneficiary identification, and transaction recording. Use of ICT was

inevitable for a transparent and more efficient system. Hence, all fair price shops were equipped with point-of-sale (POS) devices with internet connectivity and beneficiaries were provided with a smartcard.

Each beneficiary is authenticated and checked for the eligible quantity by swiping the smartcard with the POS device. Salesperson then enters the required quantity of commodities, which is updated with the central server. The device generates a receipt, which is provided to the beneficiary, after which the payment is received and beneficiary can collect the commodities. Freedom to choose fair price shops and installation of POS devices empowered beneficiaries by eradicating the forced monopoly of fair price shops, providing better service, weeding out non-performing fair price shops, and reducing diversion of commodities through automated authentication of beneficiaries.

Challenges in technology adoption

Heeks (2001) studied the extent of e-government failure and established that 35% of e-government initiatives are complete failures, 50% are partial failures, and only 15% are successes. Successful adoption of e-governance initiatives faces a variety of challenges. Rao (2004) studied rural ICT infrastructure and identified durable technology, degree of employee involvement, transparency, cost reduction, citizen convenience, process improvement, ease and strength of the public–private partnership arrangement, and increased revenue as major factors responsible for successful implementation of ICT projects.

Gichoya (2005) reviewed literature of ICT implementation in developing countries and categorized the factors affecting technology implementation into success factors and failure factors. He identified vision, strategy, government support, technological advancements, beneficiary expectations, effective project management, and ethical practice as the major drivers

and enablers for success of ICT projects. Gichoya (2005) further identified infrastructure, funding, incompatible data systems, leadership style, culture, attitude, and lack of skill toward e-governance as the major barriers in the way of smooth implementation of e-government initiatives. Vision, strategy, and government support were mentioned as the most important success factors, and insufficient resources and lack of infrastructure were identified as failure factors.

Ejiaku (2014) discussed various challenges encountered in the adoption of ICT in developing countries and determined that infrastructure, training, government policies, and the country's culture were the major challenges. Infrastructure included telecommunication systems as well as human resources required to effectively operate these systems (Ejiaku, 2014). Training included providing sufficient education and skills to professionals involved in creating and maintaining the infrastructure (Ejiaku, 2014). Various policies and funding towards ICT infrastructure were related to the government's attitude and country's culture towards ICT (Ejiaku, 2014).

The abovementioned studies undertook a critical examination of ICT adoption in rural e-governance initiatives and therefore provided a broad list of challenges faced in adopting new technology. However, the research methodology of these studies did not take into consideration the opinion of primary users of introduced technology, which may have created a gap in the studies' analyses and actual challenges faced in field. Furthermore, the literature did not provide information on the importance of these challenges. This is important because some of the identified challenges may require more focus from government agencies compared to others. The present study attempted to fill this gap in the literature by creating an organized list of challenges

faced by fair price shop salespeople in adopting POS devices and then creating a list of priority areas on which government agencies and policymakers must focus.

Methodology

In this section, we describe the tools used to analyse data, participants, sample selection, survey instrument, and procedure of data collection and analysis.

Quality management tools

Tague (2005) categorized quality management tools into six categories, which included (a) idea creation tools, (b) process analysis tools, (c) cause analysis tools, (d) data collection and analysis tools, (e) planning and implementation tools, and (f) decision-making and evaluation tools. Brief descriptions of these tools along with some examples are given in Table 2.1. Data analysis, idea creation, and decision-making tools were used in this study to analyse the data collected through questionnaire-based survey.

Table 2.1. Types of Quality Management Tools: Description and Examples

Tools	Description	Examples
Idea creation tools	To create new ideas and to organize a complex list of ideas for easier analysis (José Tarí, 2005; Tague, 2005)	Affinity diagram, benchmarking, brainstorming, mind maps
Process analysis tools	To understand and analyse a process or a set of activities taken from the process (Tague, 2005). These tools are used for process planning, resource management, and analysis of work flow (Bal, 1998)	Flowchart, requirements table, critical to quality analysis, cause and effect analysis, relations diagram, work flow diagram, house of quality
Planning and implementation tools	These tools are used to manage projects from the project planning and initiation stages to the project implementation and completion stages (José Tarí, 2005)	Checklist, contingency diagram, project charter, presentations, arrow diagrams, potential problem analysis
Data collection and analysis tools	To collect and analyse data using standard charts, tables, and graphs (Bunney & Dale, 1997)	Pareto chart, box plot, control chart, run chart, stratification, sampling
Cause analysis tools	To help individuals and teams identify root cause of problems in order to avoid improper utilization of resources by employing them to address symptoms instead of the root cause (Sarkar et al., 2013)	Fishbone diagram, failure modes and effects diagram, fault tree analysis, scatter plot, why-why diagram
Decision-making and evaluation tools	To choose the best decision out of available choices and evaluate decision and project outcomes (Tague, 2005)	List reduction, decision matrix, decision tree, prioritization matrix

List reduction

List reduction is a data evaluation and analysis tool used to narrow down a list of brainstormed options by removing duplicate and trivial ideas (José Tarí, 2005; Tague, 2005). The purpose of using this tool was to reduce the 71 ideas identified from the survey into a reasonable number by eliminating the options that were not related to the research objective and combining the options that were similar to each other. Each idea was first evaluated by filtering the list and removing the ideas that were not related to the research objective. Then, each of the remaining ideas was compared to all others and identical ideas were then grouped as one challenge. A list of the processed data after applying list reduction is provided in appendix A. This list, obtained after using the tool, was the final list of 33 challenges faced by fair price shop salespeople in adopting the point-of-sales devices. These data were further analysed using an affinity diagram.

Affinity diagram

An affinity diagram is an idea-creation and brainstorming tool used to gather information and consolidate a large number of ideas into categories that have a natural affinity (Chansa-ngavej & Srijuntub, 2010; Tague, 2005). An affinity diagram can be used in any scenario where a large number of ideas are to be categorized under various themes. Grover et al. (2016) used an affinity diagram to group challenges faced by small food facilities in the adoption of preventive controls of food safety modernization act. Cheng & Leu (2011) employed an affinity diagram in the construction sector to analyse and classify common bridge construction defects into suitable groups based on the underlying similarities among them. The aforementioned literature shows the use of an affinity diagram to group challenges faced under two different scenarios. A similar approach was used in the current study to group the challenges obtained by list reduction into six themes or priority areas. The six priority areas were selected from the literature in a manner such

that each priority area could be considered as an area requiring focus from government agencies and policymakers (Ejiaku, 2014; Gichoya, 2005; Omekwu, 2003; Rao, 2004). These focus areas were further prioritized using a Pareto chart.

Pareto chart

A Pareto chart is a bar graph used to prioritize a large number of brainstormed options and focus on the most significant ones (Tague, 2005). This chart is based on the Pareto principle, which states that 80% of the effects are caused by 20% of the causes (Oke et al., 2008). In context of this research, Pareto chart was used to prioritize the six identified areas to determine the most important areas of improvement on which policymakers should focus for better ICT adoption. The number of salespeople who stated a challenge in adopting POS devices was considered as the frequency of that particular challenge. The sum of all the challenges falling under each priority area was considered as the frequency of that particular area. The six priority areas were arranged in descending order of their frequency. Arranging them in decreasing order made it easier to distinguish the areas requiring higher attention from those requiring little or no focus.

Aforementioned methodology is diagrammed in figure 2.1. Top row shows the processing of data from collection to final outcome and bottom row shows the tools used to analyse the data at each step.

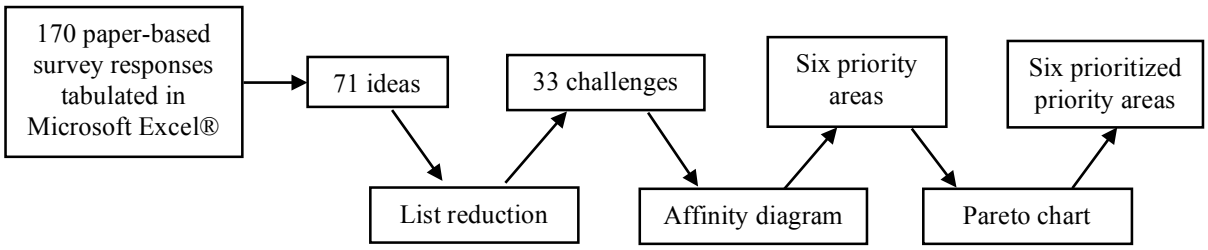

Figure 2.1. Flowchart showing research methodology

Participant description and selection

Participants in the study consisted of fair price shop salespeople who operated government-mandated POS devices to distribute food grains and other essential commodities. Salespeople working in fair price shops are responsible for receiving the commodities from government warehouses, displaying samples of food grains that the fair price shop is supplying, authenticating beneficiaries by their ration card, selling commodities to registered cardholders at the issue price specified by state government, and maintaining a record of each transaction. Use of POS devices in fair price shops was the criterion of sample selection. Out of 218 fair price shops where POS devices were installed at the time of data collection (Chopra and Rajan, 2016), 170 usable responses were analysed by employing various quality management tools. Sample descriptive statistics of these responses are listed in Table 2.2.

As shown in Table 2.2, more than 36% of the respondents were 21 to 30 years old, approximately 31% were 31 to 40 years old, and approximately 16% were from 41 to 50 years old, allowing us the opportunity to get the opinion of salespeople from various age groups. This is important because attitude towards new technology is different for younger than for older operators (Morris and Venkatesh, 2000). Similarly, experience with technology plays a vital role in developing one's attitude toward adopting it (Liao and Lu, 2008). Therefore, a variety in the experience of salespeople working in fair price shops as well as the variety in their experience with POS devices helped in understanding the challenges of technology adoption from the perspective of salespeople with different levels of experience.

Table 2.2. Sample Descriptive Statistics

Variable	Frequency	Percentage
Age (years)		
≤20	4	2.35
21–30	62	36.47
31–40	52	30.59
41–50	27	15.88
51–60	13	7.65
No Response	12	7.06
Gender		
Female	13	7.65
Male	153	90.00
No Response	4	2.35
Experience with fair price shops (years)		
≤10	116	68.23
11–20	31	18.24
≥21	13	7.65
No Response	10	5.88
Experience with POS devices (months)		
≤12	73	42.94
13–24	74	43.53
≥25	14	8.24
Not available	9	5.29
Education level		
Primary (Up to 5^{th} grade)	7	4.12
Secondary (Up to 10^{th} grade)	50	29.41
Higher Secondary (Up to 12^{th} grade)	54	31.76
Bachelor's and higher	55	32.35
No Response	4	2.35

Survey instrument and data collection

Information on challenges faced by fair price shop salespeople while adopting new technology was collected as a part of a larger survey conducted in three districts of Chhattisgarh in December 2013 by the second and third author. A questionnaire was prepared in the native language of participants (Hindi) to make it easier for them to understand what was being asked. The questionnaire consisted of 66 items, of which two open-ended questions asked the

participant's opinion about POS devices and suggestions for modifications of POS devices as well as changes in business processes due to POS devices.

Responses to these questions were used to identify major challenges faced by fair price shop salespeople in adopting the POS devices to carry out daily transactions. Participants with an education level of bachelor's degree or higher were asked to complete the survey themselves, and a 10-minute interview was conducted to verify their responses (Chopra and Rajan, 2016). Interviews lasting from 45 minutes to 1 hour were conducted for all other participants, during which the questions were explained and responses to each question were recorded by interviewers (Chopra and Rajan, 2016).

Data analysis

Data collected were translated from Hindi to English, and the responses were kept anonymous during the analysis. Data were recorded and analysed in a Microsoft Excel® worksheet and a built-in Microsoft Excel® Pareto chart format was used to prioritize the major focus areas and challenges.

Findings

List reduction and identified challenges

Some of the observations in the 71 identified items were identical and could be placed under one challenge. An example of identical observations is that some of the salespeople mentioned that the device did not provide real-time information of the quantity of commodities sold as well as stock remaining in the fair price shop, whereas others mentioned that there was a difference in the quantity of stock available in fair price shop shown by POS device versus the actual stock in the shop. These two points were aggregated into one challenge named real-time information of stock required.

Similarly, some of the responses were trivial for the purpose of this study and were not considered for further analysis. For example, some of the salespeople pointed out that they wanted shop hours to be increased to provide better service to beneficiaries. Others mentioned that fair price shops did not receive commodities on time when the stock was depleted, and they had to buy some of the commodities from the open market at higher prices to be able to serve the beneficiaries. Many times, available commodities were of poor quality and fair price shop salespeople had to get the grains cleaned themselves. Although observations like these were concerned with challenges faced by salespeople while making transactions, these were not related to adoption of POS devices. Hence, these challenges were removed from the list.

Once the trivial and duplicate ideas were removed, a final list of 33 challenges was identified. Identified challenges are described briefly in the appendix A.

Affinity diagram

Affinity diagram with 33 challenges consolidated into six potential priority areas is shown in Figure 2.2. The six areas into which the challenges were divided were: device design (from both hardware and software points of view), process design, infrastructure, government support, and salespeople's errors. These themes were selected considering the general realms on which governments could focus for better adoption of technology in e-government initiatives. Some of the responses of fair price shop salespeople categorized on the basis of identified priority areas are exhibited in Table 2.3.

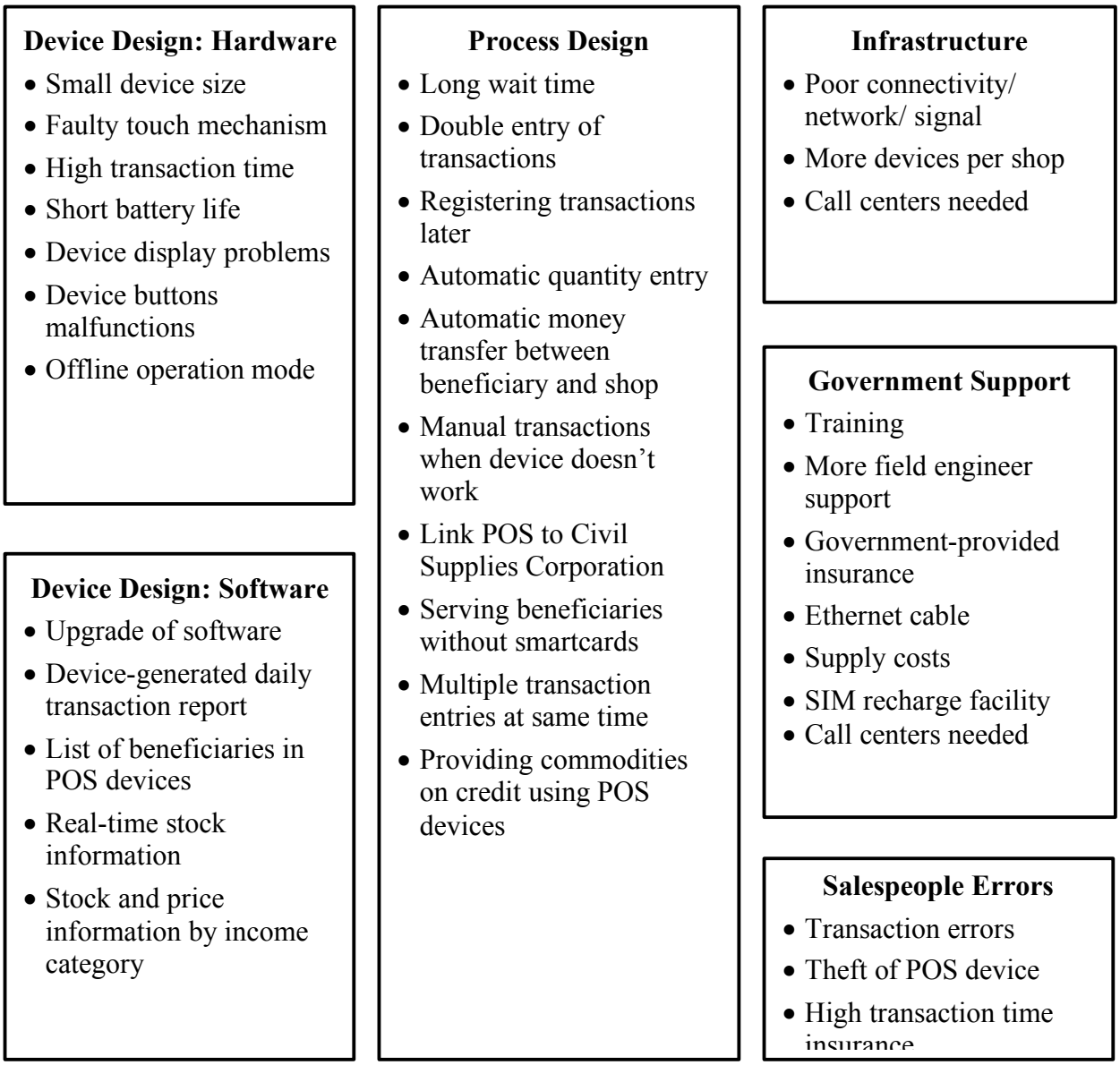

Figure 2.2. Six themes identified by affinity diagram

Table 2.3. Selected Responses of Fair Price Shop Salespeople

Priority area	Response
Device design: hardware	"Machines are too slow. Earlier it took a minute and now it takes more than 5 minutes to carry out a transaction. Shops get very crowded because of this."
Device design: software	"Information of commodities must be made available in POS devices according to beneficiaries' card color i.e. separate information for above poverty line, below poverty line, poorest of the poor etc."
Process design	"Three simultaneous transactions at same time must be allowed so that beneficiaries can be served faster."
Infrastructure	"Server problem should be solved at priority so that both fair price shop salespeople and beneficiaries do not face inconvenience."
Government support	"Training should be provided so that salesperson can themselves take some steps when machine stops working or when there is network problem."
Salesperson errors	"Sometimes transactions carried are wrong because of incorrect buttons pressed while carrying out transactions."

Pareto chart for priority areas

The Pareto chart depicting the prioritized order of focus areas is shown in Figure 2.3. The rank order was as follows: (a) infrastructure, (b) device design: hardware, (c) process design, (d) salespeople' error, (e) government support, (f) device design: software. The number at the top of each bar represents the sum of frequency of challenges falling in each priority area. The line graph depicts the cumulative percentage of the frequency. The graph shows that approximately 75% of the challenges faced in technology adoption can be minimized by focusing on improvement in three areas: infrastructure, device hardware design, and process design. Salespeople' error, government support, and device software design were not immediate concerns on which to focus.

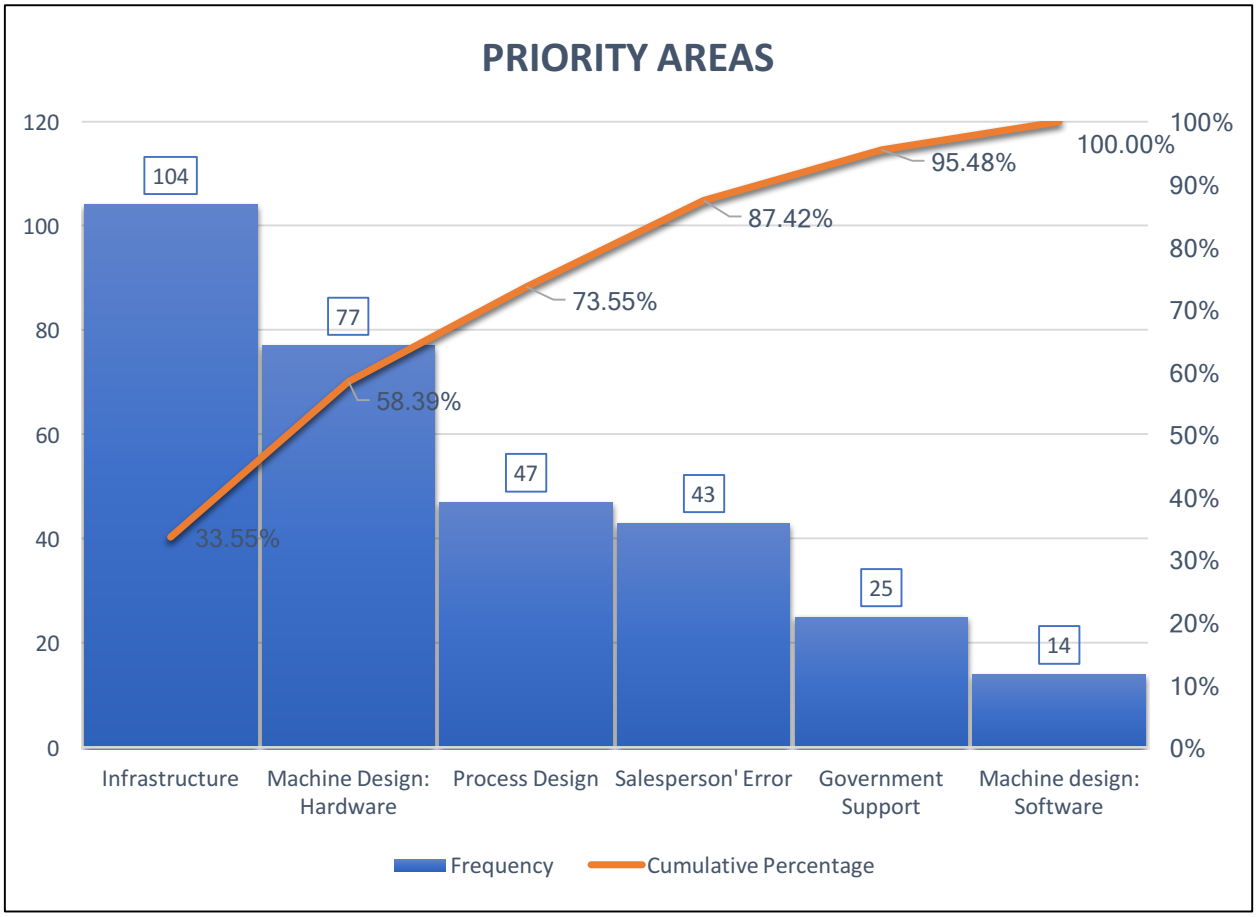

Figure 2.3. Pareto chart showing priority areas

Discussion

Purpose of this study was to identify and prioritize challenges faced by users in technology adoption in e-government initiatives by analysing the adoption of POS devices introduced in the PDS of Chhattisgarh to distribute essential commodities, manage stock, reorder supplies, authenticate beneficiaries, and maintain records. Quality management tools were used to analyse the data. Findings from this systematic methodology of data analysis can be used to interpret and prioritize the technology adoption challenges for future e-government initiatives. This will help government representatives and policymakers to focus on the top priority challenges that could help them channel funds to appropriate areas as well as optimize the use of resources. Moreover, the study demonstrates the use of quality management tools in the area of

public administration and technology adoption. This provides an opportunity to use these tools in future studies related to adoption of technology as well as e-government and public administration challenges.

The prioritized list of challenges established lack of infrastructure as the biggest challenge faced by users in adopting new technology. Ejiaku (2014), Gichoya (2005), and Omekwu (2003) also identified lack of proper infrastructure, such as telecommunication systems and information technology personnel, to be a major hindrance in ICT adoption. Lack of ICT infrastructure is the reason for stagnated development of e-governance in developing countries (Ejiaku, 2014). Adding to the current literature, the present study found that lack of infrastructure comprised more than 33% of total challenges. The affinity diagram depicted that infrastructure consisted of three challenges. Providing better connectivity by employing a faster network, installing more than one device per shop, and establishing call centres to register and get solutions to new technology-related queries were the infrastructure related challenges faced by ICT users. This means that focusing on three of the 33 identified challenges could help in easier adoption of technology by resolving 33% of the challenges. Detailed planning of required infrastructure before establishing new technology and development as well as maintenance of ICT infrastructure could make it easier for users to adopt and employ ICT in their routine activities.

As shown in the Pareto chart (Figure 2.3), design of device hardware was the second most significant priority area identified by the study. Rao (2004) also identified technology design as a factor affecting successful implementation of new technology. Participants of the study mentioned device size, device speed, quality of display, and weak batteries among various challenges that made it difficult for them to carry out transactions efficiently. Approximately one

fourth of the challenges were related to device hardware design, which leads to the suggestion that an ergonomically designed technological intervention is more likely to achieve easier ICT adoption. Ergonomics is a discipline of science that deals with the study of the relationship between humans and their environment through the design and use of equipment in such a way to minimize users' fatigue and optimize performance (Dul et al., 2012). Therefore, designing devices for e-government systems in a manner that makes them easier for the users to operate would lead to easier technology adoption.

The third most significant priority area identified in the study was process design, which constituted more than 15% of the total challenges. Rao (2004) suggested that process challenges can be a major barrier in implementation and adoption of new technology. Participants provided various suggestions for better processes that would lead to more efficient technology use. For example, one of the respondents mentioned that "money should be deducted directly from the beneficiary's smartcard and debited to fair price shop owner's bank account." They noted that linking beneficiaries' smart cards to their bank accounts and POS devices to fair price shop owners' bank account could lead to more efficient handling of money and better recordkeeping.

Salespeople' error was one finding that was not discussed in the literature. Errors due to human negligence contributed to 14% of the challenges. These errors included salespeople being slow in carrying out transactions, devices getting stolen, and errors being made while carrying out transactions.

Government support was mentioned as a concern in ICT adoption in most of the literature (Ejiaku, 2014; Gichoya, 2005; Rao, 2004), but this study found that it contributed to only 8% of the total challenges faced by ICT users in adopting new technology. This finding was consistent with those of Chopra and Rajan (2016), who studied intermediary satisfaction with mandatory

adoption of e-government technologies in the PDS of Chhattisgarh by using the Unified Theory of Acceptance and Use of Technology. The study revealed that facilitating conditions had nonsignificant effects on technology satisfaction (Chopra and Rajan, 2016). They defined facilitating conditions as the amount of training and support related to POS devices made available to fair price shop salespeople (Chopra and Rajan, 2016).

Software design comprised less than 5% of the total challenges. These challenges were related to software upgrades, provisions to obtain real-time information about stock on hand, stock information in the device according to beneficiary's category, lists of beneficiaries, and daily transaction records. Rao (2004) identified software design as an important factor in rural e-governance application and mentioned that the user interface must be in the regional language, record user transactions, maintain the privacy of beneficiary information, and be easy to upgrade. Most of the software-related challenges in the current study dealt with the requirement of having all job-related information in the device itself. This showed that the primary users of technology were concerned about not having all the information that they needed to perform their job.

Findings from this study may be used by policymakers and governments to focus resources on areas that need immediate attention and not to use resources on areas that do not require prompt action. Findings showed that resources could be judiciously utilized by channelling them into infrastructure, hardware design, and process design. This would solve three-fourths of the concerns of users in adopting new e-governance technology.

Conclusion and Future Work

This study identified and prioritized major challenges in adopting technology under the mandatory adoption scenario of e-governance. The six identified priority areas, in order of their significance, were lack of infrastructure, design of device hardware, process design, human error,

government support, and software design. E-governance initiatives have a huge scope in both developing and developed nations. The findings from this research can help in the employment of technological interventions in future e-government measures.

Qualitative methods were utilized in this study to analyse the responses of users and gain understanding of the major challenges in adopting new technology in e-government initiatives. The findings of this study could be accompanied by a quantitative study to obtain a deeper understanding of the relationships and identify the challenges in technology adoption. This could help in providing deeper insight into the data by testing the hypothesis if the uppermost significant challenges were significantly related to technology adoption and the least significant challenges had a non-significant relation to technology adoption.

The challenges and order of priority areas identified in the study were based on new ICT implementation in the food supply chain of PDS of one of the states in India. Similar studies in e-government initiatives in other areas could bolster the findings of this study and also provide deeper understanding of areas on which government agencies must focus

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CHAPTER 3. USER ACCEPTANCE OF NEW TECHNOLOGY IN MANDATORY ADOPTION SCENARIO: UNDERSTANDING THE EFFECT OF USERS' INTERNAL TRAITS AND TECHNOLOGY CHARACTERISTICS

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Abstract

Ubiquitous utilization of information and communication technologies (ICTs) has led the governments of various countries to mandate the use of ICTs in various 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 users. Technology satisfaction, rather than technology acceptance, is a more relevant outcome variable to study in mandatory adoption scenario. We study the effect of technology characteristics and users' internal traits on technology satisfaction of users of android tablets in Indian food security supply chain. 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 of performance expectancy,

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effort expectancy, social influence and facilitating conditions. Results indicated that resistance to change, technology anxiety, trust in internet, screen design and terminology had a direct or indirect impact on users' technology adoption behavior. Result demonstrability and technology relevance were found to have no effect on technology satisfaction in case of mandatory use.

Introduction

The public administration model of New Public Management, which was introduced in 1990s, shifted the emphasis of government organizations from administrative practices to professional management practices (Hughes, 2003; Pina, Torress, & Royo, 2007; Saxena, 2005). Although this revolutionary transition from bureaucratic administration led to an increased focus on service quality, performance management and risk management but it also widened the gulf between government and citizens instead of bringing them closer to each other (Noordhoek & Saner, 2004; Pina et al. 2007). Governments of various countries are now focusing on the use of information and communication technologies (ICTs) to bridge this gap by implementing various e-government initiatives (Bhuiyan, 2011; Pang, Tafti, & Krishnan, 2014). Increase in e-governance application is quite evident from the United Nations e-government survey of 2016 which reports a sharp rise in the number of countries that are using e-governance to ensure that public institutions become more inclusive, effective, accountable and transparent (United Nations E-government Survey, 2016).

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 & Rajan, 2016; Weerakkody, El-Haddadeh, Al-Sobhi, Shareef, & Dwivedi, 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, Rajan, & Chopra, 2016; Sein & Furuholt, 2012). Intermediaries are often primary users of ICTs in public administration who are assigned the responsibility to provide required services to citizens (Chopra & Rajan, 2016; Madon & Sahay, 2002).

Practice of employing intermediaries to provide e-government services to citizens is widely accepted and implemented in India. The National e-Governance Plan (NeGP) of India envisions to "make all the government services accessible to the common men in their locality, through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at affordable costs to realize their basic needs" (Kumar, Kumar, & Kumar, 2013). 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 (Kuriyan & Ray, 2009; Masiero, 2014).

The 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, Chad, Schmidt, & Rajan, 2017; FAO, IFAD, & WFP, 2015). Under the 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 (Chhabra et al., 2016; Ingavale, 2011; Ray & Ray, 2011).

Effectiveness of the PDS food supply chain has been curtailed by inefficiencies like grain leakages, diversions, and black marketing (Rajan, Chopra, Somasekhar, & Laux, 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 (Madon, 2004). With more than 11,000 fair price shops 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 to align its policies with NeGP (Krishnamurthy, Pathania, & Tandon, 2014). 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 fair price shops 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. Fair price shop 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, Chopra, & Rajan, in press). Introduction of these tablets started from rural areas where installation of point of sale devices would have led to failed transactions due to poor network. 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., in press). Many fair price shop salespersons surveyed for the current study had a direct transition from manual food distribution system to a 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

then stopped using the point of sale device based food distribution process and relearned a new process of distributing food by android tablets.

Increased focus of governments on ICTs have led the information systems (IS) researchers to examine various streams of research in technology implementation (Kim, 2009). One of the substantially focused area of IS research is to comprehend and investigate into the driving factors that influence individuals to use any technology (Chopra & Rajan, 2016; Nov & Ye, 2008; Pavlou & Fygenson, 2006; Venkatesh, Morris, Davis, & Davis, 2003; Wu & Lederer, 2009). Although e-governance is becoming a highly-preferred practice for government institutions to connect with their constituents, 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. 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 (Nov & Ye, 2009). Users' personal convictions and emotional response to introduced technology constitute their internal traits that effect their adoption behavior (Callum, Jeffrey, & Kinshuk, 2014; Weerakkody et al.

2013). Personal convictions include characteristics like trust in the internet and resistance to change, whereas technology anxiety is an emotional response that effects users' technology adoption (Kim & Kankanhalli, 2009; Kummer, Recker, & Bick, 2017; 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. A plethora of IS literature is available on a users' intention to adopt technology (Laumer, 2011; Lee, Kozar, & Larsen, 2003). Adoption of technology is generally studied as intention to use technology in case of voluntary adoption. In the case of a 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, Massey, & Montoya-Weiss, 2002; Lee & Park, 2008).

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 a mandatory adoption scenario remains understudied. Chopra & Rajan (2016) studied the fair price shop 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. Similar extended models have been proposed and analyzed in past to study the effect of personal and system characteristics on technology adoption (Callum et al., 2014; Jeong, 2011; Kim & Kankanhalli, 2009; Kummer et al., 2017; Nov & Ye, 2009; Weerakkody et al., 2013). But 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 a mandatory adoption setting. There are certain considerations of technology adoption that may manifest under a mandated technology use setting but not volitional ones. Mandatory technology adoption setting specific considerations are discussed with their respective hypothesis in research model and hypothesis section to explain 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. The 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.

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 & Ye, 2009). In addition, Nov & 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 India. 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 3.1 depicts the proposed research model.

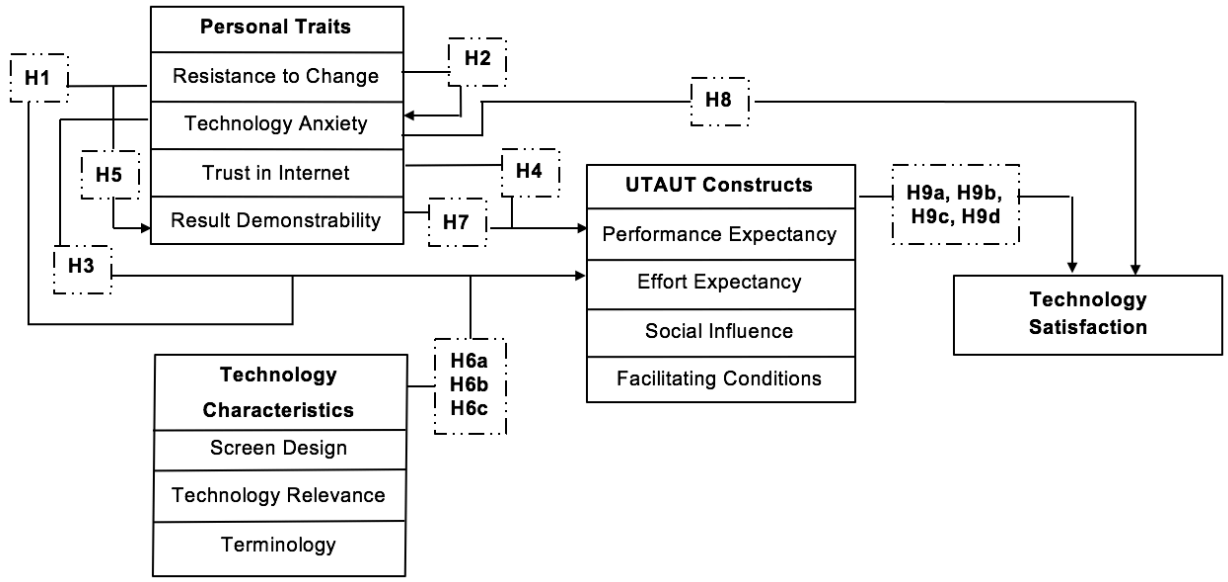

Figure 3.1. Research Model

Implementation of ICT initiatives lead to various changes in processes as well as users' attitudes and knowledge requirements (Rizzuto, Schwarz, & Schwarz, 2014). Users' attitude towards technological changes effect 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 fair price shop salespersons' perception of effort required to learn the use of android tablets and perceived ease in carrying out their daily work using these tablets. Resistance to change (RTCD) is individuals' predisposition to resist change that effects their reaction to the implemented technological system (Sargent, Hyland, & Sawang, 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 & 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 fair price shop 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. Thus, the first hypothesis is:

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). Technology anxiety results either from the fear of making an error or from the fear of damaging the equipment (Thatcher & 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 & 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 & Ye, 2009; Oreg, 2006). Therefore, we hypothesize that:

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

Callum et al. (2014) 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 & 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, Yahia, & Souiden, 2016; Wahab, Noor, & Ali, 2009). 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, Arifoglu, Tokdemir, & Pacin (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 & Ye, 2009; Venkatesh & Davis, 2000). Result demonstrability

is defined as the "tangibility of the outcomes of using new technology" (Venkatesh & Davis, 2000; Wu, Wu, & Chang, 2016). It is the degree to which users perceive that they can comprehend and communicate the advantages, disadvantages and results of using a technology (Karahanna, Straub, & Chervany, 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 & 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; Ramayah, 2006). 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. (in press) found that size of device and its screen was one of the challenges reported by fair price shop 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 & Ye, 2009). Besides interface characteristics, another component of technology attributes is the system characteristics. Focus of this component is on the interaction between the system and its organizational context (Jeong, 2011; Thong, Hong, & Tam, 2002). 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 & 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 & Davis (2000) established a positive relationship between result demonstrability and performance expectancy. Similar results were observed while studying the adoption of digital libraries (Nov & 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 less stronger relationship between the two constructs as compared to voluntary adoption case of technology use. Therefore, we hypothesize:

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, Adam, Okoe, & Anning-Dorson, 2016; Kurfali et

al. 2017). 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 & Rajan, 2016; Im, Hong, & Kang, 2011; Rana, Dwivedi, Williams, & Weerakkody, 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 intermediary 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. Therefore, we hypothesize that:

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.*

Research Methodology

Instrument Development

To validate the proposed model, a questionnaire based survey was conducted among those fair price shop 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. The questionnaire 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 fair price shop rather than from one particular fair price shop to which they were linked before COREPDS implementation. Cash transfer is a scheme in trial phase under which the state government is planning to transfer subsidies to tie 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 B (Chopra & Rajan, 2016; Nov & 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 & Beck, 2006). Content validity is the degree to which a data collection instrument has adequate sample of construct measures to define the constructs under study (Polit, & Beck, 2006). It is an essential step in development of a new data collection instrument (Beckstead, 2009). Qualitative method of determining content validity requires an examination of the questionnaire by experts (Navidpour, Dolatian, Yaghmaei, Majd, & Hashemi, 2015). Therefore, 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 for content validity 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.

Research Location

Data was collected from 176 fair price shop 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 & Rajan (2016) to investigate the fair price shop salespersons' satisfaction with mandatory adoption of point of sale devices. Therefore, the districts of Raipur and Mahasamund were also 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 & Rajan (2016) chose Mahasamund for data collection because that district had the first rural location point of sale use (Chopra & Rajan, 2016). District of 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 scheme of cash transfer was tested in some of the fair price shops in this region and therefore salespersons' response to this scheme was also explored.

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 fair price shop salespersons. List of fair price shops 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.

Table 3.1. Respondent Descriptive Statistics

Variable	Range	Number	Percentage
Age	20 – 29	47	26.7
	30– 39	70	39.8
	40 – 49	38	21.6
	50 – 59	18	10.2
	60 and above	2	1.1
	Missing values	1	0.6
Education Level	Primary (Upto 5th standard)	3	1.7
	Secondary (Upto 8th standard)	8	4.6
	Senior Secondary (Upto 10th standard)	27	15.3
	Higher Secondary (Upto 12th standard)	73	41.5
	College or higher	62	35.2
	Missing values	3	1.7
Gender	Female	8	4.5
	Male	168	95.5
Experience with fair price shops (years)	0 – 4	61	34.7
	5 – 9	52	29.5
	10 – 14	28	15.9
	15 – 19	10	5.7
	20– 24	14	8.0
	24 or more	9	5.1
	Missing value	2	1.1
Experience with tablets (months)	0 – 9	116	65.9
	10– 19	50	28.4
	20 – 29	6	3.4
	30 or more	4	2.3
Experience with cellphones (years)	0	9	5.1
	1 – 4	30	17.0
	5 – 9	78	44.3
	10 – 14	50	28.4
	15 -19	7	4.0
	Missing values	2	1.1

Questionnaires were provided to fair price shop 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 fair price shops. Table 3.1 shows the respondent descriptive statistics of salespersons from 176 fair price shops.

Data Analysis

The collected data was analyzed using partial least squares structural equation modeling (PLS-SEM) methodology implemented in SmartPLS (Ringle, Wende, & Becker, 2015). SEM is a multivariate statistical analysis tool that helps to understand and incorporate variables which are indirectly measured by indicator variables (Hair, Hult, Ringle, & Sarstedt, 2017). PLS-SEM is used for prediction and explanation of target constructs when the theory is in developing stage (Hair et al., 2017; Rigdon, 2012). 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 (Cassel, Hackl, & Westlund, 1999; Chopra & 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, Cui, & Babenko, 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. The 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 & Rajan, 2016; Fornell & 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 & Rajan, 2016).

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.

Model Reliability and Validity

Figure 3.2 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 3.3) and outer loadings of all constructs were above 0.7 (Table 3.2). These results show that all the constructs have high level of convergent validity. Appendix C indicates that the outer loadings of all the constructs were greater than cross

loadings. Furthermore, Table 3.3 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).

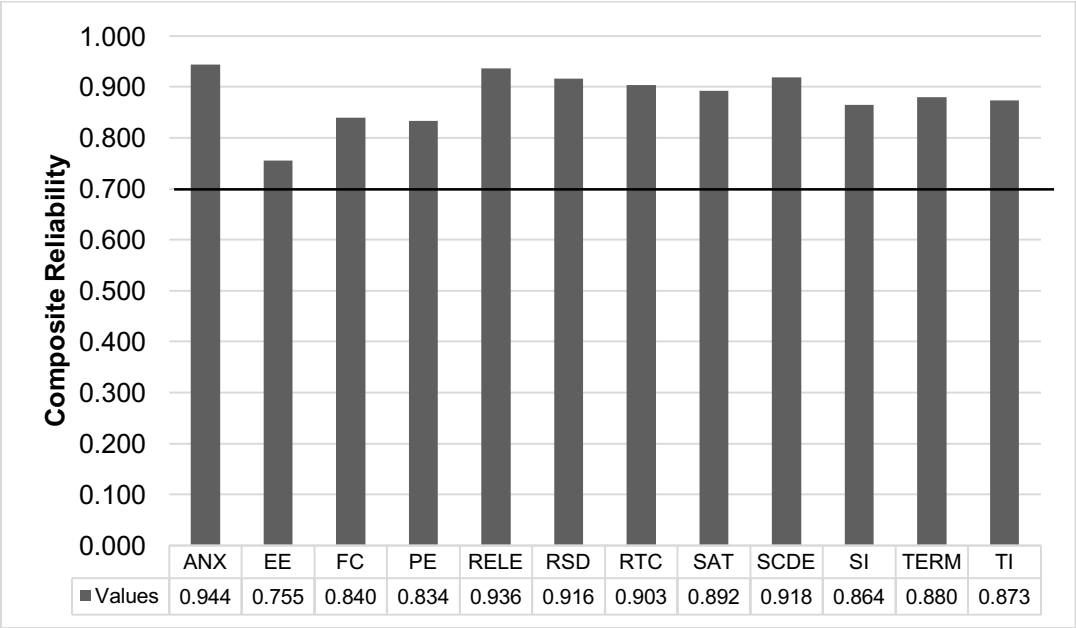

Figure 3.2. Composite reliability of model constructs: A measure of internal consistency reliability

Table 3.2. Outer loadings of model constructs: A measure of convergent validity

	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**

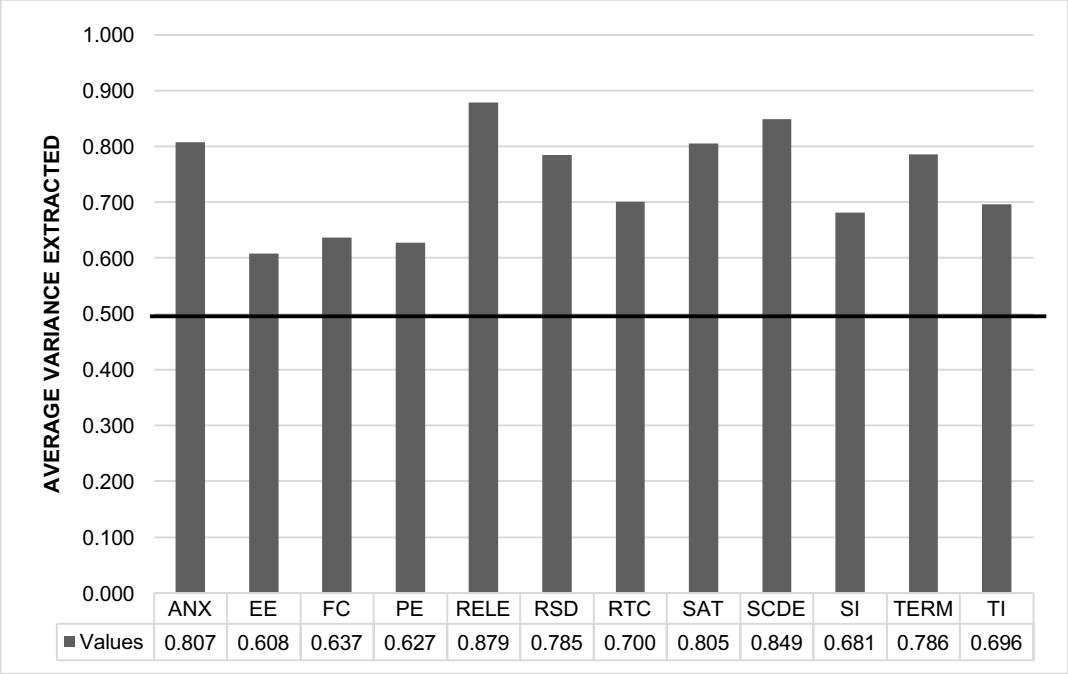

Figure 3.3. Average Variance Extracted of model constructs: A measure of convergent validity

Table 3.3. Fornell-Larcker Criterion: A measure of discriminant validity

	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**

Hypothesis Testing

Table 3.4 shows the statistical significance of path coefficients.

Table 3.4. Hypothesis testing of technology characteristics and users' internal traits

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	**<0.001*****
H5	RTC -> RSD (Negative)	-0.285	3.678	**<0.001*****
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	**<0.001*****
H9a	EE -> SAT (Positive)	0.271	4.814	**<0.001*****
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

* $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$

We considered a 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=1.094x10^{-5}); resistance to change was negatively related to result demonstrability (β=-0.285, p=2.602x10^{-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=1.436x10^{-10}); and effort expectancy (β=0.271, p=1.967x10^{-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.

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 & Ye, 2009) the current results demonstrated that users who resist change believed that introduction of android tablets increased the effort employed in their daily work. Therefore, it can be inferred that if users who inherently resist change are mandated to use new technology, they perceive that effort required to perform their daily tasks increase.

The relationship between resistance to change and technology anxiety was also consistent with literature (Nov & 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, Ostrom, Bitner, & Roundtree, 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 & 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. Hence additional steps must be taken by corresponding agencies for better technology adoption by users who tend to resist change. At present, the training provided by government agencies relates to informing the users about the working of technology. The training content does not consider the effect of users' personal convictions and their emotional response upon implementation of technology. It is vital of government agencies to make sure that users are informed about the benefits of these technologies instead of imposing their utilization.

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 (Hong et al., 2002; 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 & Ye, 2009). 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.

The results depict 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 & 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 showed that users who could understand and communicate the advantages, disadvantages and results of using android tablets had a higher performance expectancy. Hence 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, it is still an important personality trait to be studied. Result demonstrability does 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 fair price shop 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 & Wilson-Evered, 2012). With the use of android tablets, all data are 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 expectancy. 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.

Screen design, relevance of technology and terminology were the three system characteristics that were studied. Effort expectancy was found to be positively and significantly influenced by screen design and terminology. Survey of salespersons using point of sale devices in Chhattisgarh's food supply chain revealed that various salespersons were dissatisfied with those devices because of the small screen size and difficult to comprehend terminology (Chhabra et al., in press). 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 using proper device interface that users are comfortable with to perform their daily operations. Therefore, proper technology selection is a necessity to implement a new technology and its successful adoption by users. This also confirms the observed relationship between screen design and technology satisfaction. Contrary to findings of the literature (Jeong, 2011; Nov & Ye, 2009), relevance of technology did not affect the effort expectancy in this mandatory adoption environment. Therefore, users have no option but to use the provided technology without considering the degree to which it is relevant to perform tasks at hand.

Effort expectancy, performance expectancy, and social influence were found to have a significant positive influence on technology satisfaction. Therefore, ease of use and performance improvement need to be taken into consideration 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 should contain a segment elucidating the way using new system would lead to an easier and better work process. 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 & 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.

Conclusion, Limitations and Future Research

The results of this study suggest that both technology and users' internal characteristics play a vital role in their 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.

The data was collected from 176 fair price shops mostly from the rural areas because the 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 public administration. A comparison between the effect of technology and users' internal characteristics in rural and urban areas will equip policy makers to take a decision on implementing a common or separate systems 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 not only help in understanding their technology adoption behavior but also employing correct salespersons to utilize the technology and distribute food to beneficiaries. 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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CHAPTER 4. SUMMARY AND CONCLUSION

Summary

This research analyzed technology adoption of intermediary users when mandated to use point of sale devices and tablets for food distribution in the public distribution system of Chhattisgarh. The thesis provided an in-depth analysis and understanding of challenges faced by users in adopting a mandated technology and presented a deep insight into various factors that affect their technology adoption behavior. In the first study, authors prioritized the six identified improvement areas using quality management tools of list reduction, affinity diagram and Pareto chart. This prioritized list included "Infrastructure," "Machine design: Hardware," "Process design," "Salesperson' errors," "Government support," and "Machine design: Software". Utilizing the results of this study, authors proposed suggestions to aid government agencies and policy makers in expanding e-government policies.

The second study proposed an extension of UTAUT to identify the effect of technology characteristics (screen design, technology relevance, terminology) and users' internal traits (resistance to change, trust in internet, technology anxiety, result demonstrability) on technology satisfaction of intermediary users in mandatory adoption environment. The authors utilized partial least square structural equation modeling to identify the nature and effect of these factors on users' technology adoption behavior. The results indicated that resistance to change, trust in internet, technology anxiety, screen design and terminology had a direct or indirect influence on technology satisfaction whereas result demonstrability and technology relevance had no effect. An in-depth analysis of these results helped to propose policy and process improvement

suggestions that would be beneficial to technology designers, policy makers, technology users as well as end beneficiaries.

Conclusion

Analysis of technology adoption of point of sale devices and tablets by intermediary users in the public distribution system of Chhattisgarh in India indicates that government agencies and policy makers are bound to consider technology users' perspective while implementing new e-government initiatives. The results of this study will eventually help improve the efficiency of food distribution through fair price shops by proposing policy suggestions that would help implementing better technologies. Results from the first study suggest that approximately 75% of challenges faced in technology adoption can be resolved by focusing on better infrastructure, machine hardware design and process design. Furthermore, lack of infrastructure was identified as the prime area of improvement. Infrastructure consists of three challenges out of 33, which shows that providing better internet connections, more than one device shop and call centers to solve technical issues would improve the technology adoption by more than 33%. Therefore, utilizing intermediary users' perspective would allow the government agencies to create processes and policies in a way that would make it easier for the intermediaries to mediate between government and beneficiaries and provide better services in a timely manner. The results of this study were shared and discussed with NIC, Chhattisgarh in 2016. Their transition plan from POS devices to android tablets conforms with these reults.

Understanding the effect of users' personality traits and their perception of technology characteristics on their technology adoption behavior would allow designers to create a technology containing an optimum between technology and users' characteristics. It would also help government agencies and policy makers to create efficient ICT related policies, better

training programs and easier implementation of e-governance initiatives. Any improvement based on the results of this study would help increase the technology satisfaction of users, eventually leading to better services to beneficiaries.

With increasing use of technology in India and subsidized food being made a right for below poverty line households, all the states in the country are bound to implement ICTs in their PDS supply chains as well as other e-governance initiatives. Results of this study could help the state governments to consider technology users' perspective while implementing such technology based policies. Similarly, various developing countries are focusing on the use of ICTs in public administration. Learnings from technology implementation and use in India's e-governance initiatives can be utilized in implementation of technologies in similar initiatives in other developing countries. The challenges identified in the first study are not limited to ICTs in food supply chain and therefore, the results would be helpful for government agencies to create efficient process by curtailing these challenges. Furthermore, understanding the effect of technology characteristics, and users' personal convictions and emotional response would help government agencies in various developing countries to create a more efficient technology implementation plan due to increased technology satisfaction of users.

Furthermore, utilizing structured techniques like quality management tools and partial least square structural equation modeling allows researchers to evaluate the inputs in a highly systematic manner. Utilizing quality management tools allow researchers to obtain more information by systematically organizing the data. Furthermore, analysis done using these techniques consolidates information such that transition from theoretical implications to actual practice becomes feasible. Therefore, studies on technology adoption in public administration

require the use of these structured data analysis techniques that facilitates researchers to make informed decisions and government agencies to channelize their resources more effectively.

Delimitations, Limitations, and Future Work

Chapter 2 employed qualitative methods to analyze challenges faced in technology adoption by fair price shop salespersons in food supply chain of public distribution system of Chhattisgarh. Considering the highly focused and descriptive nature of the topic, the study was bounded by various limitations in terms of research location, data collection, sampling procedure and data analysis techniques. The data was collected from three regions of the state where COREPDS was implemented at different times leading to variation in experience with POS devices among the users. But aggregation of data from different regions is justified by the need of a large sample size, similar participant background, similar infrastructure availability and consistent training regardless of location of fair price shops. Furthermore, the variation in experience with POS devices helped include the perspective of salespersons that were new to the introduced technology as well as those who were utilizing the devices from two years. Although the research has a specific geographic scope but the findings can be utilized to create a hassle-free technology adoption environment at a broader level. Similar studies in other parts of the world could bolster the finding s of this study leading to generalization of results.

The data collection was restricted to fair price shops where POS devices were implemented. Data was collected using snowball sampling techniques which was an appropriate method given the field constraints. This narrowed down the breadth of stakeholders accessed leading to limited participation. Although other sampling techniques could lead the sample to be a better representation of total population, but the limited number of fair price shops with POS devices led to the utilization of this method. Furthermore, the sampling technique employed for

data collection is justifiable because of the objective of this research was to understand technology users' perspective across the state of Chhattisgarh and all fair price shop salespersons across the whole state would work under similar work setting once the technology was implemented throughout.

Data were analyzed using quality management tools that have traditionally been employed in industrial and manufacturing setting to increase profitability and customer satisfaction. Utilization of these tools provided a systematic and structured way of organizing the available data such that the results available could help various stakeholders to take informed decisions. In future, similar studies can be accompanied by quantitative studies to acquire a deeper understanding of the results.

Chapter 3 focused on utilization of PLS-SEM to analyze the effect of technology parameters and users' traits and convictions on their technology adoption behavior while utilizing tablets for distributing commodities. Most of the data was collected from rural areas because most of the urban fair price shops were utilizing POS devices at the time of data collection. The results of existing study can be utilized to urban setting to understand the technology acceptance of technology users due to the similar work processes and nature of activities carried out in fair price shops throughout the state. But a comparative analysis of technology adoption behavior between urban and rural settings is still required to collect the data from a sample that represents the whole population to give more credence to the generalization of results.

The study does not take into consideration the moderating effect of demographics factors like age, gender, education, and experience with technology, as well as fair price shops. The current research takes into consideration the perspective of salespersons of various age groups,

education levels and duration of technology and fair price shop experience, but does not analyze their effect on the results obtained. Therefore, future research work can investigate into these factors to further support in implementation of appropriate technologies across e-government initiatives. The model utilized for data analysis was found to be reliable and valid for explaining the technology adoption behavior of salespersons in mandatory technology use setting. Therefore, future studies to validate this extended model in similar empirical context would allow researchers and practitioners to generalize these results and contribute towards the larger international debate of technology utilization in public administration, specifically food security related e-governance initiatives.

APPENDIX A [CHALLENGES FACED IN ADOPTING POINT OF SALE DEVICES GROUPED BY THEME]

Challenge	Description
Device Design: Hardware	
Small device size	Small device, buttons, and screen size made the device inconvenient for salespeople to use.
Faulty touch mechanism	Unresponsive devices made handling them inconvenient during transactions.
High transaction time	Slow device speed and slow working of salespeople led to longer transaction time and beneficiary dissatisfaction.
Short battery life	Short battery life made conducting transactions a challenge.
Device display problems	Inaccurate device display was a concern reported by salespeople.
Device buttons malfunctions	The device's buttons sometimes did not work properly and had to be pressed twice, slowing down service.
Offline operation mode	Using the device in offline mode was a challenge because stock did not get updated once the device was used in the offline mode.
Device Design: Software	
Upgrade of software	Software installed in POS device was old and needed upgrading.
Device-generated daily transaction report	Salespeople wanted devices to generate a daily transaction report at the end of each day so they could more easily track the quantity of each commodity sold to various cardholder types.
List of beneficiaries in POS devices	POS devices must contain a list of all the beneficiaries.
Real-time stock information	POS devices did not display real-time stock information; they did not update once a transaction was completed, leading to a mismatch in the actual quantity of commodities available and that shown by POS devices.
Stock and price information by income category	Because people in different income categories are eligible for different commodities at different costs, salespeople wanted stock eligibility and cost information to be made available on POS devices.
Process Design	
Long wait time	Long wait time and long queues made the process of carrying out transactions very time consuming, leading to impatience and quarrels between beneficiaries and fair price shop salespeople and also shop deterioration and loss of business due to high beneficiary dissatisfaction.
Double entry of transactions	Requirement of entering each transaction twice, both using POS devices and in the register after completing transaction was a challenge and deemed unnecessary by salespeople.
Registering transactions later	Salespeople wanted the government to allow them to register transactions later, after they provided commodities to beneficiaries, to help provide faster service.
Automatic quantity entry	Improved technology needed so that quantity to be distributed is automatically entered into the device and not required to be entered by the salesperson, who could misuse the system by entering the wrong quantity.
Automatic money transfer between beneficiary and shop	Handling cash was a challenge; salespeople wanted beneficiary smartcards to be linked to the shop's bank accounts so that money could be deducted directly from beneficiary's smartcard and debited to fair price shop owner's bank account, which would be a less complex process.
Manual transactions when device doesn't work	Salespeople wanted transactions to be processed through manual registers when they were unable to carry out transactions such as when POS devices broke down or did not work due to network issues.
Link POS to Civil Supplies Corporation	Link transactions from POS devices Civil Supplies Corporation (CSC, responsible for procuring food grains and other commodities from the Food Corporation of India and distributing them to fair price shops) so that once stock in the fair price

	shop was depleted, CSC was automatically informed and provided more stock om time.
Serving beneficiaries without smartcards	It was not possible to serve beneficiaries if they did not have their smartcard at the time of transaction.
Multiple transaction entries at same time	Only one transaction at a time were possible with POS devices, leading to longer wait times for beneficiaries, which led to dissatisfaction for both beneficiaries and salespeople.
Providing commodities on credit using POS devices	Salespeople wanted POS devices changed so that beneficiaries could pay at a later date in case they were out of cash, an acceptable practice before POS devices were instituted.
Infrastructure	
Poor connectivity/ network/signal	Poor network led to failed transactions which caused some customers to leave without their entitlements.
More devices per shop	Only one device was available for each fair price shop, which meant salespeople could only provide entitlements to one person at a time.
Call centres needed	Government must provide call centre facility where salespeople can get POS-related complaints and queries recorded and answered.
Government Support	
Training	Salespeople wanted basic training to solve various POS issues at their end.
More field engineer support	Salespeople wanted field engineers to be in contact with them more often.
Government-provided insurance	Government should provide the ability to get insurance because device damage and theft was a major concern.
Ethernet cable	Salespeople had to bear the cost of the ethernet cable when it got damaged.
Supply costs	Salespeople reported that buying paper rolls for billing was a challenge, and they wanted the government to either provide them or reimburse the amount they spent buying them.
SIM recharge facility	Government must provide facility to recharge SIM cards.
Call centres needed	*Repeat*
Salespeople Errors	
Transaction errors	Salespeople sometimes carried out wrong transactions due to their own errors.
Theft of POS device	Design of POS device was such that it could be easily stolen.
High transaction time	*Repeat*

APPENDIX B [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 fair price shop 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.

APPENDIX C [CROSS LOADINGS OF MODEL CONSTRUCTS: A MEAURE OF DISCRIMINANT VALIDITY]

	ANX	EE	FC	PE	RELE	RSD	RTC	SAT	SCDE	SI	TERM	TI
ANX1	**0.833**	-0.194	-0.087	-0.234	-0.062	-0.327	0.178	-0.272	-0.158	-0.074	-0.153	-0.426
ANX2	**0.885**	-0.238	0.015	-0.134	-0.208	-0.404	0.257	-0.263	-0.147	0.044	-0.220	-0.302
ANX3	**0.943**	-0.094	0.002	-0.080	-0.147	-0.405	0.284	-0.201	-0.149	0.014	-0.199	-0.387
ANX4	**0.930**	-0.141	-0.024	-0.093	-0.259	-0.437	0.272	-0.253	-0.171	-0.017	-0.201	-0.427
EE1	-0.137	**0.832**	0.170	0.383	0.119	0.114	-0.221	0.443	0.268	0.164	0.231	0.200
EE2	-0.160	**0.724**	0.320	0.210	0.079	0.232	-0.242	0.281	0.276	0.165	0.207	0.116
FC1	-0.086	0.167	**0.727**	0.340	0.046	0.162	-0.107	0.133	0.133	0.165	-0.045	0.083
FC2	-0.118	0.239	**0.820**	0.163	-0.057	0.203	-0.089	0.154	0.102	0.141	-0.165	0.011
FC3	0.078	0.287	**0.843**	0.190	0.199	0.105	0.021	0.253	0.335	0.291	0.061	0.151
PE1	-0.142	0.260	0.216	**0.862**	-0.068	0.091	-0.009	0.394	0.012	0.317	0.004	0.282
PE2	-0.161	0.248	0.147	**0.804**	-0.105	0.209	-0.033	0.384	0.047	0.277	0.120	0.299
PE3	-0.040	0.423	0.285	**0.701**	0.057	0.018	-0.056	0.440	0.225	0.416	0.118	0.190
RELE1	-0.214	0.137	0.106	-0.076	**0.956**	0.388	-0.174	0.276	0.364	0.075	0.457	0.380
RELE2	-0.141	0.102	0.098	-0.010	**0.919**	0.269	-0.124	0.244	0.271	0.119	0.445	0.327
RSD1	-0.438	0.129	0.139	0.039	0.350	**0.862**	-0.291	0.148	0.243	-0.166	0.187	0.107
RSD2	-0.346	0.234	0.150	0.147	0.333	**0.895**	-0.214	0.203	0.338	-0.075	0.311	0.252
RSD3	-0.385	0.205	0.190	0.174	0.275	**0.900**	-0.249	0.170	0.407	-0.163	0.257	0.242
RTCD1	0.227	-0.164	0.005	-0.032	-0.185	-0.243	**0.817**	-0.246	-0.109	-0.021	-0.236	-0.211
RTCD2	0.221	-0.318	-0.164	-0.215	-0.013	-0.214	**0.777**	-0.398	-0.194	-0.184	-0.154	-0.319
RTCD3	0.270	-0.189	-0.044	0.060	-0.150	-0.222	**0.854**	-0.239	-0.193	0.030	-0.298	-0.263
RTCD4	0.217	-0.292	0.035	0.057	-0.203	-0.272	**0.895**	-0.213	-0.245	0.070	-0.301	-0.118
SAT1	-0.213	0.458	0.208	0.560	0.207	0.184	-0.326	**0.914**	0.232	0.461	0.076	0.545
SAT2	-0.288	0.386	0.228	0.345	0.302	0.165	-0.261	**0.881**	0.198	0.408	0.224	0.527
SCDE1	-0.171	0.370	0.341	0.168	0.292	0.368	-0.249	0.295	**0.952**	-0.030	0.288	0.292
SCDE2	-0.145	0.249	0.118	0.021	0.362	0.315	-0.151	0.116	**0.890**	-0.146	0.387	0.106
SI1	-0.175	0.125	0.150	0.254	0.036	-0.028	-0.132	0.373	-0.134	**0.737**	-0.037	0.254
SI2	0.099	0.236	0.297	0.397	0.116	-0.169	0.035	0.429	-0.026	**0.881**	-0.063	0.324
SI3	0.046	0.153	0.210	0.392	0.090	-0.178	0.005	0.400	-0.053	**0.851**	0.067	0.367
TERM1	-0.203	0.261	0.057	0.123	0.503	0.267	-0.234	0.188	0.432	0.003	**0.898**	0.381
TERM2	-0.182	0.237	-0.130	0.054	0.341	0.232	-0.292	0.092	0.183	-0.029	**0.875**	0.237
TI1	-0.294	0.274	0.187	0.237	0.347	0.210	-0.247	0.453	0.317	0.301	0.399	**0.859**
TI2	-0.526	0.112	-0.008	0.277	0.258	0.208	-0.208	0.402	-0.013	0.262	0.218	**0.803**
TI3	-0.275	0.142	0.105	0.297	0.337	0.159	-0.223	0.603	0.253	0.377	0.269	**0.840**