COMPREHENSIVE ADOPTION MODEL OF M-GOVERNMENT: A CITIZENS' PERSPECTIVE FROM THE SMART CITIES OF KARNATAKA

Thesis

submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

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SCHOOL OF MANAGEMENT

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA,

SURATHKAL, MANGALORE – 575025

August, 2022

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DECLARATION

I hereby *declare* that the Research Thesis entitled "**COMPREHENSIVE ADOPTION MODEL OF M-GOVERNMENT: A CITIZENS' PERSPECTIVE FROM THE SMART CITIES OF KARNATAKA**" which is being submitted to the **National Institute of Technology Karnataka, Surathkal** in partial fulfilment of the requirements for the award of the Degree of **Doctor of Philosophy in Management** is a *bonafide report of the research work carried out by me*. The material contained in this thesis has not been submitted to any University or Institution for the award of any degree.

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CERTIFICATE

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ABSTRACT

In this era of technology-driven innovation, a digital transformation like m-government services and social media plays a major role in boosting government services. Further, it has a crucial role in the realization of the smart cities mission. However, with m-government success in India falling short of expectations, there is a need for a detailed understanding of its adoption among citizens, for better implementation. The study thus integrates diffusion of innovation and uncertainty reduction theories to know the significant factors impacting the Behavioural Intention (BI) of citizens to use m-government in the smart cities of Karnataka. The framework developed consists of attitudinal factors viz. relative advantage, ease of use, compatibility, and image. As a means of reducing uncertainty, trust and transparency and under quality dimensions' information, and system quality are used. It had other external factors viz. awareness, facilitating conditions, social influence. The inclusion of social media to analyze its impact on m-government adoption is another key component.

For the analysis, the primary data (1444 responses) obtained is analyzed using structural equation modelling approach. The factors relative advantage, compatibility, facilitating condition, and trust had a significant direct impact on the BI. The mediation analysis indicated the importance of being aware of specific aspects such as relative advantage and compatibility (as mediators) to enhance adoption. Further, the vitality of information quality and transparency in increasing trust was emphasized. The results also proved the mediating role of image and social influence between awareness and trust, and then on BI. Moreover, social media was perceived to play a critical role in m-government services. The results of the moderation analysis revealed some differences between various groups of demographic variables. One of the critical outcomes here is social influence, and social media had a more substantial impact among Bengaluru's citizens, young adults, and students. Also, senior citizens, lower-income groups, and residents of cities other than Bengaluru had a more significant impact on the indirect role of awareness and information quality. The discussion on results, the theoretical and practical implications are described in detail.

Keywords: M-Government, Behavioural Intention, Social Media, Diffusion of Innovation, Uncertainty Reduction Theory, Smart Cities

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ABBREVIATIONS

AHP	:	Analytical Hierarchical Process
ANN	:	Artificial Neural Network
AVE	:	Average Variance Extracted
AW	:	Awareness
BCA-D	:	Bibliometric Coupling Analysis Of Documents
BHIM	:	Bharat Interface for Money
BI	:	Behavioural Intention
CAGR	:	Cumulative Annual Growth Rate
CBS	:	Cell Broadcasting Services
CB-SEM	:	Covariance-Based SEM
CCA-R	:	Co-Citation Analysis of References
CeG	:	Centre for E-Governance
CFA	:	Confirmatory Factor Analysis
CMB	:	Common Method Bias
CMP	:	Compatibility
CR	:	Composite Reliability
CSF	:	Critical Success Factors
DOI	:	Diffusion of Innovation
DV	:	Dependent Variables
ECM	:	Expectation Confirmation Model
EFA	:	Exploratory Factor Analysis
EG	:	Electronic Government
EMF	:	Electromagnetic Frequency
EU	:	Ease of Use
eWOM	:	Electronic Word of Mouth
FC	:	Facilitating Condition
FsQCA	:	Fuzzy Set Qualitative Comparative Analysis
FY	:	Financial Year
G	:	Graduate

G2B	:	Government to Businesses
G2C	:	Government to Citizens
G2E	:	Government and Employees
G2G	:	Governments and Other Government
GCC	:	Gulf Cooperation Countries
GE	:	Government Employee
GMS	:	Government Microblogging Services
GOI	:	Government of India
GPS	:	Geographic Positioning Systems
GST	:	Goods and Services Tax
HTMT	:	Heterotrait - Monotrait Ratio Of Correlations
ICT	:	Information and Communication Technology
IDT	:	Innovation Diffusion Theory
IM	:	Image
InDG	:	India Development Gateway
INR	:	Indian Rupees
IoT	:	Internet of Things
IQ	:	Information Quality
IS	:	Information System
ISSM	:	Information System Success Model
IT	:	Information Technology
IV	:	Independent Variables
IVRS	:	Interactive Voice Response System
KMO	:	Kaiser-Meyer-Olkin
LBS	:	Location-Based Services
LLCI	:	Lower Limit Confidence Interval
MADAD	:	Mobile Application for Desired Assistance During Travel
MCC	:	Model Code of Conduct
MD	:	Mahalanobis Distance
MGA	:	Multi Group Analysis
MGNREGA	:	Mahatma Gandhi National Rural Employment Guarantee

M-government	:	Mobile Government
MOE	:	Margin of Error
MoEIT	:	Ministry of Electronics And Information Technology
MoHUA	:	Ministry of Housing and Urban Affairs
MSDG	:	Mobile Service Delivery Gateway
NCE	:	Not Currently Employed
NeGP	:	National E-Governance Plan
NFI	:	Normed Fit Index
NIC	:	National Informatics Centre
OECD	:	Organisation for Economic Co-Operation and Development
PE	:	Private Employee
PEU	:	Perceived Ease of Use
Pg+	:	Post-Graduate and Above
PLS	:	Partial Least Square
PMGSY	:	Pradhan Mantri Gram Sadak Yojana
PPP	:	Public-Private Partnership
PS	:	Primary/Secondary
PSU	:	Public Sector Unit
PU	:	Perceived Usefulness
QFD	:	Quality Function Deployment
RA	:	Relative Advantage
RAS	:	Rapid Assessment System
RTI	:	Right to Information
RTO	:	Regional Transport Offices
SaaS	:	Software as Service
SDT	:	Self Determination Theory
SE	:	Self-Employed
SecIdAM	:	Single-Sign-On Identity Management System
SEM	:	Structural Equation Modelling
SERQUAL	:	Service Quality

SI	:	Social Influence
SJR	:	Scimago Journal Rank
SM	:	Social Media
SM Ads	:	Social Media Advertisements
SMS	:	Short Message System
CMSMS	:	Coal Mine Surveillance and Management System
SNIP	:	Source Normalized Impact Per Paper
SOA	:	Service-Oriented Architecture
SOR	:	Stimuli Organism Response
SPSS	:	Statistical Package for Social Sciences
SQ	:	System Quality
SRMR	:	Standardised Root Mean Square Residual
St	:	Students
SWOT	:	Strength-Weakness-Opportunity-Threat
T	:	Trust
TAM	:	Technology Acceptance Model
TOE	:	Technology-Organization-Environment
TPB	:	Theory of Planned Behaviour
TRA	:	Theory of Reasoned Action
TRAI	:	Telecom Regulatory Authority Of India
TRN	:	Transparency
TTF	:	Technology-Task Fit
UAE	:	United Arab Emirates
UGT	:	Use and Gratification Theory
UIDAI	:	Unique Identification Authority of India
ULCI	:	Upper Limit Confidence Interval
UMANG	:	Unified Mobile Application for New-Age Governance
UPI	:	Unique Payment Interface
URJA	:	Urban Jyoti Abhiyaan
URT	:	Uncertainty Reduction Theory
USSD	:	Unstructured Supplementary Service Data

UTAUT	:	Unified Theory of Acceptance and Use of Technology
UTS	:	Unreserved Ticketing System
VAS	:	Value Added Services
VIF	:	Variance Inflated Factor

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Chapter 1
INTRODUCTION

1.1 OVERVIEW

Mobile government (or m-government) services are now a core priority of the government in delivering citizen-centric services. This study aims to investigate the critical factors that can have a significant impact on public acceptance of m-government. The first chapter provides the background information about the m-government scenario in India, discusses the research problem, and examines the need for research. The chapter then specifically states the research goals and presents the research problems, scope, and significance of the study. Finally, it outlines the organisation of the thesis chapter by chapter.

1.2 BACKGROUND OF THE STUDY

The development of the Information and Communication Technology (ICT) sector, especially the internet and mobile technologies, has transformed the way people live in society. It has created an all-new way for communication and dissemination of information around the globe. These changes have an enormous impact on all the facets of society such as business, government, education, etc.

One of the major revolutions of this technology is the evolution of m-government that enables governments across the world in developing smart cities for sustainable and citizen-friendly governance. The rapidity of mobile penetration and its associated benefits has made it an accessible mode of providing services. The prime benefits derived from this technology are fast and easy access, and cost-effective services. Hence, m-government has become a critical subset of electronic government (EG). EG refers to the use of ICTs like the internet and computers to provide government services (Shareef et al., 2011). M-government refers to the use of mobile and wireless communication technologies such as mobile apps, within the government to deliver information and services to citizens and businesses (Ntaliani et al., 2008). It helps the government in providing effective citizen-centric services, improving their interaction with citizens in creating transparency and trust, and thus strengthening the democracy (Z. Chen et al., 2016).

India has witnessed an unprecedented increase in the usage of cellular technology and related services. According to the Telecom Regulatory Authority of India (TRAI), Government of India (GOI), there were about 1163.41 million mobile phone subscribers as of January 2021, with a monthly growth rate of 0.84 per cent (TRAI, 2021, March). The internet user base is estimated to be around 749.07 million as of 30th June 2020, with an annual growth of 21.36%. Of this, about 97% of the subscribers, i.e. 726.01 million subscribers, accessed the internet through their mobile devices (TRAI, 2020, November). Further, the average consumption of data per subscriber per month increased from 62MB in 2014 to 12.15 GB in June 2020 (TRAI, 2020, November). In addition, in the total bill component, the data component constituted about 44% of the total revenue, which is a significant contribution. It is also important to note that mobile internet users are more than computer internet users. Further, it is interesting to see that the growth pace is higher in rural India, thereby increasing the spread of access (ERU-S, 2019; TRAI, 2020, November).

Hence, the transformation and the growth taking place in these technologies, like smartphones and mobile internet, has forced the government to shift towards these technologies to tap their potential (R. Kumar, 2016; Smith et al., 2019). It is even reflected in GOI's initiative of the 'Digital India' programme and the 'Smart Cities' mission. The objective of these initiatives is to facilitate digital infrastructure for everyone and digital empowerment of citizens to reform and improve the ecosystem of public services. A lot of m-government efforts has been initiated by the GOI to increase the access to government services. Some of the notable initiatives are m-Kisan for agricultural-related information, in the field of the public distribution system, utility bill payment services and in health sectors. Even public-private partnerships are providing services in areas like m-health, m-education, m-agriculture, and m-citizen (InDG, 2019; Saxena, 2017).

As is the case in any country, India too has its share of successes and failures in the implementation of m-government. Low acceptance of these initiatives is undoubtedly one of the primary concerns for the GOI in their Digital India Mission (Agarwal, 2017; Kaur and Dani, 2017). The other challenges were found to be lack of commitment, lack of communication among the intermediaries, lack of business process modification, digital divide, poor infrastructure etc. (Mittal and Kaur, 2013; Shukla, 2017). Portals of Indian private companies are performing better than the portals of Government and PSU's. Even though the government portals in India have initiated integration for an interoperable position, there is a considerable dispersion of the level of integration of government portals (Tripathi and Gupta, 2014; Tripathi et al., 2013). Against these background, research on m-government has gained a lot of importance among the practitioners and has become a fruitful field of scientific research.

Moreover, m-government in developing countries like India are still in evolving stages, and there is a limited number of studies from the citizen's perspective (Saxena, 2017; Shareef et al., 2014; Sharma et al., 2018; Wirtz and Birkmeyer, 2018). Further, understanding citizen's perceptions are believed to play a vital role in the policy formulations concerning m-government projects (Ahmad and Khalid, 2017; Saxena, 2018; Shareef et al., 2012). Hence, it necessitates the need for a study in this direction on analysing the citizen's preferences and attitude towards the use of m-government adoption. It would primarily support the government in strategizing their plans regarding the execution of m-government projects (Ahmad and Khalid, 2017; Shareef et al., 2012). Hence, this study is oriented towards understanding the key factors influencing the m-government adoption from the citizen perspective.

The scope of this study is limited to the smart cities of Karnataka State in India. A smart city refers to the development of necessary infrastructure, the introduction of efficient urban mobility and public transport, and Information Technology (IT) connectivity besides other features in a town. The aim of which is to make the city citizen-friendly and sustainable (Smith et al., 2019). The cities like Mangaluru, Belagavi, Shivamogga, Hubbali-Dharwad, Tumakuru, Davanagere, and Bengaluru have been approved for development into smart cities and is in progress towards the same. Specific studies on these cities in terms of assessing the citizen's attitude and intention towards m-government services would give a better understanding of the citizen's acceptance of these services in the region. A location-based analysis is vital since the people's attitude and behaviour varies significantly with the cultural and sub-cultural influence of these cities on the citizen's behaviour (Ahmad and Khalid, 2017; Saxena, 2018; Shahzad et al., 2019; Wirtz and Birkmeyer, 2018). Further, the citizen's behaviour is influenced by their attitude towards respective State and Local government authorities (Ahmad and Khalid, 2017; Al-Hadidi and Rezgui, 2010; Mandari et al., 2017). Hence, m-government being an integral part of the development of smart cities, the outcome of the study would assist the success of m-government and to the overall objective of the Smart Cities Mission.

From the academic research point of view, this topic provides a comprehensive adoption model on m-government, especially for developing countries like India. The study tries to assess the influence of Social Media (SM), and the critical quality factors, along with theories like Diffusion of Innovation Theory (DOI) and Uncertainty Reduction Theory (URT), on the behavioural intention of people towards m-government use. Integration of m-government and social media is a new and key topic in the current scenario as the popularity of social media in these aspects are rising continuously. Overall, with the lack of literature on the citizen's attitude and behavioural intention towards m-government in India and the need for profound understanding on the topic due to the presence of behavioural dynamics, this study is significant. It helps the researchers and implementers, especially in developing countries like India, to have a deeper understanding of the adoption behaviour of individuals, and it also opens up the possibility of further research in the field.

1.3 RESEARCH PROBLEM

Mobile governance is an area that has drawn the attention of the governments across the globe in the attainment of their nation's digitisation goal over the last two decades. It is true even in India, where mobile governance is given the higher priority towards the attainment of the Smart Cities Mission and Digital India Programme of the Government (InDG, 2019). Though several mobile governance projects have been launched in the past, their success is shallow and are not to the expectations (Abu-Shanab and Haider, 2015; Kesavarapu and Choi, 2012; Ochara and Mawela, 2015; Sharma et al., 2018). The significant barriers in developing countries hindering the m-government projects are lack of infrastructures, lower citizen participation, lack of trust with the service providers and poor citizen-centric services (lower access to information and modes of services available) (OECD, 2011; Ochara and Mawela, 2015). Government across the globe have thus realized the need to strategically implement these services rather than just in silos at all levels of ministries and agencies (OECD, 2016). These above developments have resulted in a higher scope for research in this field. Hence, a lot of research works are being carried out across the globe on m-government.

The research on m-government initially has been explored primarily from a technical aspect or supply perspective like the development of frameworks, accessing the challenges and opportunities etc. (M. Kumar et al., 2008; Narayan, 2007; Ntaliani et al., 2008; Sheng and Trimi, 2008; Tomer et al., 2016). However, it is equally important to understand the demand perspective or citizens point of view before strategizing m-government plans (Saadi et al., 2017; Saxena, 2018; Sharma et al., 2018). Hence, empirical research is very crucial, especially on the assessment of citizen's attitudes/intentions towards the adoption of mobile government (Wirtz and Birkmeyer, 2018). Though a few studies have already been carried out in this regard, it is not substantial to get a complete understanding of the prevailing dynamics in the field of adoption behaviour (Liu et al., 2014; Saadi et al., 2017).

Researchers have insisted on making a distinction between m-government and EG and not treating them as the same. M-government with an open network and virtual mode of operation needs a behavioural change in people's attitudes. Thus necessitating the need for specific researches in the area of m-government (Al-Hubaishi et al., 2017; Shareef, Kumar, et al., 2016). Further, the long-term success of m-government cannot be achieved unless these services meet user requirements. In line with these aspects there is a need for further research in understanding the citizen's preferences and perceptions on m-government in India (Saadi et al., 2017; Shareef, Kumar, et al., 2016).

Further, most of the prior studies were cross-sectional (on a particular time), and there exists an experience-transfer effect (change in behaviour through experience over time). Many past researchers have thus highlighted the need for continuous research to observe the changing behavioural attitudes (Alsaadi et al., 2018; Liu et al., 2014). Prior studies also focused on a few specific applications mainly short message system (SMS) based service and thus there is a need to expand the work to newer mobile websites and apps (Beza et al., 2018; Hung et al., 2013; Shareef et al., 2014).

The m-government services are primarily administered by the respective State or Local government in India (InDG, 2019). Hence, the attitude of people towards the government will influence the citizens' acceptance of these services (Al-Hadidi and Rezgui, 2010). It is believed that the citizen's trust in the government will positively impact m-government adoption (Liu et al., 2014; Park and Lee, 2018; C. Wang, 2014). Further, the variations in the level of maturity of m-government services and support provided by government agencies in different locations will also influence the individual's adoption behaviour (Mandari et al., 2017; C. Wang, 2014; Xin et al., 2015).

Hence, there is a need to study from location perspectives such as City, State, or Zone wise to capture better insights on m-government adoption (Alsaadi et al., 2018; Chanana et al., 2016; Ghosh Roy and Upadhyay, 2017; Wirtz and Birkmeyer, 2018). The points mentioned earlier are further critical for India with its initiatives towards digitisation through the Digital India programme and Smart Cities Mission. M-government plays a vital role in the success of the Smart Cities Mission. Furthermore, with the administrative and development responsibilities of this mission given to the respective State governments, their policies and actions become crucial in its success (Alsaadi et al., 2018; Sareen et al., 2013). Hence, understanding the citizen's perception in these cities towards m-government would greatly assist in the formulation of strategies in the implementation and success of m-government.

From a theoretical perspective on behavioural studies, several theories have been adopted by the researchers like Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Unified Theory of

Acceptance and Use of Technology (UTAUT), and DOI among the popular ones. Even though the methods like TAM and UTAUT are most commonly used, it has been argued that these theories are too general, which lack explanatory power (Mandari et al., 2017). On the other hand, DOI theory is said to have constructs that are more specific with high explanatory power under the changing technological environment (Mandari et al., 2017; Saadi et al., 2017). It is also argued that all the theories, including DOI, are not comprehensive enough in explaining the citizen perception of adoption.

Researchers have also emphasized the need to integrate these theories or add other relevant variables to develop a detailed adoption model with better explanatory power (Al-Hadidi and Rezgui, 2010; Carter and Belanger, 2005; Saadi et al., 2017). Here, care should be taken to avoid the possible multi-collinearity by the overlapping of factors (Kapoor et al., 2015; Ohme, 2014). Furthermore, understanding of the variable awareness and the aspects of uncertainty along with the means to reduce it is crucial in the initial stages of technology adoption (Berger and Calabrese, 1975; Shahzad et al., 2019; Venkatesh et al., 2016). Hence, exploring the m-government adoption by integrating the DOI theory and the URT would provide valuable insights on m-government adoption. Besides, the URT theory not being explored substantially in the area of m-government, studies on this will significantly contribute to the field.

Further, Shahzad et al. (2019) in their work, highlighted the need to add social factors along with URT theory to offer a novel perspectives on the m-government adoption. Moreover, a detailed understanding of the relationships between variables such as the direct and indirect effect (i.e. mediations role) are crucial, which are less examined and needs further validation. For instance, Mandari et al. (2017) highlighted the need to examine the indirect role of awareness through attitudinal factors. Similarly, the influence of the factors 'image on social influence' and 'social influence on trust' result in a few mediation paths with BI (Liu et al., 2014). Further, Venkatesh et al. (2016) and Shahzad et al. (2019) highlighted the significance of the factors trust, and transparency as mediators between quality factors and BI to use a technology that is less explored and thus necessitating further investigation.

Furthermore, most studies on m-government have not analysed the influence of demographic factors as moderators but indicated the need to explore these factors (Liu et al., 2014; Saadi et al., 2017; Saxena, 2017; Shareef, Dwivedi, et al., 2016; Sharma et al., 2018). Moderators are considered to improve the predictive power of the model (Sharma et al., 2018). Mandari and Chong (2018) have stated the usefulness of adding moderators with DOI theory to improve the results. The contradicting effects on demographic factors observed in previous studies necessitate the need for further investigation (Ahmad and Khalid, 2017; Beza et al., 2018; Saxena, 2018; W. Zhou et al., 2018).

For instance, Ahmad and Khalid (2017) highlighted the need to analyse the moderating influence of experience on the intention to use m-government. The factors like social influence, and image also had contradicting results which were observed in the previous literature (Kant and Jaiswal, 2017; Kapoor et al., 2015; Shareef, Kumar, et al., 2016). Hence, it necessitates the need to investigate these factors further to consolidate the findings for better understanding. Also, Liu et al. (2014) have proved the relationship of the image on social influence, which has not been considered in many studies. The other important aspect which is less explored is concerning the role played by social media on individual's behaviour and their perception towards the government use of social media in promoting these services (Al-Aufi et al., 2017; Park and Lee, 2018).

Hence, m-government being in an evolving stage, the aspects discussed above will contribute significantly to understand the adoption behaviour of citizens (Saxena, 2018; Shahzad et al., 2019). The study will contribute substantially to the field of research by developing a comprehensive m-government adoption model. The integration of URT and DOI, along with awareness and social factors is a significant contribution to the field. Nevertheless, the practical implications of the study are also vital since it gives a better understanding of the citizen on the perspective of m-government adoption from these proposed smart cities of Karnataka. M-government being a key pillar in the success of this mission, the insights from the study will assist in the effective formulation of strategies about m-government implementation in the Karnataka State of India.

1.4 PROBLEM STATEMENT

MG adoption in India has not been as expected, and there has been a limited supply of empirical research into citizens' intention to adopt these technologies. Furthermore, MG is critical to the success of India's Smart Cities Mission, which is still in its early stages of development. As a result, the limited understanding of citizens' perceptions of MG, particularly in these proposed smart cities, is a knowledge gap that may jeopardize the success of MG and Smart Cities Mission. Hence, this must be addressed through additional research on citizen adoption behaviour.

1.5 RESEARCH QUESTIONS

The key research question that the study addresses are:

1. What are the key determinants that influence the acceptance of m-government services?
2. Is there a significant impact of social media on m-government determinants and adoption?
3. Are there any differences in the adoption behaviour of citizens based on their demographic factors?
4. Are there any differences in the adoption behaviour of the people between the different cities?

1.6 RESEARCH OBJECTIVES

The research aims to investigate the key determinants that influence the adoption behaviour of the citizens towards m-government services. The insights obtained by the study will assist the government agencies in strategizing the implementation of m-government projects especially in the study locations to attain success. Accordingly, the following objectives of the study are laid down:

1. To identify the significant factors that influence the citizens' intention to adopt m-government services.
2. To examine the impact of these factors on intention to use m-government services among the citizens.
3. To study the effect of SM on awareness, trust, transparency, image and social influence in relation to m-government services.

4. To investigate the mediating role of attitudinal factors between awareness and intention to use m-government services.
5. To analyse the influence of trust and transparency as mediators between quality dimensions and intention to use m-government services.
6. To explore the moderating role of demographic variables in the relationship between adoption factors and intention to use m-government services.

1.7 SIGNIFICANCE OF THE STUDY

This study is significant and makes important contributions to both academic research and policymaking. The significance of the study is discussed further in the subsections that follow.

1.7.1 For Academia

M-government in India and most other developing countries is still in its early stages, and there is a need for research in this area given the limited number of empirical studies from a citizen's perspective. Majority of studies have highlighted the need to understand the citizen's attitude and behaviour towards m-government before planning its implementation along with the technical aspects (Abu-Shanab and Haider, 2015; Liu et al., 2014; Saxena, 2017; Shareef et al., 2012). This study becomes significant as it provides a comprehensive explanation to citizens m-government adoption characteristics (Saxena, 2017, 2018).

The integrated model of DOI-URT theories, in conjunction with external factors, provide broader perspectives on m-government adoption in this case. More specifically, the use of DOI with constructs of specific characteristics and the relevance of uncertainty reduction theory in the early stages of adoption provide significant critical insights, which are expected to have an enhanced explanatory power of the model (Moore and Benbasat, 1991; Saadi et al., 2017; Shahzad et al., 2019; Venkatesh et al., 2016). Furthermore, the study investigates the indirect relationship between awareness and BI via attitudinal factors (mediating paths), which validates and strengthens previous findings (Mandari et al., 2017). Moreover, a detailed exploration of the relationships between variables considering all the direct as well as mediations paths provides crucial insights and this has a significant contribution to the field of research.

The investigation of social media influence on m-government adoption, is another important component of this study which is an emerging aspect and is less explored. It is currently gaining a lot of prominence in the research field of social media usage and its influence on people's adoption behaviour. Further, specific location-based study has a critical contribution, as it provides clear and distinct information on people's attitudes and behaviour, which are influenced by cultural and sub-cultural factors, as well as attitudes toward state government (Alsaadi et al., 2018; Bachrach, 2014; Chanana et al., 2016; Ghosh Roy and Upadhyay, 2017; Mwalukasa et al., 2018; Saxena, 2018).

Overall, all these aspects explored through the conceptual framework developed in the study are not addressed adequately in m-government literature. Hence, the insights of this study make important contributions to research field. Moreover, given the fact that these aspects in the Indian context received little attention, this study may be a significant way forward.

1.7.2 For Policy Makers

Digital technologies such as m-government and social media are expected to play a critical role in the Smart Cities Mission's success. Furthermore, M-government adoption in India and other developing countries being limited, necessitates additional scientific research in the field (Abu-Shanab and Haider, 2015; Kesavarapu and Choi, 2012; Sharma et al., 2018). As a result, the information obtained through this study will undoubtedly benefit policymakers involved in the Smart Cities Mission and m-government development activities in Karnataka's proposed smart cities. The main beneficiaries in this case are the Central and State governments, as well as the related agencies involved in m-government projects. These insights are critical in assisting policymakers in capitalising on the potential of m-government. It aids in the development of an effective implementation strategy and re-development plans for m-government projects. It also contributes significantly in attracting more citizens to use these technologies.

For example, the study's findings can be used to determine the depth of awareness and training campaigns required for these technologies to be accepted by the general public in a specific city. It also highlights how successful social media could be and what aspects should be prioritised when integrating social media into m-government services. Similarly, it provides inputs on designing the m-government systems in terms of the relevance of compatibility requirements as well as user-friendly applications, the role of quality dimensions, and so on. As a result, the cost and funds for these services may be optimally managed. It also improves the utilisation and public acceptance of these technology-based services. Overall, it provides clarity on people's perceptions of m-government services on various dimensions, allowing policymakers to target these dimensions in their implementation plans for the successful adoption of m-government services by the public. As the success of m-government services is directly related to the Smart Cities Mission, this study also contributes to the achievement of this mission in the Indian state of Karnataka.

1.8 SCOPE OF THE STUDY

The scope of the study is limited to the people in the proposed smart cities of Karnataka. The aim is to understand the adoption behaviour of citizens towards m-government services. The understanding of this will help in planning the implementation of m-government projects of these cities. Because the study focuses on citizens' perceptions of m-government adoption in general, its scope may be limited and should be used with caution when applying for specific applications. Despite the fact that the focus is primarily on utility services (such as electricity, water, telephone, and travel) and a few critical applications such as passport, Adhaar card, PAN card, and income tax filing, the study did not limit data collection to these specific applications.

Nevertheless, the conceptual model developed can further be extended to other cities of the country. Further, the literature gap identified through a systematic review, though, is well accepted might bring in some limitations. For example, in the study, gap identification has been made by considering relevant literature from the first and second quartile in Scopus, which might act as a limitation. The top two Quartile journals are considered since the top-ranked journals have the highest citation impact and community engagement. It reflects on the quality and reliability of the work in those articles. Hence, any research gap identified with these considerations will have a direct impact on the quality of work and contributes significantly to the field of research (Colledge et al., 2010; Ellegaard and Wallin, 2015). Further, due to the time limit, the current research will be carried out as a cross-sectional study, which by its nature limits the reliability of the outcomes on a longer time horizon.

1.9 ORGANIZATION OF THE THESIS

The thesis divided into seven chapters:

Chapter One: This chapter presents an introduction to this research study, wherein it describes the background of the research topic, presents the research problem with a clear description of research gaps and the need for the study. It then states the problem statement, research questions and research objectives that are investigated in the study. Finally, it states the significance of the research, the scope of the study, and the structure of the thesis.

Chapter Two: This chapter describes the scenario of m-government services in India. It describes a few important m-government applications launched by the government of India and then presents the crucial m-government projects initiated by the State government of Karnataka. Later it provides some information on a few crucial dimensions of telecom statistics for India and Karnataka State. Finally, it briefs on the Digital India programme, Smart Cities Mission, and initiatives related to this missions in the State of Karnataka.

Chapter Three: This chapter discusses the review on literature in the field of m-government wherein it first describes the processes performed to carry out bibliometric analysis of m-government research. Later it gives a background review on m-government studies performed in the past. It then presents an overview of research works based on theoretical frameworks adopted by the researchers. Later, it discusses the research model and provides a detailed review of each variable considered in the study. In addition, a detailed review of literature focusing on social media use in m-government services is presented. Lastly, the chapter presents the operational definitions of the variables considered in the study and lists the hypotheses defined for the analysis purpose.

Chapter Four: This chapter discusses the research philosophy presumed in the study. It then discusses the research design, research approach, and the research method adopted in the study. Later, it describes the procedure adopted in data collection, instrument development, the sampling procedure and sample size estimation. Finally, the chapter presents the results of the pilot study performed in the study to validate the instrument developed in the study.

Chapter Five: This chapter discusses the various aspects of results and analysis carried out in the study. It explains the data screening process and then checks on the assumptions required to perform SEM analysis such as normality, common method bias, outliers etc. Then it presents the descriptive analysis of the respondents and distribution statistics of every latent variable in the study. It briefly describes the results of the assessment of the measurement model in terms of convergent and discriminant validity. Then, it describes the results of the assessment of the structural model proving the hypotheses stated in the study. Here, the results of the direct relationship between the variables, the mediation paths between the variables and moderating role of the demographic variables between the relationship of two variables are discussed in detail.

Chapter Six: This chapter discusses and provides reasoning for the critical outcomes of the study. It examines these findings with research from other studies that have produced similar results. Later, the chapter sheds light on some of the key implications of these findings for academia. In addition, implications for actual practice were listed, which would aid policymakers, particularly those from Karnataka's Smart Cities Mission, in the effective implementation of m-government projects. In general, the chapter comprises some of the study's major contributions.

Chapter Seven: This is the final chapter that summarises the key findings and accomplishments of the study's defined objectives. Furthermore, it outlines some of the most significant contributions to the body of knowledge. It also lists a few of the assumptions or limitations of the study. Finally, it discusses the possibilities of expanding the current study for future exploration.

Chapter 2
M-GOVERNMENT IN INDIA

2.1 OVERVIEW

The chapter provides background information and a scenario for India's m-government initiatives. It then lists a few of the most important applications launched centrally by the GOI. It also specifically provides information on the Karnataka State's m-government initiative. Later in the chapter, information on telecom statistics in India and Karnataka are provided. Finally, the chapter provides an overview of the Digital India program and discusses Smart Cities Mission and its implementation in Karnataka State.

2.2 ABOUT MOBILE GOVERNMENT

The term "mobile government" comes from the words "mobile" and "government," and it refers to the use of mobile technology in the governance system. This technology is crucial in the dissemination of information and the provision of government services (Ntaliani et al., 2008). Mobile technology and mobile internet are two critical components in this case. It is regarded as a critical subset of e-government services capable of transforming the governance system. M-government is not intended to replace e-government, but rather to enhance it through a hybrid mode (Refiloe and Noluntu, 2018). The presence of an e-government system integrated with m-government and social media-based technologies is critical.

2.2.1 Transformation from E-government to M-government

Initially, advances in ICTs (also known as Web-2 technologies) resulted in advances in e-government services, which is essentially the use of web-based internet applications in governance systems for interaction and delivery of services to its stakeholders. As indicated in Figure 2.1, transformation was initially seen in the information and communication infrastructure, as well as the development of social networking applications. It has then resulted in the use of these related technologies for communicating information about government services, resulting in the evolution of the e-government system. Furthermore, in later stages, these technologies were used to involve and participate stakeholders in the governance system (i.e. in e-government services and e-democracy), which is known as e-participation. Finally, all of these systems are integrated and improved in order to enhance the overall governance system (i.e. e-governance).

These systems are thought to deliver information more quickly, increasing transparency. Users can also access the services from any location at any time, making it an appealing and efficient way of delivering government services at a lower cost. The transition from basic Web-2 technologies to artificial intelligence-based applications is the era of Web 3 technologies. These intelligent technologies were capable of delivering user-specific information based on user behaviour (previous search history) and of performing personalized searches in the web-based system by extracting and analyzing specific relevant information.

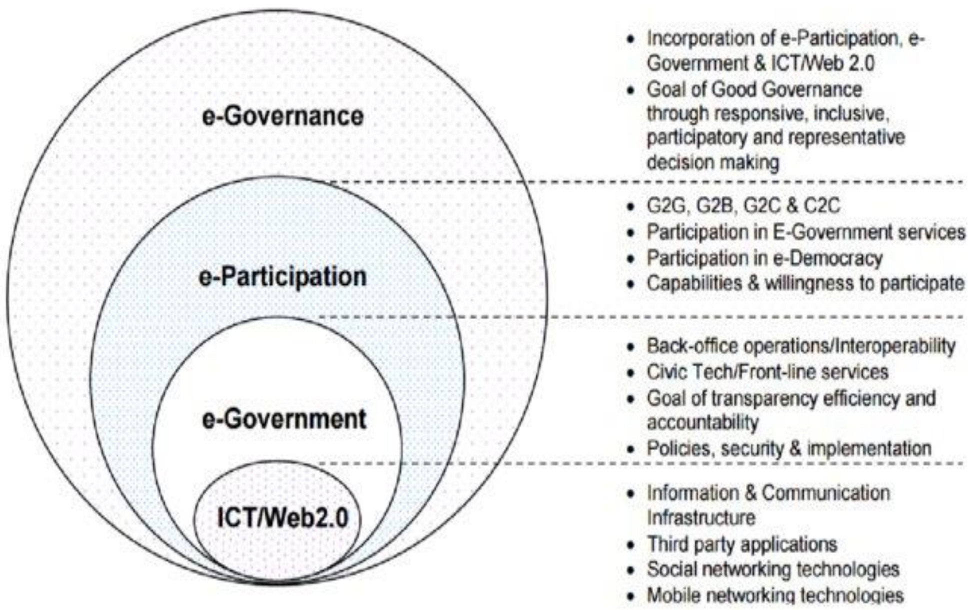

Figure 2.1: Evolutionary E-Governance 2.0 Model *(Source: Huffman, 2017)*

However, as mobile technologies and mobile-based internet services (data) evolved, they were integrated into e-government services, giving rise to m-government. However, the concept was first transformed in the private/corporate sector, namely m-commerce, such as online shopping. It was later used in government services due to its potential and it is the Web-4 era. Professor Ibrahim Kushchu coined the term "m-government" while conducting research in Japan's mGovlab. These technologies enable users to access m-government services from any location and at any time (Kushchu and Kuscu, 2003). Its potential was further enhanced by the rapid increase in the use of mobile technologies among people worldwide. As a result, the m-government system is thought to have a wider reach and faster communication and is regarded as a critical component of the e-government. Furthermore, as people's use of social media grows, so does the social media-enabled m-government for communication and interaction activities.

2.2.2 Developments and Applications of M-government

M-government services evolved in tandem with the advancement of mobile and mobile internet technologies. The applications began as a way to share real-time information. For example, using SMS-based services to share emergency information or agricultural information among farmers, etc. With the advancement of smartphone technology and mobile data, the m-government system has reached new heights. The smart and intelligent applications enhance the mobile platform's ability to deliver all government services. These platforms also enhance users' abilities in social forums for continuous interaction and engagement. It is thought to improve the efficiency of government services by facilitating real-time information sharing and increasing transparency. As a result, people's awareness and knowledge of these services improve. It is also regarded as a simple and effective tool for interacting with customers and gathering feedback on services. According to Refiloe and Noluntu (2018), the maturity or growth of m-government can be divided into five stages:

Phase 1: Augmentation: This phase focused on extending e-government services to m-government systems. The emphasis was on information dissemination and access via these technologies.

Phase 2: Elementary: This phase focused on improving the compatibility of service websites so that they could be accessed via mobile devices. Even simple tasks or services via mobile devices, such as SMS-based uses, have emerged. For example, SMS can be used to provide news and weather updates, as well as to book a service and provide related information.

Phase 3: Interaction: Advanced capabilities in interacting and having two-way interaction between users and service providers, thereby improving service efficiency and providing support and feedback services.

Phase 4: Transactional: The phase had grown in its ability to conduct transactions related to services, particularly financial transactions, via mobile devices. The stage has also witnessed a shift in privacy and security concerns in these technologies.

Phase 5: Involvement: The integration of mobile applications and social media, resulting in an advanced system with greater access and service delivery capabilities, such as 24x7 provision. The phase observed increased reach, even in rural areas, increased interaction and support via social networking forums, increased transparency and citizen engagement.

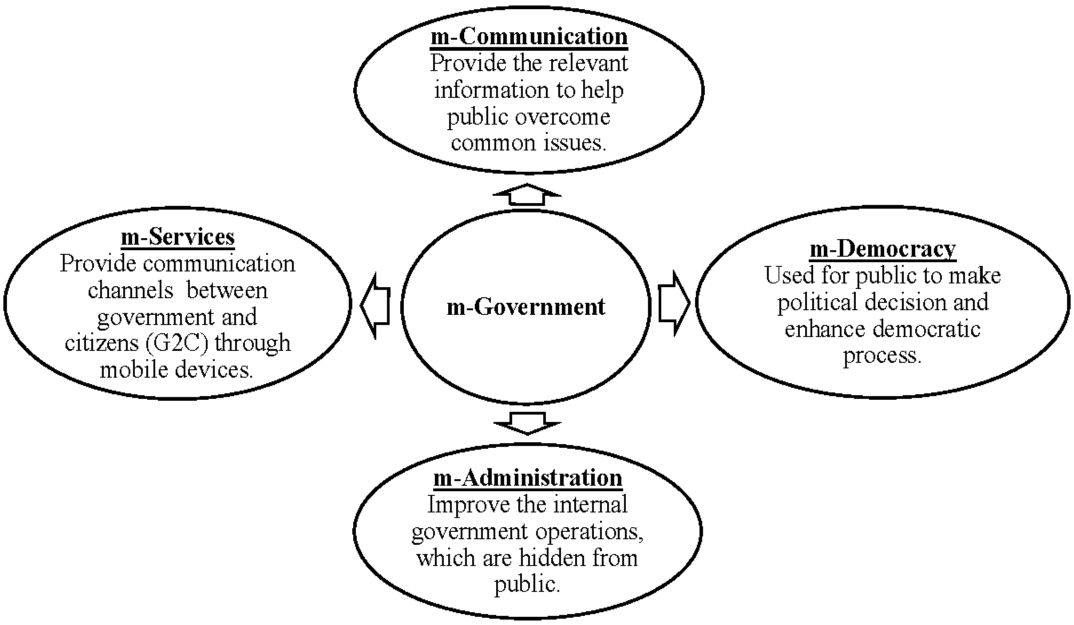

Figure 2.2: Applications of m-government *(Source: Ghazali & Razali, 2014)*

Furthermore, m-government is thought to exist in the following applications in the governance system, as shown in Figure 2.2. It is critical in the communication of stakeholders such as citizens (G2C), businesses (G2B), government agencies (G2G), and government and employees (G2E). It also plays an important role in providing government services to its stakeholders, particularly citizens and businesses. Improves governance system efficiency through operational excellence within the governance system. Finally, it promotes greater participation in government decision-making, thereby improving democracy, i.e. m-democracy (Ghazali and Razali, 2014).

2.3 BACKGROUND OF M-GOVERNMENT IN INDIA

Every nation across the globe is focussing on tapping the potential of ICTs in their government services. EG thus has been one of the key drivers in the growth of a nation. India, too, is moving towards the transformation in the EG system with an objective of maximum governance with minimum government. The Digital India program and Smart Cities Mission under the National e-Governance Plan (NeGP) are the best examples. The primary focus of these initiatives is on easy access to government services to the common people. It is reflected in the United Nations EG index, where India secured 96^{th} position in 2018 with a leap from 107^{th} position in 2016 (United Nations, 2018).

In India, the evolution of EG started with the initiative of computerization of government offices and then towards the improvement of network connectivity. The current focus by the government is towards mobile governance, mainly addressed under the e-Kranti framework. The objective of this framework is to provide government services electronically in an efficient, transparent, and reliable manner through an integrated and interoperable system. One of the critical considerations under this framework is 'Mobile First,' referring to designing/redesigning service framework to enable access through mobile (InDG, 2019).

In this context, mobile technologies are one of the most affordable and widely available modes of communication in both rural and urban India. Furthermore, it is believed that increased use of mobile phones will empower citizens and transform people's interactions within society. As a result, m-government has emerged as a strategic area for growth in the e-government system. Agriculture, health care, education, financial services, retail trading, utilities, communications, manufacturing, transportation, and services are some of the key sectors where the government is focusing on implementing mobile-based services (Singhania and Jaitly, 2017).

The GOI, under the Ministry of Electronics and Information Technology, has laid down specific measures for the development of m-government in the country. These measures are as follows (InDG, 2019):

- Mobile-compliant websites across all the government departments and agencies through 'one-web approach.'
- Improving interoperability and convenience across various operating systems and devices through standardization.
- Every government departments and agencies shall develop and deploy mobile applications for providing all their public services through mobile devices.
- Development of Mobile Service Delivery Gateway (MSDG), a core infrastructure to enable services through mobile devices in a time-bound manner through different channels.

Services are provided across the different classes of digital interactions such as Government to Citizens (G2C), Government to Businesses (G2B), Governments and other Government agencies (G2G), and Government and Employees (G2E) (Singhania and Jaitly, 2017). The channels through which the services are delivered are,

- SMS (Short Message Service),
- IVRS (Interactive Voice Response System),
- USSD (Unstructured Supplementary Service Data),
- CBS (Cell Broadcasting Services), and
- LBS (Location-Based Services),
- Mobile websites and Mobile applications or a combination of these

Further, it is vital to note that the Central Government has given the authority to respective State Governments to develop m-government projects. The control over the type of services rendered and infrastructure development activities reside with the individual States. The Central ministries control only a few of the services related to

Central departments. With this focus, the GOI has launched 'Mobile-Seva' to provide its services through mobile phones and tablets. It has also approved the framework for financial services (InDG, 2019). The GOI has taken several initiatives in the development of m-governance system. In the next section, some of the G2C based services are presented, as it is the focus of our study.

2.4 MOBILE GOVERNANCE SERVICES IN INDIA

A few essential services offered by the Government of India are discussed below (Table 2.1).

Table 2.1: M-government services in India *(Source: InDG, 2019)*

M-Government Services	Description
mAdhaar	It is a mobile application developed by the Unique Identification Authority of India (UIDAI). It provides an interface for Aadhaar Number Holders to carry their demographic information. Here, the information such as name, date of birth, gender and address, and photograph are linked with their Aadhaar number in smart phones.
UMANG	Unified Mobile Application for New-age Governance (UMANG) provides a single platform for all Indian citizens to access pan India EG services. It intends to provide major services offered by Central and State government departments, local bodies, and other utility services from private organizations.
Mobile Passport Seva application	mPassport Seva is a lightweight, easy-to-use app that provides several functions. The functions such as new user registration, existing user login, apply for passport services, pay online, schedule appointment, know location of passport centres, fee details, application status, contact and other general information is provided through this application.
Mobile app for citizen feedback	The mobile apps are available to register citizen's feedback on various government schemes like,

	Mera Aspataal / My Hospital is an ICT-based Patient Satisfaction System (PSS) for implementation in public and empanelled private hospitals. *Meri Sadak* is a versatile mobile app that empowers citizens to give critical feedback concerning the pace of work, nature of work, and Pradhan Mantri Gram Sadak Yojana (PMGSY) streets to nodal departments in the State Governments/National Rural Roads Development Agency (NRRDA). Citizens can take photos of the site and submit them, along with feedback. *Rapid Assessment System* (RAS)- is an initiative of the Ministry of Electronics and Information Technology to encourage citizen engagement in governance. It enables Government departments and agencies to capture citizens' feedback related to EG services. *Swachh App*- The app provides real-time sanitation coverage in rural areas at your fingertips. It enables citizens to do the following: rate one's village on Swachhta, view the number of household toilets constructed for beneficiaries under Swachh Bharat Mission-Gramin, view real-time sanitation coverage in percentage, view the number of open defecation free villages.
Janmanrega- citizen feedback app on MGNREGA	It is a citizen feedback app on assets created in the Mahatma Gandhi National Rural Employment Guarantee (MGNREGA) program. Its focus is on providing at least 100 days of guaranteed wage employment in a financial year to every rural household whose adult members volunteer to do unskilled manual work.
Deactivation of VAS in mobile	Deactivation of Value Added Services (VAS) by mobile customers using a toll-free shortcode 155223. VAS in mobiles means those services that telecom service providers offer to customers beyond the core services like SMS, voice, and data.
Tarang Sanchar portal	Tarang Sanchar is a web portal for information sharing on Mobile Towers and Electromagnetic frequency (EMF) Emission Compliance. It has been developed in Public-Private Partnership (PPP) mode by the Department of Telecommunications with Industry.

	It is used to locate mobile towers in the vicinity of any locality. Find mobile towers with their EMF safety status based on your current location, and EMF measurement requests by public.
Unreserved ticketing system (UTS) on mobile	Booking of unreserved tickets on all non-suburban sections across all Zonal railways has been made available using the UTS app to enable seamless booking of unreserved tickets all over Indian railways. Services like booking, cancellation, issue/renew m-wallet balance check, etc. are delivered through this application.
Know your representative	The Parliament of India is a magnificent manifestation of the democratic ethos of our country. The Parliament of India has three constituents: The President of India, the Rajya Sabha (Council of States), and the Lok Sabha (House of the People). The app provides information about the same.
Grahak Sadak Koyla Vitaran app	Coal India limited, a Government of India undertaking, it has launched the "Grahak Sadak Koyla Vitaran App" for the benefit of its customers in lifting coal through road mode.
Swachhata App	The Swachhata application is a fourth-generation complaint redressal mobile and web platform. It is a quantum leap in how Municipal Corporations in India are redressing complaints and grievances. This solution is for all the 4041 towns and cities of India. The core of the Swachhata application is to use citizen participation and civic engagement to help resolve the Swachh Bharat complaints.
ASH Track App	ASH TRACK Mobile App has been launched by the Ministry of Power for better management of fly ash produced by thermal power plants by providing an interface between fly ash producers (Thermal Power Plants) and potential ash users such as – road contractors, cement plants, etc.
Sukhad Yatra App	The Ministry of Road Transport and Highways has launched the Sukhad Yatra App and Toll-free Emergency number for the benefit of the highway users. It enables users to enter road quality-related information, report any accident or pothole on the highway, give real-time data related to waiting time expected at plazas. It also provides information about various facilities like points of interest,

	highway nest/nest mini, etc., available across the highway, and users can purchase the FASTag tag.
Rail Madad App	The Ministry of Railways has released the mobile app "Rail MADAD (Mobile Application for Desired Assistance During travel)" to expedite and streamline passenger grievance redressal.
Khan Prahari app	Khan Prahari app is a Ministry of Coal tool for reporting any activity related to illegal coal mining like rat-hole mining, pilferage, etc. The app is part of the Coal Mine Surveillance and Management System (CMSMS).
cVIGIL app	"cVIGIL" is a user-friendly and easy-to-operate Android application. It will be operational only where elections are announced. It will allow anyone in the election-bound state to report violations of the Model Code of Conduct (MCC) that comes into effect from the date of announcement of elections and goes on till a day after the polls.
Jan Dhan Darshak App	The Department of Financial Services, Ministry of Finance, and National Informatics Centre (NIC) have jointly developed this mobile app. It is a part of the financial inclusion initiative. This app will guide the people in locating a financial service touchpoint at a given location in the country.
URJA App	The Ministry of Power has launched the mobile app "URJA" (Urban Jyoti Abhiyaan) App. It is a digital initiative to place before the people the performance of Distribution Utilities in IT-enabled towns. Its vision is to generate positive competition amongst the stakeholders and urge all concerned for better performance in all consumer-centric parameters.
Bharat Interface for Money (BHIM)	It is a user interface application for cashless transactions. Here, the application developed is such that money is transferred directly between accounts rather than through the cash held in an online wallet.
Goods and Services Tax (GST) Rate Finder	The application enables business owners and entrepreneurs to learn about the current and applicable GST rates without hiring a chartered accountant to handle the taxes.
Online Right to Information (RTI)	This mobile application is available to those who wish to file an RTI. The application contains a provision for virtual lawyers and experts

	to draught the application, which will then be submitted to the RTI department for approval following your approval and modifications.
MyGov	It is a citizen engagement application that enables citizens to participate in the country's governance activities. The application connects people with central ministries and related government organizations and serves as a channel for ideas, comments, and creative suggestions.
Startup India	It is a government initiative to connect young people who want to start a career as an entrepreneur. It helps connect with the right leaders, mentors, incubators, investors, and other entrepreneurs for advice and assistance in the early stages of their new start-up’s journey.
Arogya Setu	The GOI has launched this application to combat the Covid-19 pandemic. Its primary goal is to facilitate contact tracing, syndromic mapping, and self-assessment of people's risk of contracting the disease. It also provides other support activities such as connecting people to essential health services, providing information, best practices, and advice on Coivd 19.
m-Parivahan	Its primary objective is to provide citizens with instant access to transportation information, services, and utilities. It is a convenient and transparent system that includes information such as the owner's name, registration date, vehicle model, age class, fuel type, etc.
Vahan 4	It is an application aimed at making Regional Transport Offices (RTO) paperless. It offers online services such as vehicle registration, ownership transfers, driving licenses, e-payment, and other RTO-related services.

2.5 MOBILE GOVERNANCE IN KARNATAKA

Karnataka State is one of the top States in India to tap the potential of m-government. The people of Karnataka are adopting these new technologies like Smartphones, Internet services, and Mobile Internet, which is reflected in the usage statistics (Table 2.2). It has around 66.68 million mobile phone subscribers, of which 26.8 million are from rural parts, and 39.88 are from urban parts of Karnataka as of June 2020 (TRAI, 2020).

In Karnataka, the Centre for e-Governance (CeG) society under the Department of Personnel and Administrative Reforms is responsible for all the electronic and mobile governance activities. Under its arm, some of the critical mobile governance initiatives that have been implemented are:

- Janahitha: Municipal reform cell has developed this public grievance and redressal application to register complaints with the Municipal Office.
- KarnatakaBB: This pull SMS service handles applications sent by citizens and blood bank officers to be processed by the application.
- KarnatakaNEMMADI: Citizens of Karnataka will send an SMS request to Nadakachri to know the application status. People can avail of services related to caste certificates, income certificates, land documents, birth and death certificates, agriculture documents, social security pensions, etc.
- KarnatakaBHOOMI: Farmers of Karnataka will send SMS requests to know the application status of their land-related activities. The main objective of this program is the digitization of land records.
- Karnataka MobileOne: It is a single platform linking over 4000 citizen-centric services. It has been recognized as India's first and World's largest multi-mode m-governance application with various services. It is accessible to the residents of Karnataka to access government services, be it payment of taxes, utility bills, traffic violation fines, tracking applications of passports, birth certificates, or university results. The services are categorized under utility, banking, police, healthcare, transport, telecom, municipal, travel, taxation, agriculture, and others.
- Sakala Mobile Application: It is developed to ensure that citizens get a certain standard of services within a specified time. It has covered 447 services and achieved success since its inception.
- In response to the pandemic spread throughout the state, the government has launched the 'Apthamitra' mobile application, which provides citizens with online medical assistance. Also, with the increase in Covid-19 cases, it has launched a quarantine application to track people in isolation.

- PurePrayer app is for booking sevas, temple-specific rituals, and poojas at temple-specified rates. The Department of Hindu Religious Institutions and Charitable Endowment (Muzrai) established it.
- The Higher Education Department has launched the GetCETGo application, a free crash course for students preparing for the Common Entrance Examination, National Eligibility cum Entrance Examination, and Joint Entrance Examination.
- The Shikshaka Mitra application was launched by the Department of Primary and Secondary Education for teachers to use to obtain services such as loans and provident fund advances and apply for leave and transfers.
- Kayakamitra is an application for submitting work demands for people with MNREGA job cards, particularly in rural areas.
- The Department of Stamps and Registration has launched the Maulya application to provide citizens with guidance on the value of any immovable property.
- The Dishaank application provides a survey number of plots and ownership details based on the user's location via Geographic Positioning System (GPS) and tracing location and property information via satellite.
- e-Sarvajanika Granthalaya is a mobile application-based public library for citizens.
- The Karnataka State Natural Disaster Monitoring Centre has launched the Sidilu and Bengaluru Megha Sandesha applications. The first app warns people of lightning strikes 45 minutes ahead of time. The latter provided updates on rainfall and weather information of a locality.
- The Bele Darshak application provides farmers with data from a survey conducted on their farms.
- The Zoos of Karnataka app allows people to donate and adopt animals. It also has a provision for booking tickets for the entrance and safari.
- The Karnataka State Human Rights Commission has launched an application called Manava Hakku Rakshane, which allows you to file a complaint or obtain information about human rights.

2.6 TELECOM STATISTICS OF INDIA AND KARNATAKA

It is key to know that India is the second-largest market in terms of the country's total number of internet subscribers. It has grown at a Cumulative Annual Growth Rate (CAGR) of 21 percent from 2014 to 2020 to reach 743.19 million subscribers. Further, it is essential to note that the mobile internet usage rate in the country increased at 11.01 percent quarterly and is currently at 25,369,679 TB in the first quarter of the financial year (FY) 2021. Average wireless data usage per wireless data subscriber per month 12.15 GB.

However, the total number of wireless subscribers, mainly mobile technology, declined in the quarter ended 30th June 2020, but the mobile internet user base increased 0.79 percent for the first quarter of FY 2021. The growth in internet subscribers has also been seen in the State of Karnataka (0.79% quarterly). The statistics also indicate a relatively good rural penetration rate both in Karnataka and India as a whole. The gross revenue for the quarter ended June 2020 stood around INR 66,858 crores, which is expected to grow further in the future years (IBEF, 2021). The robust demand, attractive opportunities, policy support, and increasing investment are the critical drivers for future advantages in the telecom market in India (IBEF, 2021). The quarterly statistics for March 2020 and June 2020 are provided in Table 2.2 below.

Table 2.2: Telecom statistics of India and Karnataka *(Source: TRAI, 2020, Sept, Nov)*

	Mobile Phone Subscriber (in Million)		**Internet Users (in Million)**	
	As of March 2020	**As of June 2020**	**As of March 2020**	**As of June 2020**
India	**1157.75**	**1140.71**	**743.19**	**749.07**
Urban	*638.48*	*619.11*	*457.23*	*455.98*
Rural	*519.27*	*521.60*	*285.97*	*293.09*
Karnataka	**67.63**	**66.68**	**45.833**	**46.113**
Urban	*39.16*	*39.88*	*28.820*	*29.471*
Rural	*28.47*	*26.80*	*17.013*	*16.642*

2.7 OVERVIEW OF THE DIGITAL INDIA PROGRAM

The Digital India program launched in this direction aims to transform India into a digitally empowered society and a knowledge economy. It ensures the electronic presence of government services by improving internet connectivity and its infrastructure, both urban and rural India. It has three core components viz. secure and stable digital infrastructure, government service delivery in digital mode, and digital literacy of citizens (MoEIT, 2019).

2.8 SMART CITIES MISSION

Smart Cities Mission is an urban renewal and retrofitting program by the Government of India to develop 100 cities across the country, making them citizen-friendly and sustainable. Each city will create a Special Purpose Vehicle, headed by a full-time CEO, to implement the Smart Cities Mission. Centre and State governments will provide ₹1,000 crores (US$140 million) funding to the company, as an equal contribution of ₹500 crores each. The company has to raise additional funds from the financial market as debt or equity. The 100 cities selected across India were through a 'smart cities challenge' (in five phases), a countrywide competition on the developmental idea of a particular city. The Union Ministry of Urban Development is responsible for implementing the mission in collaboration with the State governments of the respective cities. It was launched on 25th June 2015 (MoHUA, 2019). Some typical features of comprehensive development in smart cities are described below (MoHUA, 2019).

- Promoting mixed land use in area-based developments where planning for 'unplanned areas' is vital. Compatible activities and land use close to one another are the focus to make it more efficient.
- Expanding housing opportunities for all.
- Creating walkable localities with administrative services in and around. It thus reduces congestion, air pollution, and resource depletion. It also boosts the local economy, promotes interactions, ensures security, improves road networks with consideration for pedestrians and cyclists.
- Preserving and developing open spaces such as parks, playgrounds, and recreational areas to enhance citizens' quality of life with a better eco-system.

- Promoting a variety of transport options like Transit Oriented Development, public transport, and last-mile para-transport connectivity.
- Making governance citizen-friendly and cost-effective through online services, especially using mobiles to reduce cost and provide mobility to services without the hassle of visiting municipal offices.
- Forming e-groups to listen to people, obtain feedback, and use online monitoring of programs and activities with the aid of cyber tours of worksites. It will increase transparency and building trust with the government.
- Giving an identity to the city, based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, dairy, etc.
- Applying Smart Solutions to infrastructure and services in area-based development to make them better. For example, making Areas less vulnerable to disasters, using fewer resources, and providing cheaper services.

2.8.1 Smart Cities of Karnataka

In Karnataka, a total of seven cities were considered and approved for development. Here, Davanagere and Belagavi were selected during the first round of selection. Shivamogga, Hubbali-Dharwad, Mangaluru, and Tumakuru were approved in the third round. Lastly, Bengaluru was chosen in the fourth round (MoHUA, 2019). Some of the projects initiated by the Government of Karnataka concerning the Smart Cities Mission are:

- Application-based intelligent government service on Area-based Bin-less Solid-waste management system in Davangere, Karnataka.
- Geographic Information System (GIS) integrated one city one website supporting mobile platform in Davangere and Belagavi cities of Karnataka.
- Public mobility app for dynamic bus information system in Mangalore city.
- Twenty major roads and renovation of the historic KR and Russel markets in Bengaluru.
- Development of two major lakes in Shivamogga.

2.9 SUMMARY

From these discussions, we can infer that m-government is an integral component in the development of smart cities. Here, m-government services can use the platforms such as Mobile Web, Mobile App, IVR, USSD, Pull SMS and Push SMS in delivering the services. This study assesses citizens' perceptions of m-government services in general, referring to any type and mode of services provided via mobile devices. It could be SMS-based services, mobile-friendly websites, or applications. It can also be utility services, information delivery services, health-related services, and so on. The popular mobile applications referred to the respondents during the survey are listed in Table 2.3, though not limited to only these.

Table 2.3: Mobile applications considered for accessing the perception of citizens

Services	Description
Power/Electricity	Payment of electricity bill through mobile
Water	Payment of water bill through mobile
Travel/Transport	Booking of Railway Tickets or Bus Tickets etc.
Adhaar	Applying for/Renew/Updating UDIP Card
Passport	Applying/Renew/Updating of Passport
Electoral	Applying/Updating Voter Id
Taxation	Property tax and Income tax
Municipal services	Birth/Death Certificate, Property identification number, and tax

Chapter 3

LITERATURE REVIEW

3.1 OVERVIEW

This chapter aims to perform secondary data analysis using a systematic review approach and the traditional interpretative approach in the area of m-government and its scenario in India. This review captures the research themes and theories in M-government research that the researchers have commonly applied to date. Nevertheless, the primary purpose of this chapter is to identify the research needs and gaps from the understanding the existing sources of literature.

3.2 SYSTEMATIC REVIEW ON M-GOVERNMENT

Initially, the literary database was searched to understand the field of m-government (also known as m-governance). One of the established databases for the peer-reviewed collection of journals is Elsevier's Scopus. It is considered an excellent alternative to other databases like Web of science due to its ease of use (Boyle and Sherman, 2006). Thus, using the Scopus database, the article list and their details on m-government research field have been extracted and analysed using bibliometric analysis to understand this field of research.

The systematic steps adopted to carry out the literature search and the review process are discussed below:

Step 1: Following keyword protocol has been used to perform the literature search, TITLE-ABS-KEY ("Mobile Govern*" OR "m Govern*") AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (SRCTYPE, "j")) AND (EXCLUDE (SUBJAREA, "EART")) AND (EXCLUDE (SUBJAREA, "BIOC")). The above keyword search was used on 21st August 2019 and yielded a list of 145 journal articles published in the area of m-government.

Step 2: Search engines on reputable journal publisher's websites such as Science Direct, Taylor and Francis, Springer, SAGE, Emerald, Wiley, and Inderscience, were used to locate documents on m-government research. The keywords used here were "Mobile

Government" OR "Mobile Governance." The manual search with these two keywords was carried out on 31st December 2018, and based on which following article lists were obtained (Table 3.1).

Table 3.1: Details of an article extracted through key journal publisher's website search engine

Journal Publisher	No. of Articles	Source
Elsevier	55	https://www.sciencedirect.com
Emerald	160	https://www.emerald.com/insight
Inderscience	37	https://www.inderscienceonline.com
Sage	3	https://journals.sagepub.com
Springer	81	https://link.springer.com
Taylor and Francis	48	https://www.tandfonline.com
Wiley	31	https://onlinelibrary.wiley.com

Step 3: All the article lists from Step 1 and Step 2 were consolidated to eliminate the recurring article titles. The final list of the article is obtained, which had 446 journal articles.

Step 4: From these 446 articles, only relevant documents on the focus area of m-government research from the citizen's perspective/demand perspective are shortlisted for further review. In the search, we obtained a list of 218 relevant articles on the topic.

Step 5: To identify the research gap, only the articles from the 'top 50%' of the impact factor distribution (or first two quartiles in Scopus based classification/ranking) in the area were selected and reviewed. The sorted list had around 57 journal articles. Further, the documents from the top-ranked journals based on Scopus metric analysis are also considered to identify the research gap. The process resulted in a list of 61 articles for review and gap identification.

Step 6: Other articles, too, were reviewed to deepen the understanding of the topics further. For example, to understand a particular theory or about critical determinants in the research area. The study also reviewed additional documents to identify any significant contributions in the field or to know any critical gap that needs attention.

Step 7: Later, the literature was further updated based on the search performed in the Scopus database on 27th February 2021 with the same keyword protocol mentioned above, which yielded about 198 articles in the field.

3.3 SCOPUS METRIC AND BIBLIOMETRIC ANALYSIS

Bibliometric analysis and Scopus metric analysis are considered beneficial inclusion or exclusion techniques or methods of filtration of documents in the Literature review stage to obtain a comprehensive list of quality research in the area of interest. This method extracts the essential and latest trending research topics from an extensive list of documents. Thus, scientifically directing towards the strategic theme of research on the matter. To know the contributions in the field of m-government, Bibliometric and Scopus metric analyses were performed, the results of which are discussed below.

3.3.1 Scopus Metric Analysis

Scopus metrics are the journal metrics used to access the impactful journal in a particular field of research. It has many vital metrics like Cite score metrics, Source Normalized Impact per Paper (SNIP), and SCImago Journal Rank (SJR), which are used to access the information on m-government research in the study.

The following methodology explains the way documents are extracted in the current research.

1. *Cite Score:* The cite score of a journal refers to the average citation for all the documents that a title receives over a three-year duration. It reflects on the performance of a journal through accessing the journal's impact in the field of research. A higher cite score journal implies that researchers follow and read that particular journal in their research work resulting in updated information. It has eight complementary indicators: CiteScore, CiteScore Tracker, CiteScore Percentile, CiteScore Quartiles, CiteScore Rank, Citation Count, and Document Count (Zijlstra and McCullough, 2016). Cite Score and Cite Score Quartiles were the two criteria in selecting the journal articles and their sources for this study.
2. *SJR:* In traditional citation analysis, all the citations have equal weight, whether it's a widely read multi-disciplinary journal or core-specific filed journals with limited

group interest. In SJR, this limitation is addressed through awarding weightage scores for citations based on journal popularity and prestige. Thus, the SJR score gives the ranking on quality journals more realistically and improves on the traditional system of assessment (Colledge et al., 2010; Elsevier, 2019).

3. *SNIP:* SNIP attempts to address differences in subject filed based on current interest and relevance, which were not explicitly considered in the preceding two methods. It is the ratio of the journal's citation impact and degree of the topicality of the subject filed (i.e., relevance). A degree of topicality measures the citation potential in a particular journal field, representing how often and how rapidly others cite works and how the area is covered in a database like Scopus. Thus this measure identifies the quality journals relevant to the current practice with high citation and clear structure in the core and peripheral journals (Colledge et al., 2010; Elsevier, 2019).

Finally, all the above three methods focus on identifying the journals of high quality and current relevance in the field (Boyle and Sherman, 2006). These are the most preferred journals which are used by the researchers for publishing, referring, and citing during their research process. The results of these Scopus metric analyses are discussed in the following section.

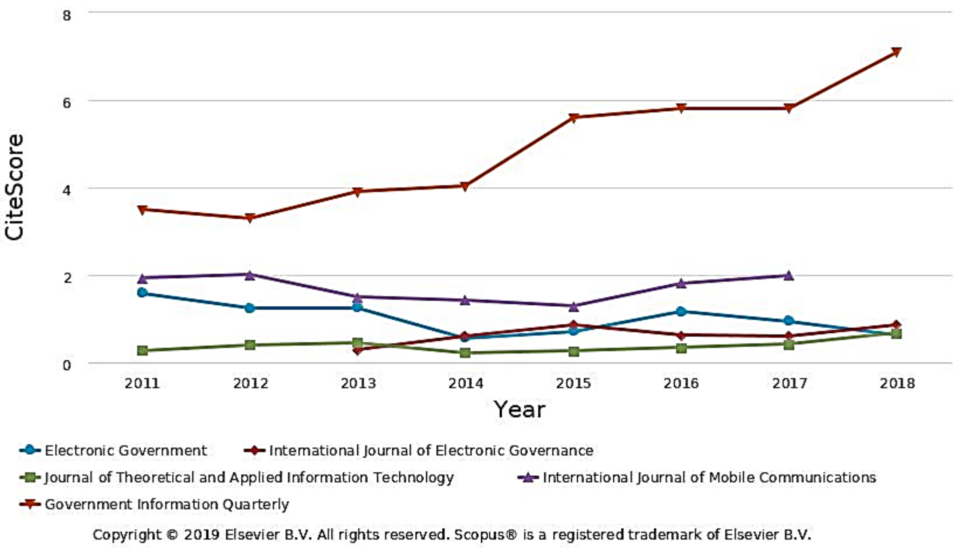

Figure 3.1: CiteScore publication by year on m-government journals (Scopus, 2019).

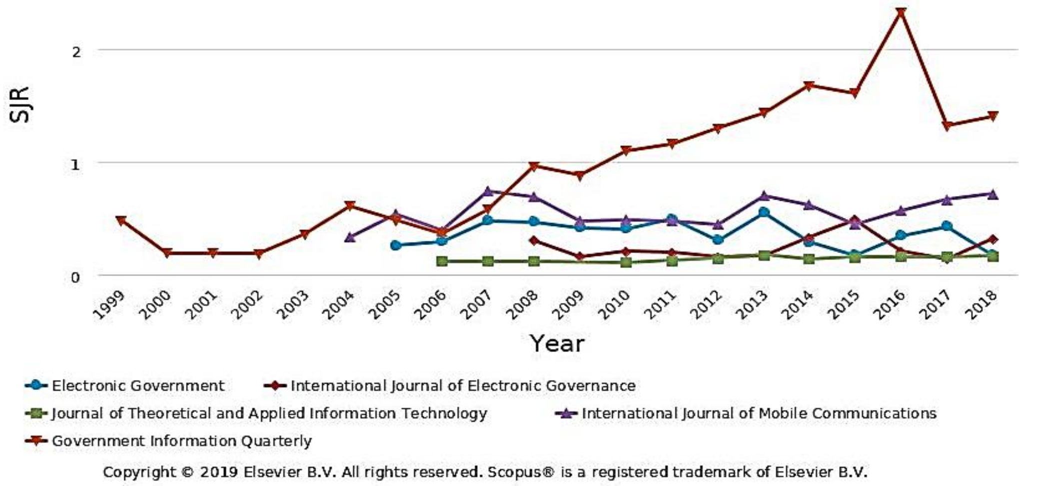

Figure 3.2: SCImago journal rank by year SJR on m-government (Scopus, 2019)

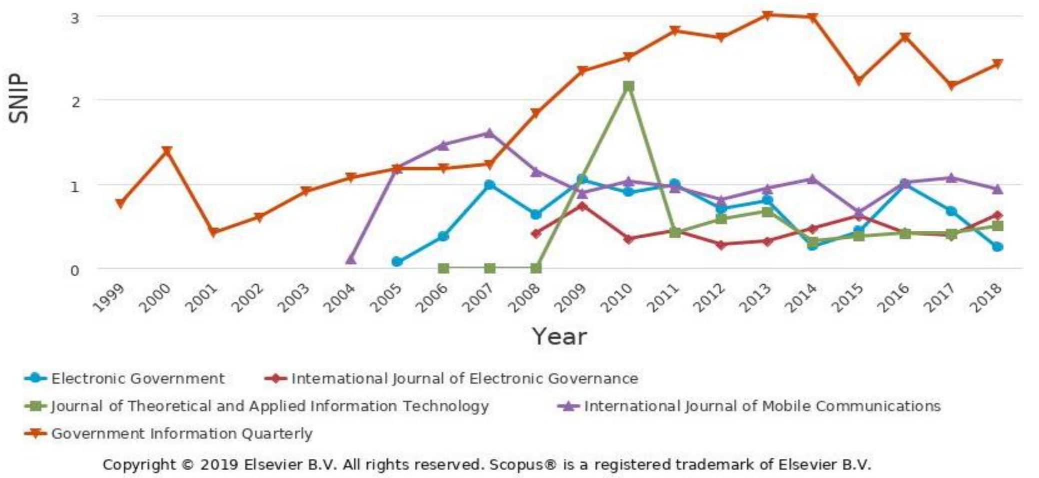

Figure 3.3: SNIP by year on m-government (Scopus, 2019).

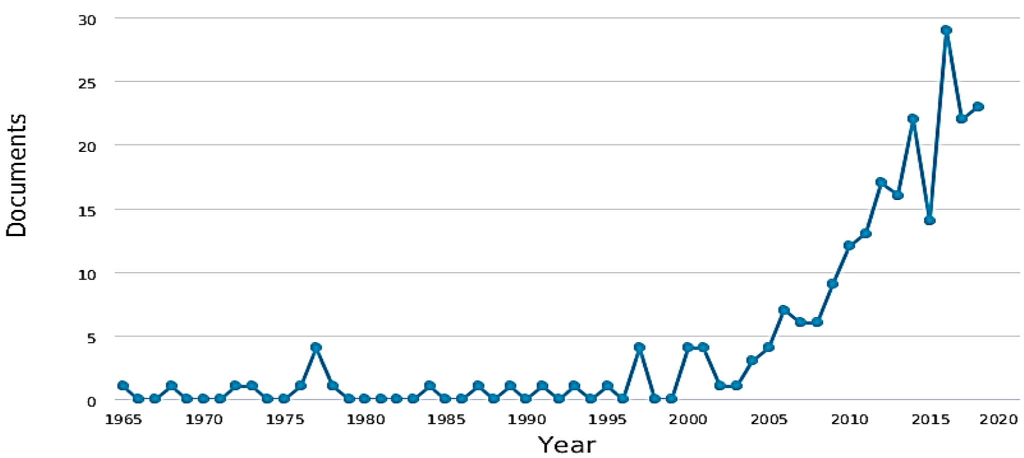

Figure 3.4: Published documents by year from Scopus database (Scopus, 2019).

From the results of Scopus metric analysis (Figure 3.1 to Figure 3.3), the quality journal in the area of m-government are; 1) Government Information Quarterly, 2) International Journal of Mobile Communications, 3) International Journal of Electronic Governance 4) Journal of Theoretical and Applied Information Technology, and 5) Electronic Government. Further, it was observed that the number of articles published from 1972 to 2008 was very minimal, and from 2008 onwards, it started increasing exponentially. Additionally, for the past two years (2017 and 2018), articles published in the area are maximum. It indicates the relevance and scope of the field to the present time (Figure 3.4).

3.3.2 Bibliometric Analysis

A bibliometric analysis helps understand a particular field of research concerning its growth prospects, trends, theoretical and methodological foundations. The retrospection on the prevailing works can help identify research themes and build on the existing knowledge and theories. It also determines the interrelationships among various literature and highlights the newer emerging themes for further research (Linan and Fayolle, 2015; L. Zheng et al., 2019). Two crucial techniques adopted for this purpose are Co-Citation Analysis of References (CCA-R) and Bibliometric Coupling Analysis of Documents (BCA-D). A CCA-R technique recognizes the theoretical and methodological foundations in a particular field of research. Contrary, BCA-D determines the recent trends or themes in the area of research. Here, the significant contribution of this analysis is; first, it determines the most influential existing studies. Second, it provides a valuable reference base. Third, it categorizes various sub-categories or themes and highlights under-researched areas. Overall, it offers researchers and practitioners a clear overview of m-government research and directs future research. The methodology adopted is discussed in detail below:

- Since the study focuses on m-government, especially IS research, the following keyword protocol was used on 27th February 2021.
- TITLE-ABS-KEY ("Mobile Govern*" OR "m Govern*") AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (SRCTYPE, "j")) AND (EXCLUDE (SUBJAREA, "EART")) AND (EXCLUDE (SUBJAREA, "BIOC")).

- The keyword extracts the articles which have used mobile government or its abbreviated terms. Further, only journal documents are considered from the database as the information obtained from these are more reliable and valid (Linan and Fayolle, 2015). The books, chapters and conference papers are excluded since it has varied peer-review process (Jones et al., 2011).
- The article list has been extracted to Dot CSV file format from the Scopus database with all its information. The collected data included bibliographies, abstracts, keywords, authors, citations, etc.
- These articles are then sorted and arranged according to the highest number of citations they had as of date. It is then used to perform the CCA-R and BCA-D analysis using the VOS viewer software. In the current study, all the references of 198 documents were extracted and mapped, and the results are discussed below.

3.3.2.1 CCA-R and BCA-D Techniques

A CCA-R technique identifies the authors, works, theories, and methodologies popularly adopted in the research area of interest (Zupic and Cater, 2013). The process is carried out by analysing the commonly cited references in two or more articles (co-citation). Based on the co-citations, and their number of occurrences and mapping, the popularly cited articles are obtained which forms the foundational works in the field (Callon et al., 1993; Stock and Weber, 2006). However, it does not extract the details of recent trending articles and their respective themes (Zupic and Cater, 2015). CCA-R helps us understand the theoretical foundation or the seminal text, progressively helping future scholars build on theories and practical applications.

The BCA-D technique extracts research themes/topics/objectives that are currently trending or relevant in a specific area of research. Here, document mapping is carried out and analysed with the number of shared references between any documents. The reflection of closeness among two papers on a particular theme/objective is known with the number of closely shared references between the papers (Y. Chang et al., 2015). Thus, this mapping will assist in understanding the transformation in a field of research from traditional foundational studies to the latest trends in the area. It also helps to know the themes or critical issues that are being discussed on a particular topic. This technique can also identify the gaps and context in which the problems are discussed (Walsh and Renaud, 2017).

However, it is essential to note that in CCA-R, the citations of references change over time. Hence, their co-citations will change and thus are not stable. On the other hand, BCA-D with constant cited references of an article is stable. Mapping and analysis of these co-citations and reference lists of articles is performed using an appropriate tool. The standard tool that is being used for both these analyses is VOS-Viewer software. It is an open access bibliometric analysis tool developed by Van Eck (Van Eck and Waltman, 2011; Van Eck et al., 2010).

Further, CCA-R is the map that represents the frequency with which two documents are cited together by the other articles (Small, 1973). Using the VOS viewer software, all 6019 references from the 146 articles were considered for co-citation analysis. Here, the co-citation with fractional counting approach is used to normalize the data, which is the preferred one and commonly used (Perianes-Rodriguez et al., 2016). The references cited at least five times were considered as the threshold, and 20 cited references were considered for mapping, and the results of the same are analysed (Figure 3.5 and Table 3.2). For the BCA-D analysis to investigate the recent trends, all 198 were considered. Here, about 60 articles were not having interlinkages and are excluded while mapping. A total of 138 documents was mapped and resulted in eleven clusters using a fractional counting approach for normalization. The results are presented in Figure 3.6 and Table 3.3. The cluster numbers (Cl), article details under each cluster, citations (Ct), and link strength (L) of each article are provided in Tables 3.2 and 3.3, which were primarily used in the mapping of articles.

Table 3.2: Details of the CCA clusters

References	Clusters	Citations	Link Strength
Abdelghaffar and Magdy (2012)	Cluster 1- Red	5	5
Amailef and Lu (2011)	Cluster 1- Red	8	8
Carter and Belanger (2005)	Cluster 1- Red	5	5
Fornell and Larcker (1981)	Cluster 1- Red	5	5
Hung, Chang, and Kuo (2013)	Cluster 1- Red	7	7
Ishmatova and Obi (2009)	Cluster 1- Red	8	8
Liu, Li, Kostakos, Goncalves, Hosio, and Hu (2014)	Cluster 1- Red	9	6
Shareef, Kumar, Kumar and Dwivedi (2011)	Cluster 1- Red	5	4
Shareef, Archer, and Dwivedi (2012)	Cluster 1- Red	6	6
Trimi and Sheng (2008)	Cluster 1- Red	6	6
Warkentin, Gefen, Pavlou and Rose (2002)	Cluster 1- Red	5	5
Ajzen (1991)	Cluster 2- Green	6	6
Bertot, Jaeger, and Grimes (2010)	Cluster 2- Green	11	10
Davis (1989)	Cluster 2- Green	14	10
Davis, Bagozzi, and Warshaw (1989)	Cluster 2- Green	5	1
Venkatesh and Davis (2000)	Cluster 2- Green	6	6
Venkatesh, Morris, Davis, and Davis (2003)	Cluster 2- Green	7	7
T. Zhou, Lu, and Wang (2010)	Cluster 2- Green	8	7
Davis (1989)	Cluster 3- Blue	5	4
Hung, Chang, and Kuo (2013)	Cluster 3- Blue	7	7
Ntaliani, Costopoulou, and Karetsos (2008)	Cluster 3- Blue	7	7
C. Wang (2014)	Cluster 3- Blue	5	5

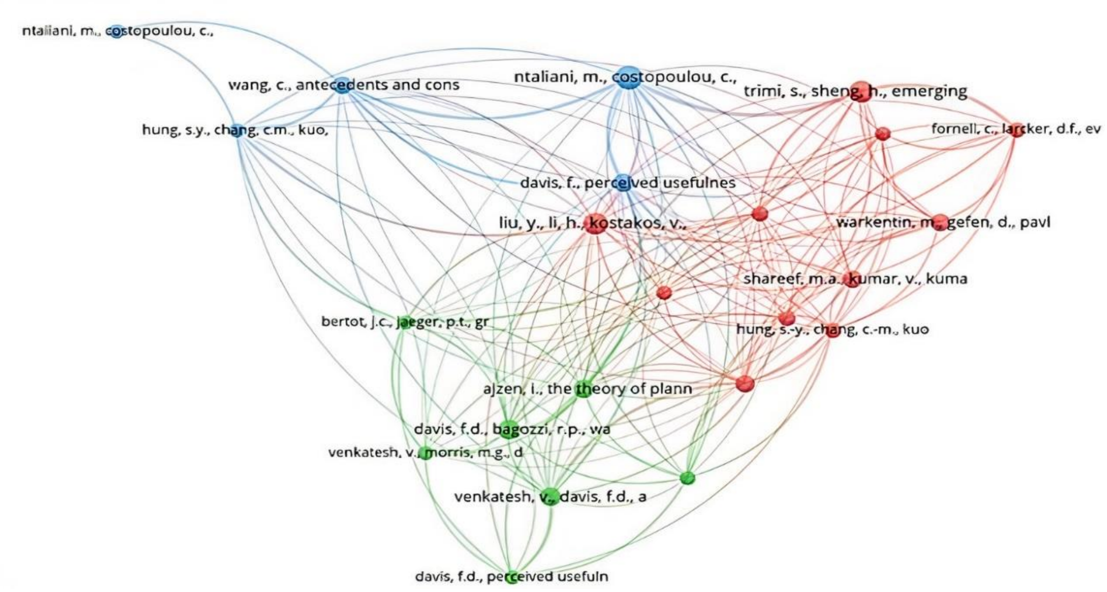

Figure 3.5: Seminal works of m-government through CCA-R mapping

Table 3.3: Details of the BCA clusters

Cl	Authors	Ct	L
1	Al-Dalahmeh, Al-Shamaileh, Aloudat, and Obeidat (2018)	4	1
1	Al-Masaeed and Love (2014)	1	6
1	Aloudat and Michael(2011)	39	12
1	Alssbaiheen and Love (2015)	2	3
1	Alssbaiheen and Love (2016)	1	10
1	Bakar, Abdul-Rahman, and Abdull-Hamed (2015)	5	5
1	Inalo, Sarfarazi, and Khalili (2012)	1	1
1	De Reuver, Stein, and Hampe (2013)	28	7
1	Emmanouilidou and Kreps (2010)	17	13
1	Eom and Kim (2014)	16	17
1	Fan, Gao, and Gao (2016)	1	13
1	Garcia, Vivacqua, and Tavares (2011)	7	2
1	Alonso, Thoene, and Benavides (2020)	0	7
1	Glood, Osman, and Nadzir (2016a)	4	22
1	Glood, Osman, and Nadzir (2016b)	2	15
1	Hobololo and Mawela (2017)	2	12
1	Imran, Quimno, and Hussain (2016)	5	4
1	Kariuki (2015)	4	2
1	Kaur and Dani (2017)	4	7
1	A. Roy, Dutta and Das (2019)	1	7
1	Salameh (2020)	0	12
1	Wu, Ozok, Gurses, and Wei (2009)	32	13
1	Yu and Janssen (2010)	9	7
2	Alharbi, Halikias, Yamin, and Basahel (2020)	0	4
2	Ali and Al Kabbi (2018)	1	20
2	Bakhshimazdeh and Alikhasi (2015)	3	30
2	Chanana, Agrawal and Punia (2016)	8	12
2	Erturk, Sengul, and Rehan (2013)	0	2
2	Karantjias, Papastergiou, and Polemi (2009)	12	6
2	Karantjias and Polemi (2009)	7	8
2	Karantjias, Polemi, Stamati, and Martakos (2010)	8	10
2	Karantjias, Stamati, and Martakos (2010)	6	4
2	M. Kumar, Hanumanthappa, and Reddy (2008)	5	2
2	S. Lee, Tan, and Trimi (2006)	39	6
2	Ntaliani, Costopoulou, and Karetsos (2008)	94	5
2	Ntaliani, Costopoulou, Manouselis, and Karetsos (2009)	11	3
2	Sareen, Punia, and Chanana (2013)	14	17
2	Sharma and Gupta (2004)	53	3
2	Sheng and Trimi (2008)	46	13
2	C. Wang (2014)	80	62
2	C. Wang, Fang, Park, Feng, Lu, and Cui (2012)	8	36
2	C. Wang, Feng, Fang, and Lu (2012)	11	17
2	Yaghoobi, Bakhshimazdeh, and Alikhasi (2014)	4	27
2	Zhuo, Wei, Chen, and Li (2010)	4	13
3	Althunibat, Alrawashdeh, and Muhairat (2014)	4	18
3	Althunibat, Zain, and Ashaari (2011)	7	21
3	Amailef and Lu (2013)	117	5
3	Amailef and Lu (2011)	22	11
3	Deep and Sahoo (2011)	3	1
3	Ingrams (2015)	13	13
3	Kesavarapu and Choi (2012)	5	9
3	R. Kumar (2016)	1	6
3	Kyem (2016)	6	5
3	Liu, Li, Kostakos, Goncalves, Hosio, and Hu (2014)	88	32
3	Liu, Mezei, Kostakos, and Li (2017)	55	17
3	Misuraca (2009)	56	6
3	Mossey, Bromberg, Manoharan (2019)	2	17
3	Neutens, Delafontaine, Scott, and De Maeyer (2012)	33	1
3	Ohme (2014)	14	24
3	Poblet (2011)	7	5
3	Tawfeeq and Sultan (2018)	0	5
3	Watari, Zaidan, and Zaidan (2013)	2	9
4	Ahmad and Khalid (2017)	53	36
4	Ding, Yang, Chen, Long, and Wei (2019)	6	30
4	Joseph (2019)	0	7
4	X. Li, Ding, and Li (2019)	3	13
4	Y. Li, Yang, Chen, and Yao (2018)	15	28
4	Liang, Wang, Dong, Zhang, and Qi (2021)	0	20
4	Mensah, Zeng, and Luo (2020)	0	23
4	Ni, Yang, Pan, Yao, Li, and Chen (2019)	1	15
4	Peng, Wang, and Yang (2021)	0	1
4	Shahzad, Xiu, Khan, and Wang (2019)	7	68

4	Shahzad, Xiu, Khan, and Shahbaz (2020)	1	81
4	Talukder, Chiong, Corbitt, and Bao (2020)	0	30
4	Sharma, Al-Badi, Rana, and Al-Azizi (2018)	26	33
4	Talukder, Chiong, Dhakal, Sorwar, and Bao (2019)	2	42
4	C. Wang and Teo (2020)	4	61
4	C. Wang, Teo, and Liu (2020)	5	54
4	S. Yang, Jiang, Yao, Chen, and Wei (2018)	21	26
4	S. Yang and Zeng (2018)	6	23
5	Abu-Shanab and Haider (2015)	22	31
5	Albesher and Stone (2016)	8	39
5	Almaiah, Al-Khasawneh, Althunibat, and Khawatreh (2020)	1	26
5	Almiani, Razaque, and Al Dmour (2016)	5	10
5	Hou, Arpan, Wu, Feiock, Ozguven, and Arghandeh (2020)	0	27
5	Ishengoma, Mselle, and Mongi (2019)	3	16
5	Kharma, Hassan, Shambour, Turab, and Nairoukh (2020)	0	16
5	Kharma, Turab, and Shambour, and Hassan (2020)	2	16
5	Onashoga, Ogunjobi, Ibharalu, and Lawal (2016)	3	2
5	Phusavat, Anussornnitisarn, Helo, and Dwight (2009)	42	1
5	Reddick and Zheng (2017)	14	24
5	Sultana, Ahlan, and Habibullah (2016)	13	17
5	Whitmarsh, Northen, and Jaffry (1999)	26	1
6	AlBar and Hddas (2018)	0	7
6	Alqaralleh, Al-Omari, and Alksasbeh (2020)	1	29
6	Alsaadi, Ahmad, and Hussain (2018)	3	28
6	Alsaadi, Ahmad, and Hussain (2019)	2	25
6	Al-Sherideh, Ismail, Wahid, Fabil, and Ismail (2018)	0	5
6	Azeez and Lakulu (2018)	2	30
6	Costopoulou and Molhanec (2014)	1	4
6	Eid, Selim, and El-Kassrawy (2020)	0	47
6	Mandari and Chong (2018)	4	42
6	Mandari, Chong, and Wye (2017)	6	51
6	Wirtz and Birkmeyer (2018)	6	34
6	Wirtz, Birkmeyer, and Langer (2019)	2	49
6	Zamzami (2019)	2	17
7	Aloudat, Michael, Chen, and Al-Debei (2014)	54	32
7	Alrazooqi and De Silva (2010)	13	12
7	Dunn (2009)	5	1
7	Ekong and Ekong (2010)	15	1
7	Faisal and Talib (2016)	19	13
7	Hussain, Mkpojiogu, Ishak, Mokhtar, and Ani (2019a)	2	1
7	Jahanshahi, Khaksar, Yaghoobi, and Nawaser (2011)	14	21
7	Jaradat, Moustafa, and Al-Mashaqba (2018)	5	44
7	Mishra and Singh (2019)	0	26
7	Mishra and Singh (2020)	0	23
7	Saadi, Ahmad, and Hussain (2017)	10	45
7	Vincent and Harris (2008)	33	1
7	Winkler, Ziekow, and Weinberg (2012)	12	13
8	Madden, Bohlin, Oniki, and Tran (2013)	7	1
8	Mervyn, Simon, and Allen (2014)	21	6
8	Reddick, Zheng, and Perlman (2020)	1	17
8	Muller, Lerusse, Steen, and Walle (2021)	0	18
8	Shareef, Archer, and Dwivedi (2012)	61	44
8	Shareef, Dwivedi, Laumer, and Archer (2016)	24	55
8	Shareef, Dwivedi, Stamati, and Williams (2014)	34	48
8	Shareef, Kumar, Dwivedi, and Kumar (2016)	43	73
8	Tomer, Chauhan, and Panigrahi (2016)	3	19
8	G. Wang, Chen, Xu, and Leng (2020)	0	21
9	Almarashdeh (2020)	0	30
9	Almarashdeh (2018)	10	48
9	Almarashdeh and Alsmadi (2017)	27	19
9	G. Chen, Zhao, Zhang, Wang, and Guo (2015)	4	15
9	Z. Chen, Vogel, and Wang (2016)	32	32
10	Hung, Chang, and Kuo (2013)	182	42
10	Saxena (2017)	16	89
10	Saxena (2018)	9	75
11	Al-Hubaishi, Ahmad, and Hussain (2017)	31	47
11	Al-Hubaishi, Ahmad, and Hussain (2018)	1	54

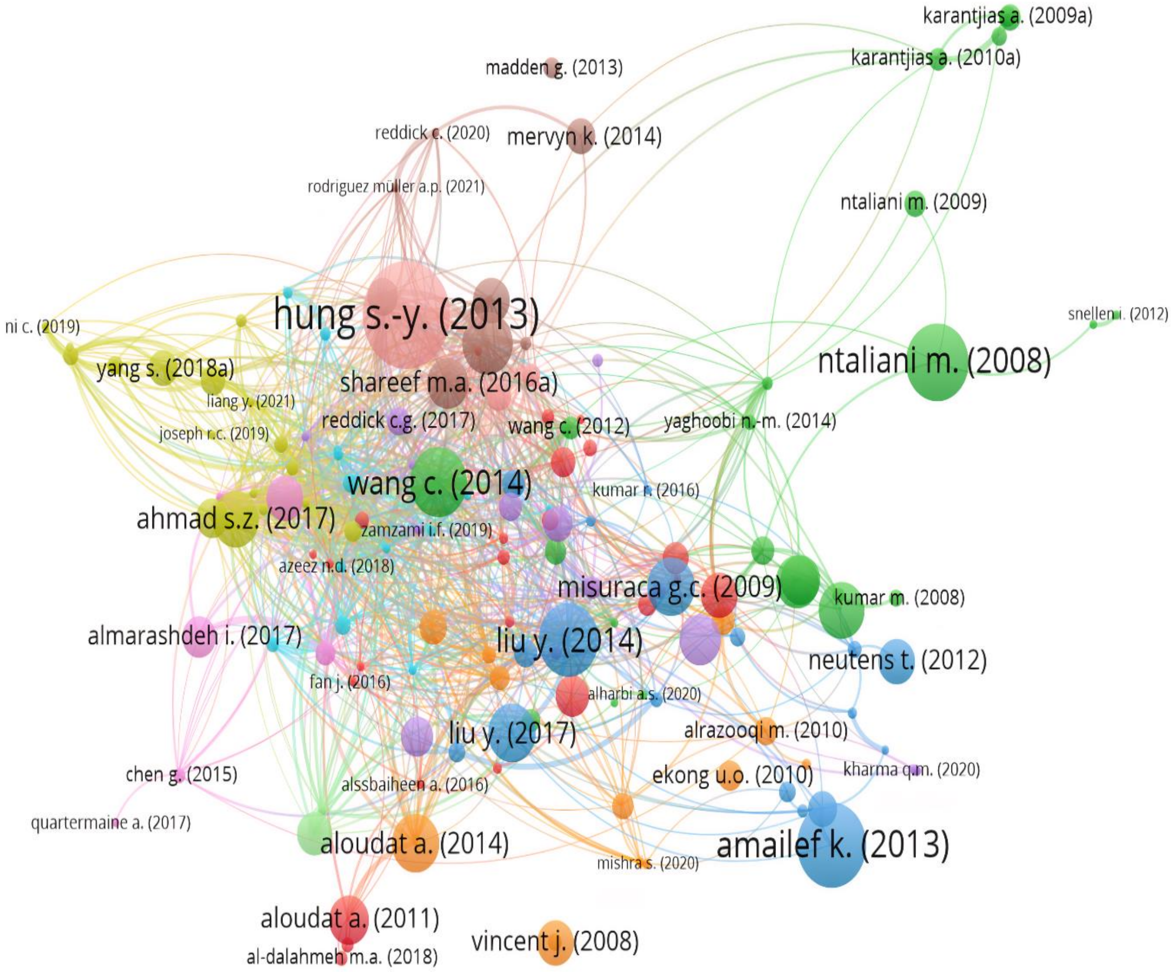

Figure 3.6: BCA-D cluster mapping for main themes in m-government

The results of the CCA-R and BCA-D techniques are mapped and presented in Figure 3.5 and Figure 3.6. In these maps, nodes are the unit of analysis like the references that are more cited or co-cited in CCA-R and BCA-D analysis. It represents the documents that have the most number of shared references. Here, the software assigns each unit to a cluster based on references in CCA and documents in BCD, using the normalized indices. Each group has different colours, and closely related units are mapped through nodes. Prioritization of nodes is based on the significance of the nodes (most cited documents) among the several node labels in the map. The size of the nodes represents the strength of the relationship, and the thickness of the link between the nodes represents the proportion of co-citation indices in the CCA map and bibliographic coupling indices in the BCD map.

3.3.2.2 Interpretation of CCA-R Cluster Analysis

The CCA-R analysis identified the seminal works in m-government, representing the stature theoretical or methodological foundation. These pieces of literature strengthen the fundamental and critical knowledge in the respective field of work. In the current study, the CCA-R analysis highlighted three main clusters based on the documents' references in the area of m-government. The section below interprets and describes these clusters in detail.

Cluster 1 (Red Colour) – Core Research on M-Government Dimensions (11 papers)

Cluster 1, represented by red, reveals the seminal works carried out in m-government research, as it evolved on various dimensions. It considers all the aspects from the theoretical perspective on assessing the environment (like opportunities, challenges, infrastructural elements, and trends) to the quantitative methods in analysing the adoption of m-government among citizens. The cluster also reflects on the significant theories and factors considered by the researchers during the initial stages of research on m-government.

The transformation in research from EG to m-government mainly began by studies focusing on knowing the benefits, challenges, need, and value of m-government in general or country-specific (Ishmatova and Obi, 2009; Trimi and Sheng, 2008). Later on, empirical studies investigating the acceptance of m-government by the public started gaining prominence (Abdelghaffar and Magdy, 2012; Amailef and Lu, 2011; Hung et al., 2013; Liu et al., 2014; Shareef et al., 2012). The studies on m-government were mainly extended from the previous literature on EG due to its close relevance to the field (Carter and Belanger, 2005; Shareef et al., 2011; Warkentin et al., 2002). Here, the empirical studies mainly adopted the structural equation modelling (SEM) for analyzing m-government adoption. The inclusion of a seminal work on SEM by Fornell and Larcker (1981) as a cited reference demonstrates the relevance of this approach. Further, seminal works on specific applications like agriculture and emergency systems were also highlighted, gaining much prominence in recent times (Amailef and Lu, 2011; Liu et al., 2014).

From a theoretical perspective on m-government research, TAM, TPB, and DOI are the popular theories used by the researchers. Further, in their study on EG, Shareef et al. (2011) emphasized that theories like TAM, TPB, and DOI cannot capture the complete essence of adoption characteristics and stress using an integrated model. It has also been highlighted in the previous works of Carter and Bellanger (2005), Hung et al. (2013), Shareef et al. (2012). Hence, studies on m-government have mainly used an integrated model for understanding m-government adoption. Further, variables like trust and awareness were predominantly used by the authors indicating the significance of these factors (Abdelghaffar and Magdy, 2012; Carter and Belanger, 2005; Liu et al., 2014).

Hence, this cluster summarizes the seminal works that give insights on the benefits, challenges, and existing scenarios in m-government. It further revealed some of the significant works on empirical studies in EG, which are referred to carry research in m-government.

Cluster 2 (Green Colour) – Theories in M-government Adoption Studies (7 papers)

Cluster 2, represented by Green, discusses relevant technology adoption theories that have been commonly applied in m-government studies. Some of the significant theories adopted primarily are TRA, TAM, TPB, TAM2, UTAUT, and Technology-Task Fit (TTF). It also reflects the evolution of these theories over the preceding to overcome the limitations of the older theories.

The Information system (IS) research on technology adoption evolved with the development of the TRA. This theory mainly presumed that attitude and norms are the two critical determinants of an individual's behavioural intention (Davis et al., 1989). Further, attitude is influenced by the strength of behavioural beliefs and confidence in the outcomes. Norms represent the external influence which the influence of others (Subjective Norms). The normative belief describing the acceptance of action by significant others and the motivation to comply with the same are two key aspects that influence the norm. The theory was later extended by replacing the two attitude measures with technological factors viz. perceived usefulness and perceived ease of use, known as TAM (Davis, 1989). Further, Davis et al. (1989), through a comparative study of TAM and TRA, identified the significant influence of PU and PEU in explaining the behavioural intention (BI) over the other factors. It strengthened and further validated the TAM theory.

The other significant extension of TAM is the development of TPB by Ajzen (1991). This theory focused on addressing the limitation in the construct norms that neglected the external factors that restrict an individual's action. The determinants like Attitude, Subjective Norms, and Perceived Behavioural Control (PBC) reflecting on user capacity and availability of resources are used. It is proved to have better predictive and explanatory power over the TRA (Ajzen, 1991).

Later on, TAM was criticized on two aspects, firstly for considering only two constructs that are too general. The second was for neglecting the non-technological factors. To address these drawbacks, the TAM was extended as the TAM2 model. Here, the variables included were subjective norms, voluntariness, and image measuring social influence. Further, the factors considered under the cognitive instrumental process are job relevance, output quality, result demonstrability, and perceived ease of use (Venkatesh and Davis, 2000).

Further, Venkatesh et al. (2003) categorized all of these critical constructs influencing the adoption behaviour under four constructs viz. performance expectancy, effort expectancy, Social Influence (SI), and Facilitating Condition (FC). The model so developed refers to the UTAUT model. It showed a significant explanatory power in technology adoption and is being widely used and validated by many researchers across several areas of technology adoption.

Later on, the TTF theory gained prominence among the researchers in understating the individual's use of an IS. This theory mainly considers that the user will use a technology based on technical characteristics and the task needed to be performed and match/fit between the two. If the task technology fit is high, the consequence will be impacting the performance and the utilization of technology (Goodhue and Thompson, 1995). T. Zhou et al. (2010) integrated the UTAUT and TTF theories to explain the behavioural intention of an individual towards a mobile banking system. The other dimension in these studies is on accessing the influence of social media on technology adoption. Social-media-based studies are gaining much popularity in recent times. The prominent work in this area is by Bertot et al. (2010), highlighting the significance of EG and social media in creating a transparent government. It is believed that these technologies play a vital role in minimizing corruption and forming an open government.

Summarizing from the result (Figure 3.6), that the TAM and TPB are the most widely adopted model, followed by the UTAUT model in the field of m-government (cluster size). Further, it can be concluded that the transformational phase started from TRA to TAM and TPB and then to TAM2 and UTAUT. Later, the study is extended towards TTF theory and on Social media influence while understanding the adoption of these technologies.

Cluster 3 (Blue Colour) – Key Initial Studies on M-government (4 papers)

Cluster 3, represented by blue, reflects on the seminal works on m-government during its initial phases of evolution, which formed a standard reference for future studies. Here, the study by Ntaliani et al. (2008) is vital, which lights on the significance of mobile technology for information sharing and providing services by the government. Further, empiric studies on citizen perspective using fundamental theories like TAM (Davis, 1989) form the basis for any technology adoption study such as m-government. Here, the seminal work by Hung et al. (2013), C. Wang (2014) are mostly cited, focusing on accessing the influence of critical factors on the adoption of m-government. The factors like PU and PEU of TAM and other factors like trust, social influence, and self-efficacy are the key considerations in these studies.

3.3.2.3 Interpretation of BCA-D Cluster Analysis

The BCA-D analysis determines the key themes/categories of m-government research that are being studied. A total of eleven clusters were formed during this analysis using VOS software. The sources (Table 3.3) and description of these clusters are presented below:

*Cluster 1 (Red) – M-*government *Environment and Success Model (23 papers)*

The documents in the cluster focus on accessing the m-government environment (in terms of challenges/limitations and opportunities) and then develop a business model that would upshot the success of these IT-based projects. Although mobile technology penetration is high in most countries around the globe, several studies have reported low usage of m-government services (Bakar et al., 2015; Garcia et al., 2011; Glood et al., 2016a, 2016b). Nonetheless, it is expected that m-government, with its potential, would enhance public participation (De Reuver et al., 2013; Garcia et al., 2011; Hobololo and Mawela, 2017). It also improves the emergency systems, healthcare services, and assists in management of migrants and refugees (Alonso et al., 2020; Aloudat and Michael, 2011; Wu et al., 2009). As a result, numerous studies have been carried out on the aforementioned aspects to assist in executing these ventures (Al-Dalahmeh et al., 2018; Aloudat and Michael, 2011; Inalo et al., 2012).

These studies have identified several critical issues that would impact the success of m-government. First, it is essential to understand citizens' needs and preferences, given their profile (Bakar et al., 2015; Eom and Kim, 2014). Further, it is also essential to consider the social implications like people's trust and risk perception in developing the business model (Al-Masaeed and Love, 2014; Aloudat and Michael, 2011; A. Roy et al., 2019). Therefore, it is crucial to establish a clear relationship between the strategic goals, action plans, and performance measures (Yu and Janssen, 2010).

The second aspect addressed is the complex interplay between stakeholders such as government, telecommunications providers, the public, and other value-chain members (Eom and Kim, 2014; Kariuki, 2015). Therefore, selecting the right partners and identifying their roles and responsibilities is very important (Al-Dalahmeh et al., 2018; De Reuver et al., 2013; Kariuki, 2015). Studies also revealed the need for a collaborative environment between stakeholders without a superficial relationship with appropriate financial compensation (Al-Dalahmeh et al., 2018; Fan et al., 2016). The third aspect commonly reflected in these studies is assessing the security and privacy issues before designing an m-government service model (Al-Masaeed and Love, 2014; Aloudat and Michael, 2011; Alssbaiheen and Love, 2016; Imran et al., 2016).

The fourth aspect discussed is the need to understand the technological, organizational, and financial design issues to ensure the strategic effectiveness and performance of the m-government system (De Reuver et al., 2013; Eom and Kim, 2014). From a strategic point of view, studies have identified the need for higher information and system quality (Alssbaiheen and Love, 2015, 2016; Fan et al., 2016; Glood et al., 2016a, 2016b; Salameh, 2020). Al-Dalahmeh et al. (2018), in their study of the mobile emergency system, found misunderstanding of the information as one of the significant limitations. Overall, it is vital to develop a flexible system to balance old and new technology depending on circumstances and time (Al-Dalahmeh et al., 2018).

Lastly, prior studies have also listed other significant barriers in implementing m-government, where accessibility is the primary concern reflecting on service to all (Alssbaiheen and Love, 2015; Imran et al., 2016; Kaur and Dani, 2017; A. Roy et al., 2019). Emmanouilidou and Kreps (2010) emphasized the importance of a service being easily accessible to both the disabled and the elderly. The authors also identified the need to consider physical, mental, and technical skills before developing m-government services. The other main barrier is lower awareness of these services and their associated benefits, especially in developing countries (Al-Masaeed and Love, 2014; Alssbaiheen and Love, 2015, 2016). The key issues that impede the performance of m-government that are highlighted in the previous literature are, Infrastructure challenges such as organizational and technological (Alssbaiheen and Love, 2016; Eom and Kim, 2014); cost and investment-related challenges (Al-Dalahmeh et al., 2018; Al-Masaeed and Love, 2014); service customization (Alssbaiheen and Love, 2016); the right attitude among government agencies (Bakar et al., 2015; Kariuki, 2015); local government inexperience (De Reuver et al., 2013), etc.

Therefore, several studies developed a model considering these issues. For instance, Yu and Janssen (2010) adopted a Value Sensitive Design (VSD) model that integrates organizational and technological concepts and methodologies. In addition, a study on m-participation developed an SMS-based architecture with WAP application for interface design to a participatory budgeting system (Garcia et al., 2011). Further, De Reuver et al. (2013) integrated Mobile technology, Wiki concepts (for content creation), and geo-referencing (for location-specific interaction) for the public to report incidents and interact with the government. Similar technologies were also adopted for location-based emergency systems (Al-Dalahmeh et al., 2018). In addition, it was recommended to follow the six phases of implementation (roadmap) viz. data collection, policy formulation, pre-design, design, testing and launch (Al-Masaeed and Love, 2014). Overall, the cluster reflected on the key aspects that need to be considered before developing an m-government service model for its success.

Cluster 2 (Green) – M-government Frameworks (21 papers)

The documents in this cluster discuss the development of a useful framework for the m-government application for delivering its services (Alharbi et al., 2020; Karantjias et al., 2009; Karantjias, Stamati, et al., 2010). It also discusses on the issues and challenges in its implementation (Ntaliani et al. 2008; Ntaliani et al., 2009; Sharma and Gupta, 2004; Sheng and Trimi, 2008). These studies' primary aim was to design effective and cost-efficient m-government applications using different modes like audio, video, and text (Sharma and Gupta, 2004). Studies have also analysed the current m-government practices in leading countries based on the state of the art, benefits, risks, and future directions and also highlighted the importance of assessing value generated through these services (Ali and Al-Kabbi, 2018; Erturk et al., 2013; S. Lee et al., 2006; C. Wang, 2014; C. Wang, Fang, et al., 2012; C. Wang, Feng, et al., 2012).

Further, most studies have discussed privacy, security, and risks aspects while developing m-government frameworks (M. Kumar et al., 2008; Ntaliani et al., 2009; Zhuo et al., 2010). The critical success factors in developing a framework like interoperability, scalability/extensibility, trust, service quality, business-technology domain alignment, and organizational agility was also identified (Chanana et al., 2016; Karantjias et al., 2009; Karantjias and Polemi, 2009; Karantjias, Stamati, et al., 2010).

In developing an m-government framework, most studies have adopted service-oriented architecture (SOA) based framework (Karantjias et al., 2009). Besides, the m-government framework was developed mainly based on integrated peak XML-based technologies by the researchers (Karantjias and Polemi, 2009; Karantjias, Stamati, et al., 2010). Further, the Software as Service (SaaS) model-based approach was found to address most of the challenges in developing the m-government system for advanced e/m government application (Zhuo et al., 2010). Karantjias, Polemi, et al. (2010) developed targeted, user-centric, and federated design using Single-Sign-On Identity Management System (SecIdAM) framework to build privacy-aware, interoperable, and secure mobile applications. A methodologically qualitative approach like an expert opinion, fuzzy Delphi, and AHP was used to identify and rank factors (Bakhshimazdeh and Alikhasi, 2015; Sareen et al., 2013; Yaghoobi et al., 2014).

*Cluster 3 (Blue) – Information in M-*government *and Sustainability (18 papers)*

The information is a critical component in any democratic nation, the sharing of which with the public will help build transparency and trust with the government (Liu et al., 2014; R. Kumar, 2016). Here, the m-government system is expected to have a great potential in information sharing between government and public, thereby improving the governance system and developing the society (Deep and Sahoo, 2011; Kesavarapu and Choi, 2012; Neutens et al., 2012; Poblet, 2011). However, its acceptance is a crucial concern, and the information on the same is a valuable insight (Althunibat et al., 2011, Althunibat et al., 2014; Ohme, 2014). Further, many research works in this cluster have discussed this aspect of information in m-government and its significance (Ingrams, 2015; Misuraca, 2009; Ohme, 2014). Most studies have mainly focused on this aspect concerning the role, technical requirements, and challenges in information management of an m-government system (Amailef and Lu, 2011; Ingrams, 2015; R. Kumar, 2016; Kyem, 2016; Liu et al., 2014; Mossey et al., 2019).

The vital contribution of literature in this section is on developing a framework with an efficient algorithm for information extraction, an aggregate algorithm for the integration of information from multiple sources, storage, and dissemination of information (Amailef and Lu, 2011, 2013). Further, the other key area of interest is privacy and information security to minimize the risk during m-government use (Amailef and Lu, 2013; Mossey et al., 2019; Ohme, 2014; Tawfeeq and Sultan, 2018; Watari et al., 2013). These algorithms focus mainly on improving the interaction between the stakeholders of the m-government system (Amailef and Lu, 2011, 2013;

Watari et al., 2013). Further, data transmission as cryptography algorithms is applied to secure information (authentication and confidentiality) (Tawfeeq and Sultan, 2018). All these aspects were discussed with an objective of long-term use and sustainability of the m-government system (R. Kumar, 2016; Liu et al., 2014; Mossey et al., 2019). Further, quantitative studies have mainly adopted regression-based methods for data analysis (Liu et al., 2014; Ohme, 2014). Contrary, Liu et al. (2017) have suggested configurational analysis using fuzzy set qualitative comparative analysis (FsQCA) to overcome the limitation of regression methods (i.e., the assumption of symmetric relations).

Cluster 4 (Yellowish Green) – Key Approaches in M-government Research (18 papers)
The documents in this cluster highlight various approaches and theoretical frameworks for assessing the citizens' perspective on accepting and using m-government services. Studies here are primarily empiric-based studies that have mainly adopted the Structural Equation Modelling (SEM) method (Ahmad and Khalid, 2017; Mensah et al., 2020; Shahzad et al., 2019; C. Wang and Teo, 2020). The prominent theoretical framework adopted here was the UTAUT model for assessing the intention to use m-government services (Menshah et al., 2020; Sharma et al., 2018; Talukder et al., 2020).

Further, the literature also focused on measuring the value of m-government services based on a value-based adoption model (C. Wang et al., 2020; S. Yang et al., 2018). Additionally, C. Wang and Teo (2020) integrated a value-based model with the IS Success Model of DeLone and McLean (2003) to explain m-government success. Moreover, a combination of the Stimuli Organism Response (SOR) framework with social theory and value-based perspective was used to describe the continuance intention towards mobile-based government microblogging services (GMS) (Y. Li et al., 2018; Ni et al., 2019; S. Yang and Zeng, 2018).

In addition to this, the gratification theory (Y. Li et al., 2018) and transaction cost-based view (X. Li et al., 2019) were adopted to assess the satisfaction and sustainability of m-government services. An integrated model of the Technology-Organization-Environment (TOE) framework with the Trust-based Theory was also used to measure the acceptance of mobile cloud computing systems (Liang et al., 2021). The other emphasis in this direction was on evaluating the consumer experience regarding their level of engagement. Here, utilitarian engagement was found to impact citizen engagement positively, while hedonic engagement had low importance, as these are government-related programs (Joseph, 2019).

A two-stage predictive modelling approach to describe m-government adoption is another primary approach used in most literature. SEM is used in conjunction with the Artificial Neural Network (ANN) technique to reinforce the findings of the SEM method (Ding et al., 2019; Peng et al., 2021; Shahzad et al., 2020; Sharma et al., 2018; Talukder et al., 2019; S. Yang and Zeng, 2018).

Cluster 5 (Purple) – M-government Adoption Model and its Security (13 papers)

Documents in this cluster primarily focus on developing the m-government adoption model (Almaiah et al., 2020; Sultana et al., 2016). It also focuses on the development of the secured framework and measuring the performance of a public sector system that uses these technologies (i.e., m-government) in improving their services (Almiani et al., 2016; Kharma, Hassan, et al., 2020; Kharma, Turab, et al., 2020; Onashoga et al., 2016; Phusavat et al., 2009). The critical success factors on m-government adoption such as security, benefits, usability, access, responsiveness, personal initiatives and characteristics were identified in these studies (Abu-Shanab and Haider, 2015; Ishengoma et al., 2019). Studies have also focused on measuring the value and acceptance of these services (Hou et al., 2020; Reddick and Zheng, 2017). Here, Almaiah et al. (2020) integrated the generalized additive model with UTAUT for the same. Further, Whitmarsh et al. (1999) used a contingent valuation method focusing on measuring the gains and losses in terms of the value of enjoyment.

Moreover, studies have identified the roadblocks in successfully integrating performance measurement to management control in public sector companies (Phusavat et al., 2009). Further studies have highlighted the importance of understanding the needs and expectations of users and the associated complexities to improve the performance (Abu-Shanab and Haider, 2015; Albesher and Stone, 2016;

Ishengoma et al., 2019; Onashoga et al., 2016). The primary purpose of these studies is to assist the government in implementing and controlling the m-government services effectively.

Cluster 6 (Light Blue) – Quality dimensions on m-government use (13 papers)

The documents in the cluster discuss the importance of quality dimensions on m-government technology and its impact on citizens' perceptions. Quality dimensions, such as information quality, system quality, and service quality, are critical dimensions that have proved to be significant in developing satisfaction and behavioural intentions (Alqaralleh et al., 2020; Azeez et al., 2018; Wirtz and Brikmeyer, 2018).

Studies also integrated quality dimensions with TAM to explain the adoption of m-government (Alqaralleh et al., 2020; Wirtz et al., 2019). Furthermore, these dimensions also influence the citizen's perception of ease of use and its subsequent impact on the individual's attitude (AlBar and Hddas, 2018; Eid et al., 2020). Quality factors also play a critical role in building trust towards m-government (Alqaralleh et al., 2020; Azeez et al., 2018).

Similarly, quality dimensions, such as demonstrability, visibility, network capabilities and access to technologies, interactivity, are significant for m-government adoption (Costopoulou and Molhanec, 2014; Mandari et al., 2017; Mandari and Chong, 2018; Zamzami, 2019). Another critical factor contributing to the success of m-government is security and privacy, and their relationship with quality dimensions (Al-Sherideh et al., 2018; Eid et al., 2020; Wirtz et al., 2019). The importance of the quality function deployment approach in the identification of service quality issues and possible methods for improving the same was also reflected in this cluster (Alsaadi et al., 2018, 2019).

Cluster 7 (Orange) – M-government Studies at Initial Phase of Implementation (13 papers)

The documents in this cluster mainly discuss the types of studies performed at the initial implementation phase of m-government services. These transformations from EG or traditional services to m-government are considered to be a complex process that requires careful implementation. Hence, most studies tried to understand the existing environment and users' opinions on m-government, which are critical before implementation. In this direction, Alrazooqi and Desilva (2010) mapped the user requirement with technical requirements based on technology task fit theory for the Dubai police system. The study assessed the public's need in terms of service type and its characteristics which are then mapped to the technical requirements for Dubai police system.

Similarly, Jahanshahi et al. (2011) proposed a native m-services model for Iran, based on factors obtained through SWOT analysis which are further rated for attractiveness on the Quantitative Strategic Planning Matrix (QSPM). The other important aspect is testing and understanding the prototype or the application developed from a usability standpoint (Ekong and Ekong, 2010; Hussain et al., 2019a). Further, evaluating the existing cases would provide insights and will be a benchmark for newer projects (Vincent and Harris, 2008; Winkler et al., 2012).

However, most studies have adopted the two most basic and prominent adoption theory viz. TAM and DOI to understand the public opinion (Aloudat et al., 2014; Jaradat et al., 2018; Saadi et al., 2017). Further, the external factors like trust, accessibility, government support, security, and risk were found to be significant in the acceptance of m-government services (Aloudat et al., 2014; Dunn, 2009; Faisal and Talib, 2016; Hussain et al., 2019a; Jaradat et al., 2018; Saadi et al., 2017). Similarly, studies tried to identify the various enablers for the successful implementation of m-government services using existing literature and expert opinion (Faisal and Talib, 2016; Mishra and Singh, 2019, 2020). Further, Winkler et al. (2012) applied a System Dynamics simulation approach to predict the diffusion, use, and impact of m-government services before its implementation.

Cluster 8 (Brown) – Individual Factors on M-government (8 papers)

The individual factors reflecting on the user characteristics and capabilities like literacy, cognitive and technical capabilities, culture, etc., are found to influence the adoption behaviour significantly. It is even found to be critical in m-government acceptance and success. The belief and attitude of individual play a vital role in forming intention towards using m-government systems (Mervyn et al., 2014; Shareef, Kumar, et al. 2016; Tomer et al., 2016). Individual and demographic factors like literacy, technical skills, and socio-emotional issues are critical elements influencing the adoption of m-government (Mervyn et al., 2014; Muller et al., 2021; Reddick et al., 2020; Tomer et al., 2016).

Studies have also focused on the factor 'belief' of an individual and are grouped under cognitive, affective, and conative components, and the factors influencing these three components were analysed (Shareef et al., 2012; Shareef, Dwivedi, et al. 2016; Shareef, Kumar, et al., 2016). Further, the culture, sub-culture, and socio-economic factors of an individual also impact the belief and attitude of an individual (Mervyn et al., 2014; Shareef, Dwivedi, et al., 2016; Shareef, Kumar, et al. 2016; Tomer et al., 2016).

Furthermore, these individual factors like view and trust in government also act as barriers to adopting m-government (Reddick et al., 2020; G. Wang et al., 2020). Hence, the role of government is crucial in mitigating these barriers through its support and awareness programs (Madden et al., 2013; Mervyn et al., 2014; Tomer et al., 2016). Further, in their study, Shareef et al. (2014) stressed the quality dimensions in m-government use.

Cluster 9 (Violet) – Task-Technology Characteristics of M-government (5 papers)

The articles in the cluster mainly focus on the task and technical characteristics of m-government services rather than people's perception of the abstract concept of fit that would enhance service fairness and satisfaction. The characteristics such as mobility, location sensitivity, time criticality, personal control, mobile multimedia, non-routineness, and interdependencies were found to be significant in enhancing the procedural fairness of service (G. Chen et al., 2015; Z. Chen et al., 2016). Here, the theoretical framework of the task-technology fit model is used for mapping the task and technology characteristics that would deliver a fair service (G. Chen et al., 2015; Z. Chen et al., 2016).

Similarly, process procedures presented to consumer (distributive justice), how the outcome is attained (procedural justice), and the way service providers manage the process (interpersonal justice), were found significant in delivering fairness and enhancing loyalty to a service (Almarashdeh, 2020). The perceived trust in technology, cost of service is also vital for satisfying the citizen and making them use these m-government services (Almarashdeh, 2018; Almarashdeh and Alsmadi; 2017).

Cluster 10 (Pink) – TAM-TPB Integrated Model (3 papers)

The cluster reflects the importance of integrating the constructs of TAM and TPB theories to measure m-government adoption. The factors PU and PEU of TAM and the factor self-efficacy of TPB were proved to be significant for m-government adoption, whereas facilitating condition was proved insignificant in the studies of this cluster (Hung et al., 2013; Saxena, 2017, 2018).

Cluster 11 (Light Green) – M-government Service Quality Dimensions (2 papers)

The cluster presents two significant works on m-government service quality. These studies considered the dimensions like interaction quality, environment quality, information quality, system quality, and network quality for assessing the m-government service quality and were proved significant. These studies also indicated the significance of service quality in deriving customer satisfaction (Al-Hubaishi et al., 2017, 2018).

3.3.2.4 Discussions on Bibliometric Analysis

The bibliometric analysis of articles on m-government resulted in identifying seminal works, various themes, and sub-themes in the area of m-government. In addition, the mapping of the results of CCA-R and BCA-D helped to connect seminal works to a specific theme as per relevance (Figure 3.7). It provides an overall view of the seminal works that are significant to a particular theme.

Most of the literature in the area considered m-government a critical subset of the EG system and is believed to transform the governance system. The large user base and the convenience it offers make this a prominent tool for providing government-related services. Moreover, studies have revealed the significance of m-government in the applications such as citizen engagement/participation in government decision making, provision of services such as utility, agriculture, healthcare, and emergency systems, etc.

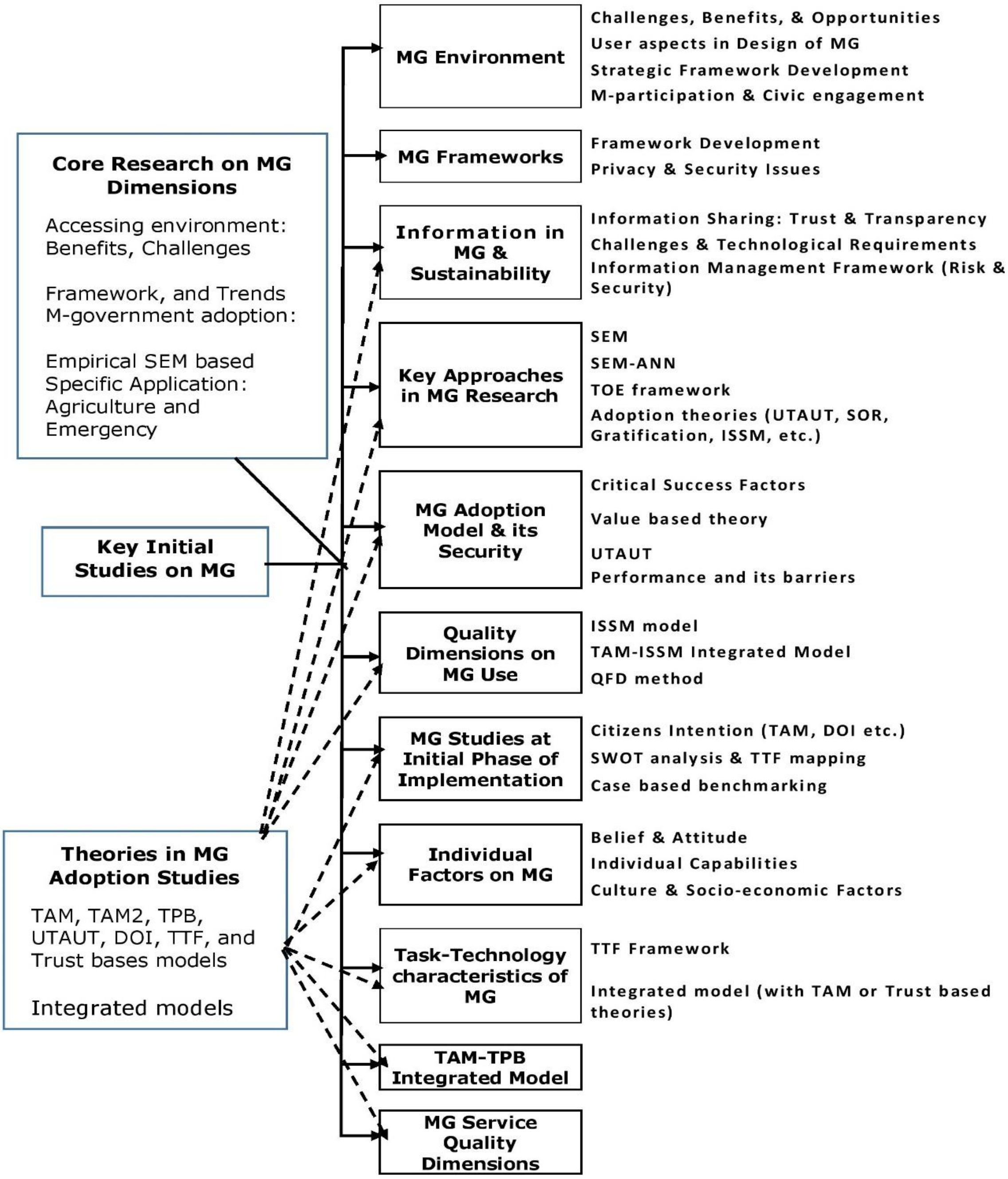

Figure 3.7: Categories and sub-categories in m-government research (Source: Author)

However, the success of m-government has always been a challenge, probing for more and more research in the area. From a technical point of view, the government needs to develop a citizen-cantered system. Further, it is critical to make these systems accessible to all in a readily usable way. Here, mobile technology and geo-positioning systems make this system efficient in providing location-specific information and services. Nevertheless, implementers should focus on building trust among users addressing privacy and security issues to achieve the desired outcome. Here, the information being the prime component of these systems, safety and privacy are very critical.

Further, adequate sources of information with efficient storage and distribution channels are also critical. The m-government framework so developed should be effective in considering all these aspects and cost-effective as well. Most researchers have demonstrated the suitability of Service Oriented Architecture (SOA) with integrated XML technologies to develop m-government systems. From the operational point of view of interoperability problems, workers' morale significantly impacts m-government performance. Hence, studies have highlighted the need for a collaborative environment with cooperation among various stakeholders, including citizens, and is believed to be the key to success. The role and attitude of local governments are also expected to play a vital role in encouraging people to use these systems. Focus on building awareness and developing quality services are the focal points for the government to consider.

Studies in this direction have highlighted the need to monitor and obtain timely information on citizens ' perceptions of these services on an ongoing basis. Measurement of perception in terms of intention to use, satisfaction, level of commitment, and attractiveness is vital in providing a clear understanding of m-government services. This is essential for effective decision-making and strategically positioning these services to attain the desired success. Here, the individual factors such as literacy, technical skills, culture, socio-economic condition, and technological characteristics such as personalization, convenience, speed, etc., influence citizens' satisfaction and future use. Furthermore, the understanding of the adoption of m-government applying the various IS theories such as TAM, TPB, DOI, TTF, etc., is said to extend the knowledge on the same, thus assisting the decision-makers. Overall, the primary objective of all these studies is to ensure the long-term continued use and sustainability of these m-government systems.

From the point of view of future research, though recent studies focused mainly on citizen-based empirical research on acceptance or satisfaction, there is also a need for studies on technical perspectives. Hence, both these dimensions of research are very much essential for the effective implementation of m-government. From a technical point of view, future studies should mainly focus on a strategic and holistic approach, taking into account aspects of sustainability, organizational capabilities and readiness, social and political factors (Alsaadi et al., 2018; Ding et al., 2019; Hobololo and Mawela, 2017; Kaur and Dani, 2017). Further, upgrading technical frameworks to the latest technologies and addressing privacy and security issues with better technology and frameworks is essential (Kaur and Dani 2017; Madden et al., 2013; Mervyn et al., 2014).

From a citizen's perspective, as the m-government is at an evolving stage, especially in developing countries around the globe, there is a need for more in-depth knowledge of the same for its success (Ahmad and Khalid, 2017; Joseph, 2019; Reddick and Zheng, 2017; Sharma et al., 2018). It is also necessary to validate and consolidate existing m-government frameworks across different nations, and more cross-cultural studies would be of value (Ahmad and Khalid, 2017; Chanana et al., 2016; Ishengoma et al., 2019; Joseph, 2019; Reddick and Zheng, 2017; Saxena, 2017; Shareef, Dwivedi, et al., 2016; Sultana et al., 2016; Tomer et al., 2016). Further, comparative studies among the developed and developing and rural versus urban users are essential to understand m-government adoption deeper (AlBar and Hddas, 2018; Saxena, 2017, 2018; Shahzad et al., 2019; Shahzad et al., 2020).

The integration of various IS theories and also the study on moderating and mediating influence of multiple factors, such as demographics, socio-economic conditions, EG experience, etc. is critical to have a deeper understanding of the field (Ahmad and

Khalid, 2017; Chanana et al., 2016; Jaradat et al., 2018; Mandari and Chong, 2018; Muller et al., 2021; Reddick et al., 2020; Saadi et al., 2017; Saxena, 2018; Shareef, Dwivedi, et al., 2016). For example, Shahzad et al. (2019) specifically identified the need to expand the URT theory with social and political factors to improve their work further. Another work by X. Li et al. (2019) highlighted the need to analyse the interaction of transaction cost theory and resource-based theory. Specific studies on the role of customer loyalty on customer satisfaction towards m-government will also be a vital contribution (Al-Hubaishi et al., 2018). In addition, the studies on individual factors like literacy, information needs, social and emotional barriers (or digital divide) are crucial for future research (Mossey et al., 2019; Reddick and Zheng, 2017, 2020).

Studies focusing on specific applications like emergency systems, agriculture are quintessential for the success of m-government projects in the future (Al-Dalahmeh et al., 2018; Kaur and Dani 2017; A. Roy et al., 2019). Here, specific case studies on successful m-government projects play a vital role in clearly understanding the implementation of m-government (Al-Dalahmeh et al., 2018; Bakhshimazdeh and Alikhasi, 2015; A. Roy et al., 2019). Another critical aspect of future research is integrating qualitative and quantitative methods to gain better insights and maximize research effectiveness (Bakhshimazdeh and Alikhasi, 2015; G. Chen et al., 2015). Eventually, most of the research cantered on government-to-citizen (G2C)-based services, and therefore studies on other sectors such as government-to-business (G2B), government-to-government (G2G), and semi-government sectors would contribute enormously to the body of knowledge (Alsaadi et al., 2018; Althunibat et al., 2014; Saadi et al., 2017).

3.3.3 Summary of Bibliometric Analysis

The bibliometric analysis may not capture all of the documents in the area that may be relevant to the research; thus, integrating this traditional interpretive approach might be an excellent option. The limitation is that these reviewed documents were from the Scopus databases only, and the inclusion of other databases may further improve the reliability of the process. Nevertheless, Scopus being an extensive database and is well accepted by many, the use of the same will guide in identifying the gap in the literature.

Further, integrating the two techniques, CCA-R and BCA-D will help overcome each method's limitations.

However, both techniques will significantly contribute towards the understanding of the area of research in m-government systematically. It assists in identifying the seminal works in the field, which is necessary for researching the area. Further, BCA-D analysis helps determine the research themes in the area that is currently in focus. Hence integrating both will provide a roadmap and critical guidelines and inputs to the research area. From the CCA-R and BCA-D analysis on m-government, the key observations are summarized below:

- The CCA-R analysis identified the three clusters highlighting the notable works related to m-government evolution as an area of research, the leading theories in adoption behavioural analysis, and the importance of m-government in agriculture.
- The BCA-D analysis identified the key themes on which the researchers have worked in the area of m-government. The critical observation here is that the recent articles are primarily dominated by empirical analysis on citizen adoption behaviour-based studies (Cluster 3).
- Nevertheless, it also highlighted how the theme has evolved with the initial focus over understating the environment, challenges and opportunities (Cluster 1 and Cluster 2). Later, the focus shifted towards the technical aspects like understanding the supplier's perspective, such as organizational factors, technical issues, etc. Simultaneously, the studies on determining citizen perception were carried out using simple theories of adoption like TAM. Later, advanced integrated models based on these theories were used to understand citizen adoption behaviour, on which many projects are being worked. Based on these theories and factors, different clusters were formed in the BCA-D analysis, which was discussed in detail.

With these insights, this study employs empirical research on citizen adoption through the use of an integrated model based on various theories. The significance of the same can be observed through the BCA-D analysis, particularly cluster 3. Furthermore, based on the literature review of articles from Cluster 3 and through other relevant sources, the research gaps are identified, and objectives are framed. The detailed discussion on the evaluation of these works of literature are described in the sections below.

3.4 LITERATURE REVIEW ON M-GOVERNMENT

The transformation in mobile technology and the penetration of mobile internet usage among the people has changed the government's focus towards m-government. M-government is regarded as an important subset of EG and is thought to improve the effectiveness of the governance system (Ntaliani et al., 2008; Sheng and Trimi, 2008). M-government will improve civic engagement, creating an open and transparent governance system, which is quick and easily accessible with a broader reach. It also enhances the ease of performing the service related tasks, and improves the quality of government services benefiting citizens. M-government refers to the use of mobile technology by the government to transact with businesses and provide information and services to citizens (OECD, 2011). The potential of m-governments is enormous, and the developed countries are tapping the maximum benefits from these technologies. Nevertheless, the developing countries like India are still in a phase of transformation in these technologies, but its success has not been on par with the other private mobile commerce sector (Glood et al., 2016a, 2016b; Kesavarapu and Choi, 2012; Sareen et al., 2013; Sultana et al., 2016; Yfantis et al., 2013). The same is reflected with the gaining prominence for scientific research in this area.

Many studies have been carried out in understanding the adoption behaviour of people towards mobile technology (Y. Kim et al., 2013), mobile sites in general (S. Yang et al., 2015; T. Zhou, 2013), m-commerce system (Chung, 2014; Tarhini et al., 2019), m-learning (Arpaci, 2015; Thongsri et al., 2018), m-education (Nikou and Economides, 2017), m-health (Pai and Alathur, 2019) and m-banking (Guo et al., 2016; K. Gupta and Arora, 2019; A. Kumar et al., 2018; Lu et al., 2019; Mohammadi, 2014; Xin et al., 2015). The latest advancement in m-government is integrating mobile technology and cloud technologies to deliver effective services, and studies focus on understanding its adoption (Liang et al., 2021). The insights play a vital role in the investigation of m-government adoption behaviour. Furthermore, studies on m-government have been found to extend theories from previous work in areas such as EG due to their similarity (Shareef et al., 2012). The results of the CCA-R analysis in the previous section also depict the same.

M-government research is being carried out in two broad categories: the supplier's or implementer's perspective and demand or citizen's perspective. Most studies in the initial stages focused on the technical aspects like developing the strategic framework, recognizing the challenges and opportunities in implementation, etc., as observed in BCA-D analysis. But researchers have also highlighted the importance of understanding the citizen's perception towards m-government for successful implementation of the same. Complete knowledge on adoption behaviour and its influencing factors is vital in directing the strategies that suit the citizens' needs and beliefs (Hung et al., 2013; Jain Gupta and Suri, 2017; Shahzad et al., 2019; Wirtz and Birkmeyer, 2018). In this direction, studies on M-government have focused on investigating the behavioural intention using various IS adoption theories which would provide diverse knowledge of the area (Liu et al., 2014).

Later on, studies have focused on analysing the continuance intention (Althunibat et al., 2011; Z. Chen et al., 2016; Gong et al., 2018). Studies also focused on assessing perceived public value (Lopes et al., 2019; Sultana et al., 2016; C. Wang, 2014; C. Wang et al., 2020), measuring satisfaction and service quality of the services provided by the government, etc. (Al-Hubaishi et al., 2017; Chanana et al., 2016; Ekaabi et al., 2020; Shareef et al., 2014; C. Wang and Teo, 2020). Further, studies also highlighted the differences in adoption behaviour among the users geographically, especially from developed and developing nations. Additionally, the variability in the influence of various factors among the nations like differences in demographic profile, stage of m-government adoption, culture, etc. creates a need for specific location-based study (Ahmad and Khalid, 2017; Saxena, 2018; Shahzad et al., 2019; Shahzad et al., 2020; Wirtz and Birkmeyer, 2018). Several comparative studies between countries had been performed to observe the influence of cross-cultural variations on the adoption behaviour of the citizens towards m-government (Shareef, Dwivedi, et al., 2016; Shareef, Kumar, et al., 2016).

Studies on M-government adoption behaviour, as described earlier, provide critical inputs for decision-making regarding implementation during the initial stage of adoption. In their research, Hung et al. (2013) found the significance of constructs viz. attitude, subjective norms, and PBC of TPB on the behavioural intention of Chinese citizens. The factors like usefulness, ease of use, trust, interactivity, subjective norm, and self-efficacy significantly affected the intention to use. Similarly, a prior study in Denmark analysed the influence of perceived risk and benefits on the three factors mentioned above. Here, the results showed that security risk had a significant impact on the attitude of people (Ohme, 2014). Eid et al. (2020), Liang et al. (2021) also showed the criticality of perceived risk in m-government trust and its adoption.

Further, many studies have extended the TAM with social influence and trust to access behavioural intention (Alharbi et al., 2020; T. Lee et al., 2020). The results indicated the significant role of trust and social influence on intention to use (Abu-Shanab and Haider, 2015; Ahmad and Khalid, 2017). Liu et al. (2014), using these constructs (trust, social influence, ease of use), analysed its impact on near-term and long-term usefulness, which then reflects the citizens' intention. Saadi et al. (2017), integrating the TAM, UTAUT, and DOI theories, applied the Analytical Hierarchical Process (AHP) methodology to prioritize the key factors. The other prominent work in the area was on understanding the differences in behaviour across different socio-demographic categories regarding the adoption of technology, satisfaction, and channel choices for using these government services (Muller et al. 2021; Reddick et al., 2017; Reddick et al., 2020). Sharma et al. (2018), in their work carried out in Oman, observed that the factors trust and performance expectancy had a significant influence on m-government acceptance.

Studies have also focused on accessing the quality of m-government services in a particular nation. For example, Alsaadi et al. (2018) in Gulf Cooperation Countries (GCC) using quality function deployment (QFD) approach, Al-Hubaishi et al. (2017), Alharbi et al. (2020) in UAE, Chanana et al. (2016), and Shareef et al. (2014) in India, Sultana et al. (2016) in Jordan, etc. The other important area of research in this field is assessing the technology-task fit of an m-government system (Z. Chen et al., 2016; S.

Yang et al., 2015). Further, several studies have validated the strength of these adoption factors through an SEM-based neural network simulation approach (Ding et al., 2019; Sharma et al., 2018; Shahzad et al., 2020; Talukder et al., 2019).

In India, Shareef et al. (2012) studied the factors influencing the adoption behaviour of citizens in the Mumbai city of India by extending the TAM model. Here, the study found the constructs such as ease of use, perceived security, reliability, relative advantage, and empathy to have significant implications on behavioural intention. Saxena (2017), in their study, further proved the above result. The author here found that the factors like ease of use, usefulness, trust, and facilitating conditions had a strong influence on behavioural intention. Also, results found the perceived risk to have a vital role in m-government adoption behaviour (Saxena, 2018). Kesavarapu and Choi (2012), using the AHP methodology, critically evaluated the criteria and goals that need attention from an Indian context. The critical factors identified are trust, system quality, and information quality. Also, goals like transparency, accountability, responsiveness, and integrity had the highest priority ranks.

Further, the recent studies are also integrating these adoption theories with the ANN approach to validate and predict the strength of the findings of these studies (Ding et al., 2019; Peng et al., 2021; Shahzad et al. 2020; Talukder et al., 2019; Talukder et al., 2020). Furthermore, many studies have been carried out on specific m-governance applications like m-health (Pai and Alathur, 2019; Park and Lee, 2018), m-banking in public sector banks (K. Gupta and Arora, 2019; Kant and Jaiswal, 2017), m-emergency and security system (Aloudat and Michael, 2011; Aloudat et al., 2014; Shahzad et al., 2019; Shahzad et al., 2020), m-policing (Ekaabi et al., 2020; C. Wang and Teo, 2020) Government Microblogging Services (Y. Li et al., 2018; Ni et al., 2019; Peng et al., 2021; Y. Yang et al., 2020) and m-agriculture (Beza et al., 2018; Tomer et al., 2016; Y. Yang et al., 2020), etc. Here, m-governance acceptance by the farmers or rural citizens is one of the emerging topic of the investigation by the researchers. Most studies analysed the farmer's intention to acquire farm-related information through m-government services (like SMS or mobile apps). For example, studies in Tanzania measured the farmer's choice to use m-government services, considering government support and awareness, and socio-demographic factors' effect on the intention to use (Beza et al., 2018; Mandari and Chong, 2018; Mandari et al., 2017). A similar study was also carried out in the Ethiopian region and India. The results indicated the significance of trust and awareness in accepting m-government services by farmers (Beza et al., 2018; Tomer et al., 2016).

Further studies on emergency and security management systems using mobile technology found the critical role of trust, service quality, and security issues in the acceptance of these systems by people (Aloudat and Michael, 2011; Aloudat et al., 2014; Shahzad et al., 2019; Shahzad et al., 2020). Further, social media plays a significant role in creating awareness, trust, and information sharing, referring to electronic word of mouth (eWOM) of any product or service (Cancan Wang and Medaglia, 2017; P. Wang et al., 2020; Yihan, 2019). Hence, studies focusing on social media influence on citizens concern on government use of these channels for promoting and improving their services have been carried out (Al-Aufi et al., 2017; Shwartz-Asher et al., 2017).

However, mobile governance is a relatively new area that is not explored in depth, especially from the citizen's point of view for developing countries like India. Further research in the area will assist in bringing more clarity and insights into the field of m-government. Moreover, the past researchers highlighted the need for research in m-government from various dimensions to acquire knowledge for better decision making (Liu et al., 2014; Saadi et al., 2017). Hence, this study works in this direction to address these gaps in the literature of m-government.

3.5 THEORETICAL BACKGROUND

3.5.1 Overview

The discussion on theoretical perspectives on m-government adoption focuses primarily on reviewing literature from the context and how studies in the focus area are conducted. Here, the emphasis is on exploring the various theories of IS technology adoption and individual behaviour synthesized through the review (Table 3.4).

Table 3.4: Theories in IS research area

Theory of Reasoned Action (Fishbein and Ajzen, 1975)	This theory mainly presumed that attitude and norms are the two critical determinants of an individual's behavioural intention. Further, attitude is influenced by the strength of behavioural belief and belief in the outcomes. Norms represent the external influence which is the influence of others (Subjective Norms).
Technology Acceptance Model (Davis, 1989)	The theory explains how users come to accept and use technology (as behavioural intention) under the two technological attributes, perceived usefulness and perceived ease of use.
Theory of Planned Behaviour (Ajzen,1985)	This theory links one's beliefs and behaviour. Here, the assumption is that the behavioural intention of an individual is shaped by three key determinants viz. attitude, subjective norms, PBC.
Innovation Diffusion Theory or Diffusion of Innovation (Rogers, 2010)	The theory developed by Rogers in 1962 seeks to explain how, why, and at what rate new ideas and technology spread. Studies on IT adoptions have used this theory to describe the adoption characteristics of innovation. the persuading factors like relative advantage, complexity, compatibility, trialability, and observability are used for this purpose.
Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)	The theory explains the user's intentions to use an information system and subsequent usage behaviour in terms of four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions.
Uses and Gratifications Theory (Katz et al., 1973)	An approach to understanding why and how an individual actively uses specific media/technology to meet their particular needs.

Expectation Confirmation Model Oliver (1977, 1980)	The theory seeks to explain post-purchase or post-adoption satisfaction as a function of expectations, perceived performance, and disconfirmation of beliefs.
Task-Technology Fit theory (Goodhue and Thompson, 1995)	The theory assumes that if the capabilities of the IS match the tasks that the user must perform, it will result in a positive impact on individual performance. The eights factors mainly used to measure this fit are quality, locatability, authorization, compatibility, ease of use/training, production timeliness, systems reliability, and relationship with users.
Self Determination Theory (R. Ryan and Deci, 2000)	It measures the degree to which an individual's behaviour is self-motivated and self-determined. It accesses the motivation behind choices people make without external influence and intervention.
Information System Success Model (DeLone and McLean, 1992)	The theory identifies, describes, and explains the relationships of six critical success dimensions used for evaluating IS. The dimensions are information quality, system quality, service quality, usage intention, user satisfaction, and net system benefits.
SERQUAL Model (Parasuraman et al., 1985)	An instrument used to measure the consumer's perceptions and expectations of service based on five dimensions of service quality viz. reliability, assurance, tangibles, empathy, and responsiveness.

The theories on technology adoption (Table 3.4) focus on understanding how and why individuals accept and use new technology. The essential theories like TRA, TAM, TPB, UTAUT, and DOI are widely used in examining the adoption behaviour of m-government. These theories assist in understanding the initial adoption behaviour as well as post-adoption behaviour of an individual. Furthermore, the theories like Use and Gratification Theory (UGT), Expectation Confirmation Model (ECM), TTF theory, Self Determination Theory (SDT), Information System Success Model (ISSM), Service Quality (SERQUAL) Model, etc. were also used especially under the post-adoption behavioural analysis. Here, the post-adoption behavioural study primarily intends to understand the after-use behaviours like satisfaction, continuance intention, or measuring the public value of the technology under consideration. The brief descriptions of these theories are given in Table 3.4.

3.5.2 Review on Theories Assessing Behavioural Intention

TRA is one of the oldest and popular theories developed to understand the technology adoption behaviour. It explains that behavioural intention is directly related to an individual's pre-existing attitude and social norms to a specific act (Fishbein and Ajzen, 1975). The TRA lacks explanation on the discrepancies in the attitude-behaviour relationship defined in theory, which has been criticized (Kan and Fabrigar, 2017). On the other hand, TAM is considered as an extension of TRA where the attitude measures are replaced with two technology acceptance measures, viz. perceived usefulness and perceived ease of use (Davis, 1989). TAM theory focuses only on the technical aspects of technology and considers it to be a critical determinant than the social attributes. Thus, it has been criticized for disregarding the non-technological factors and is believed to have lower predictive power (Chuttur, 2009; Mandari et al., 2017; Shahzad et al., 2019). The key to note here is that the actual usage behaviour is influenced by various other constraints around a user, like an individual's capabilities and control overuse (Norberg and Horne, 2007). The Theory of Planned Behaviour (TPB) was developed by extending the TRA with an additional construct PBC to overcome some of these limitations. PBC considers two aspects self-efficacy referring to one's ability to use, and controllability which refers to the degree of control an individual has over the use (Ajzen, 1985). Thus, TPB with the factors attitude, subjective norms, and PBC have a better predictive power with capabilities of explaining the actual behaviour (Ajzen, 1989). Further, TPB does not consider the emotional influence of individuals and the need/demand for technology and thus, is criticized (Sniehotta, 2009).

Based on these theories, several studies were carried out by extending these models to overcome some of these limitations, as mentioned earlier. These extended models are expected to have improved predictability and explanatory power in measuring a person's behavioural intention or attitude. The prominent work in this area was the development of TAM2. Here, external variables like subjective norm, image, job relevance, output quality, and result demonstrability were integrated with TAM. Further, experience and voluntariness are used as control variables in the model (Venkatesh and Davis, 2000). The other most significant contribution in the IS research is developing the UTAUT theory, which integrated these competing theories in the user adoption model under four factors viz. performance expectancy, effort expectancy, social influence, and facilitating condition (Venkatesh et al., 2003). This model is widely accepted and used in IS adoption studies (Mwalukasa et al., 2018; Park and Lee, 2018). However, the above theories were criticized for the constructs being too general, which limits the explanatory power (Mandari et al., 2017).

The other widely used theory in technology adoption studies is the DOI or Innovation Diffusion Theory (IDT) (Lawson-Body et al., 2014; Mandari and Chong, 2018). The theory is considered to have more specific constructs, resulting in improved clarity and enhanced explanation of the technology adoption (Mandari et al., 2017; Saadi et al., 2017). The theory proposes four main elements of diffusion of any innovation: the innovation itself, communication channel, time, and social system. It further describes the innovation-decision process, which begins with seeking information (awareness stage) to the information processing (uncertainty reduction) about the innovation. It has the following steps: knowledge, persuasion, decision, implementation, and confirmation. The theory also defines five critical characteristics of innovation, the perception of which helps predict the rate of innovation adoption. The five components are relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1995, 2010). Moore and Benbasat (1991) further extended the theory to fit into the information technology research and minimize the constructs' ambiguities. It was refined with variables such as relative advantage, ease of use, compatibility, image, result demonstrability, visibility, and trialability. Further, prior research also highlighted the need to study the effect of innovation characteristics on the rate of adoption, rather than just focusing on the attributes of adopter categories (Sahin, 2006).

Several studies in the field of m-government have adopted IDT constructs to examine adoption behaviour. Mandari et al. (2017), in their research, took the DOI constructs along with the external constructs like government support and awareness to explain the intention to adopt m-government among the rural farmers in Tanzania. Kapoor et al. (2015) highlighted the significance and uniqueness of DOI theory over the other approaches and applied the same in interbank mobile payment services in India. The study highlighted the similarity in constructs among the methods like TAM, TPB, and UTAUT. At the same time, DOI is a widely accepted theory due to its ability to capture characteristics of innovation and its effect on adoption. A study carried out in United States (US) adopting the DOI theory among the veterans identified the moderating role of the digital divide on the DOI constructs concerning EG (Lawson-body et al., 2014).

Further prior research has highlighted the importance of integrating the DOI theory with TAM and is expected to have better explanatory power and specificity in the m-government study (Al-Hadidi and Rezgui, 2010; Saadi et al., 2017). Thus, DOI can be considered one of the most popular and widely used theories in technology adoption, like m-government. It is believed to have more specific constructs with better explanatory power, proved in past studies (Lawson-body et al., 2014; Mandari et al., 2017; Saadi et al., 2017). Nevertheless, several studies have shown the need to integrate DOI theories with other theories or external variables to improve outcomes (Carter and Bélanger, 2005; Kapoor et al., 2015). DOI has also been criticized for not considering the social factors like trust and security and uncertainty issues that influence technology adoption (Chung, 2014).

Further, prior studies also highlighted uncertainty as a specific characteristic that impacts the individual's likelihood to use a technology (Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016). Uncertainty refers to the user's inability to accurately predict and understand the technological environment (M. Song and Montoya-Weiss, 2001). It can be the inability of an individual to realize the value of service through its adoption. Accordingly, URT is a popular theory in communication, which explains the nature of the initial interaction of an individual under uncertain conditions. While interacting for the first time, the individuals tend to reduce the uncertainty about their own and other individuals' interaction behaviour (Berger and Calabrese, 1975; Shin et al., 2017). The theory categorizes the individual into three types based on their interaction behaviour and information-seeking strategies adopted. Firstly, Active strategies refer to collecting information from the target person's environment. Secondly, passive strategies mean obtaining the information through the discrete observation of the targeted person. Third, an interactive strategy where the data is gathered through direct interaction with the target person. It is assumed that the information obtained will reduce the uncertainty and increase the predictability of the other person's behaviour, decreasing the perceived risk (Shin et al., 2017; Venkatesh et al., 2016).

Even though the theory is based on an interpersonal communication background, it has been applied in various areas. Prior research has used the approach in organizational behavioural context, especially the study on understanding employee's behaviour and work environment, consumer behaviour in services where the risk is perceived to be higher than a product.

Further, the URT has been applied to understand the adoption behaviour of individuals in the area of EG and m-government. These studies focused on two key aspects: sources of uncertainty like task uncertainty, workflow uncertainty, and environmental uncertainty. Task uncertainty refers to the difference in the amount of information/ knowledge required to perform a task to the information possessed. Workflow uncertainty is the lack of clarity on information-related inputs and the flow needed to complete the job. Environmental uncertainty refers to the unpredictability of environmental variables like technical and security issues (Lawson-body et al., 2014; Venkatesh et al., 2016). Thus, the government must provide the necessary information related to performing the services (like user manuals) and keep track of the workflow (like refund status) to reduce task and workflow uncertainties. Further, the government needs to ascertain the reliability and safety of the service channel to minimize environmental uncertainty (Chanana et al., 2016; Kant and Jaiswal, 2017; Lawson-body et al., 2014).

The second aspect is on the means of reducing these uncertainties. Here, trust and transparency are found to influence lowering the task and workflow uncertainties significantly. Transparency in a system provides the required information of the processes in a service which reduces the uncertainty. Trust will alleviate the unpredictability and vulnerability in the service environment and improves the willingness to accept the services (Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016; Xin et al., 2015). The information quality parameters such as accuracy and completeness are key quality determinants in developing trust in the m-government usage. Convenience and personalization, on the other hand, are two technological attributes that are believed to create trust in the use of service (Al-Hubaishi et al., 2017; Mwalukasa et al., 2018; Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016; T. Zhou, 2013). These parameters are also categorized under the two essential quality determinants: information quality and System Quality (Al-Hubaishi et al., 2017; Glood et al., 2016b; Kesavarapu and Choi, 2012).

From the basis of these theoretical backgrounds and review of literature, a conceptual model is developed. The model focuses on addressing some of these limitations identified from the past research works on m-government. It also aims to overcome the limitations in theories by integrating the same suitably and address some of the gaps in variable relationships.

3.6 REVIEW ON GOVERNMENT USE OF SOCIAL MEDIA

The Scopus database is used to identify social media literature for government services, as it is one of the most popular and generally accepted databases (Boyle and Sherman, 2006). The keyword protocol used is "Social Media" AND Government to identify research articles. Subsequently, documents were searched using the other keyword protocols such as "Social Media" AND "Electronic Govern*"; and "Social Media" AND "Mobile Govern*" with a document type limited only to journal articles. The search process identified around 379 documents after the deletion of recurrent titles from the list. Further, relevant articles (about 80 papers) were identified and studied in detail after reviewing the document's title and abstract.

3.6.1 Overview of Social Media Literature

The new digital world is all about social media. The convenience of networking and instant access to information at the fingertips (news to promotional videos) has transformed social life in society. It influences the people in every phase of day-to-day activities like sharing news, experiences, and reviews, influencing product purchase, supporting social activities, gathering information, etc. (Hajli, 2014; Voramontri and Klieb, 2019). Social media is defined as computer-mediated technologies facilitating the creation and sharing of information, ideas, and other forms of expression through virtual communities and networks (Voramontri and Klieb, 2019). The popular social media applications are Facebook, YouTube, WhatsApp, WeChat, Instagram, etc.

Governments across the globe have been swift to recognize their potential and have embraced these platforms to the fullest. Studies, however, raised questions about the efficacy and performance of these networks. The primary concern here is the lower use and participation in these social media networks (Bonson et al., 2017). Many factors affect the performance of these social media sites, the understanding of which is essential. In this direction, previous studies mainly focused on the understanding impact of social media on public engagement and public communication (Agostino et al., 2017; Hong, 2013).

Further, the other key aspect is integrating social media with the EG/m-government services to enhance these services' effectiveness (Reddick and Anthopoulos, 2014; Sonnenberg, 2020). Here, the factors like financial support, technical support, and political support (organizational perspective) are proved critical. Further, under the citizen perspective, digital divide, high service costs, cultural impact, lack of awareness and skills, motivation, trust, user-friendliness, security, and privacy are key factors that impact citizen engagement and use of government social media channels (S. Kim et al., 2015; Nisar and Shafiq, 2019; Nomani et al., 2016; Peng et al., 2021; Purwanto et al., 2020).

Although many studies are being conducted on government social media use, these were mainly based on theoretical aspects with lower empirical evidence. Furthermore, the engagement level assessment literature focused primarily on content analysis using the engagement index score, which considers the number of posts, likes, and comments. (Bellstrom et al., 2016; Rakhmawati and Hanindito, 2018). However, citizen perception studies on social media use by government and its influence on m-government are less explored (Alryalat et al., 2017; Criado et al., 2013; del-Mar-Galvez-Rodriguez et al., 2019; Dwivedi et al., 2017). The citizen's perception of the government's use of social media is believed to be a crucial aspect for the success of these new technologies (Al-Aufi et al., 2017; Shah and Lim, 2011). This aspect is vital during the initial stages of implementation, as in most developing nations like India, assisting in effective policy formulation (Chatterjee, 2020).

3.6.2 Social Media Influence on M-government

Understanding citizens' views of the government's use of social media are vital in enhancing digital services. The favourable public opinion leads to an improved presence of social media government pages. Some of the past literature has considered factors such as presence, transparency, engagement, responsiveness, and trust in government social media sites for this assessment (Alryalat et al., 2017; Al-Aufi et al., 2017). However, most studies have mainly considered and proved trust and transparency to be the significant influencer on this aspect (S. Kim et al., 2015; C. Song and Lee, 2016; G. Wang et al., 2020). Further, the studies have also shown that the factors like presence, engagement, and responsiveness mainly influence the trust and transparency in social media sites (Agostino et al., 2017; Kietzmann et al., 2011). It is also thought to play an essential role in raising awareness (Chatterjee, 2020; Nomani et al., 2016).

Additionally, the effectiveness of these channels in communication and interaction results in increased discussions and sharing of information about m-government among people and with experts (i.e., social influence), which then may impact adoption (P. Wang et al., 2020; Wirtz et al., 2018). It reflects the importance of e-WOM in m-government services (Chatterjee, 2020; Erkan and Evans, 2016). Besides, these mediums are also regarded as image enhancers, which further influences MG adoption. Hence, social media influence (or just social media) is a crucial channel that has a vital role in improving the m-government services (Al-Aufi et al., 2017; Bennett and Manoharan, 2017; Campbell et al., 2014). Here, social media influence refers to the citizen's attitude on social media, which directly affects the individual's use of m-government services (Al-Aufi et al., 2017; J. Chen and Sun, 2019; J. Chen and Sun, 2019). Social media influence is thus assumed to influence the awareness, trust, transparency, image, and social influence of m-government adoption in the current study.

3.7 RESEARCH MODEL AND HYPOTHESES

M-government in India is still evolving, and the researchers need to explore the area in different possible dimensions for more insights. Subsequently, this will assist the decision-makers in the implementation and development of the same. Hence, this study focuses on examining various factors affecting the adoption of m-government from the citizen's perspective. The model developed for the same is based on integrating different adoption theories such as TPB, DOI, and URT. Past studies have highlighted the need for these integrations to comprehensively explain the m-government adoption phenomenon (Carter and Belanger, 2005; Liu et al., 2014; Saadi et al., 2017). The existing theories have certain factors which are similar to each other and a few unique factors. So, prioritizing and considering the determinants should be such that all variables are significant and unique, without the multi-collinearity effect (Ohme, 2014). The comprehensive model developed will provide a broader perspective and better insights into the adoption phenomenon (Liu et al., 2014; De Marez et al., 2007).

Furthermore, the current studies on m-government adoption in India have adopted theories like TAM, TPB, and UTAUT. But the factors in these theories are too general and are not specific, which lacks explanatory power (Mandari et al., 2017). Liu et al. (2014) also highlighted the need to explore m-governance from different theoretical perspectives to understand the adoption of m-government better and build on the existing body of knowledge.

In India, the DOI theory is not explored much in m-government studies, with the constructs having more specificity, contributing to higher explanatory power, which the study adopts. Further, the modified DOI theory (Moore and Benbasat, 1991) is considered in the study as it is more suitable in IT-based research (Saadi et al., 2017). Further, integrating the URT with DOI constructs is significant and is not extensively adopted in m-government. Uncertainty is considered a specific characteristic that is vital in developing trust towards the technology. Further, the study addresses the limitation of the work by Shahzad et al. (2019) by integrating social and individual factors with the URT. Thus, considering these aspects, the model developed is grouped under sub-factors such as awareness, attitudinal factors, means of uncertainty reduction, perceived service quality, facilitating conditions, social influence, and social media.

3.7.1 Awareness

According to the DOI theory, awareness is the first stage in adopting an innovation. It reflects on the persuasion and implementation of an innovation. It refers to the level of knowledge an individual has about the M-government service and its use (Mandari et al., 2017; Rogers, 2010). In developing countries, lower awareness is a potential barrier to adopting m-government services (Masaeed and Love, 2014; Mohammadi, 2014; Saadi et al., 2017; Tomer et al., 2016). It is essential for the government to create and raise awareness of m-government and is significant in improving the e-participation of citizens (Masaeed and Love, 2014; Tomer et al., 2016). The higher the awareness, the greater the need for the service, which is proved in the previous literature (Almaiah et al., 2020; Mandari et al., 2017; Reddick and Zheng, 2017; Shahzad et al. 2019; Shahzad et al., 2020).

Further, the argument here is that the indirect relation of awareness to behavioural intention through the determinants of innovation is more suitable than the direct relationship. The justification was that the indirect relationship explains where to focus during awareness campaigns (Mandari et al., 2017). Studies in the past considered the indirect influence of awareness through perceived usefulness (Mohammadi, 2014; Shahzad et al., 2019; Shahzad et al., 2020) and attitudinal/innovation factors of DOI (Mandari et al., 2017). It is also said that awareness does not directly influence intention, but awareness of characteristics will create intentions (Lawson-body et al., 2014). These attitudinal factors thus act as a mediator between awareness and BI.

Therefore, the study considers the indirect relation of awareness to behavioural intention through the attitudinal factors (H1).

- H1: There is a significant influence of awareness on the intention to use m-government.
- H1a: Relative advantage mediates the relationship between awareness and intention to use m-government.
- H1b: Ease of use mediates the relationship between awareness and intention to use m-government.
- H1c: Compatibility mediates the relationship between awareness and intention to use m-government.
- H1d: Image mediates the relationship between awareness and intention to use m-government.

Further, the relationship between the image and social influence is highlighted and assessed in the study of Liu et al. (2014). Thus, it results in an indirect relation where image and social influence mediate the relationship between awareness and intention to use m-government (H1e). Moreover, the study considers the relationship between social influence and trust as mentioned in Liu et al. (2014). It again results in an indirect relation where the image, social influence, and trust serially act between awareness and intention to use m-government services (H1f).

- H1e: Image and social influence serially mediates the relationship between awareness and intention to use m-government.
- H1f: The relationship between awareness and intention to use m-government services serially mediates through image, social influence, and trust.

3.7.2 Attitudinal Factors

The constructs from modified DOI by Moore and Benbasat (1991) are considered under attitudinal factors. Here, the study evaluated the variables such as Relative Advantage (RA), Ease of Use (EU), Compatibility (CMP), and Image (IM) due to their importance in explaining the m-government adoption (Chung, 2014; Kapoor et al., 2015; Lawson-body et al., 2014; Mandari and Chong, 2018; Mandari et al., 2017). Prior IS research studies have highlighted the insignificance of visibility, trialability, and result demonstrability and concluded that these factors can be ignored from the analysis (Lawson-body et al., 2014; Tornatzky and Klein, 1982). Hence, considering this assumption the study includes four DOI constructs viz. RA, EU, CMP, and IM under attitudinal factors.

3.7.2.1 Relative Advantage

Relative advantage can be defined as the degree to which m-government is perceived to be better than the idea it supersedes (Kapoor et al., 2015; Rogers 2010). Most of the studies in the past found RA as one of the most significant factors that positively influence the adoption of m-government (Jaradat et al., 2019; Mandari and Chong, 2018; Shareef et al., 2012). Prior studies also emphasized the similarity of RA with the Perceived Usefulness (PU) of TAM theory. But it is also argued that PU captures only absolute benefits, while RA is more specific (Lawson-body et al., 2014; Saadi et al., 2017; Shareef et al., 2012). Further, particular sub-factors such as efficiency, time-saving, productivity, and mobility were considered for measuring relative advantage (Saadi et al., 2017). Similarly, C. Wang et al. (2020) included mobility, localizability, personalization, and security under the dimensions of relative advantage for measuring the public value. Hence, owing to the importance of RA in explaining adoption behaviour, the hypothesis (H2) is framed as,

H2: There is a significant influence of relative advantage on the intention to use m-government.

3.7.2.2 Ease of Use

Ease of use, also referred to as complexity, is another critical factor in DOI theory. It reflects the extent to which m-government would be free from physical and mental efforts (Mandari et al., 2017; Rogers, 2010). In other words, it can be defined as the degree to which an innovation is perceived to be relatively difficult to understand and use (Kapoor et al., 2015). Most studies in the past found EOU to be the most significant factor which positively influences the behavioural intention to adopt m-government (Alharbi et al., 2020; Alqaralleh et al., 2020; Hung et al., 2013; Kapoor et al., 2015; Lawson-body et al., 2014; Mandari and Chong, 2018; Wirtz et al., 2019). For example, EOU was the most influential factor in M-government adoption among the rural farmers in Tanzania and veterans in the USA (Lawson-body et al., 2014). Another study on m-government integrated the elements from various adoption theories and prioritized the critical factors using the Analytical hierarchy process (AHP). The results indicated EOU to have the highest priority (Saadi et al., 2017). However, Jaradat et al. (2019) also found a contrary result for this factor which showed an insignificant impact on intention to use. This attribute is thus hypothesized as (H3).

H3: There is a significant influence of ease of use on the intention to use m-government.

3.7.2.3 Compatibility

Compatibility is the degree to which the m-government services are considered consistent with the citizens' existing values, experiences, and needs (Mandari and Chong, 2018; Rogers, 2010). Studies in the past found compatibility to be a significant factor influencing the m-government adoption (Abu-Shanab and Haider, 2015; Almaiah et al., 2020; Alqaralleh et al., 2020; Saadi et al., 2017; Shareef, Dwivedi, et al., 2016). The study also proved compatibility to be significant in the sectors like mobile banking (Kapoor et al., 2015), mobile commerce (Chung, 2014), agriculture, and rural areas (Mandari and Chong, 2018; Mandari et al., 2017; Y. Yang et al., 2020), in EG adoption (Lawson-body et al., 2014), etc. Contrary, a study in China found compatibility as a non-significant factor (Hung et al., 2013). Here, it was found that the newness and incomplete projects of m-government to be the reasons for reduced importance towards compatibility (Hung et al., 2013). Similarly, in their study, Jaradat et al. (2018) showed the insignificance of compatibility on m-government behavioural intention.

Further, compatibility didn't have a significant influence on intention to use in developing countries such as India, Bangladesh, and China (Hung et al., 2013; Saxena, 2017; Shareef et al., 2012; Shareef, Dwivedi, et al., 2016; Shareef, Kumar, et al., 2016). In their study, Saadi et al. (2017) highlighted the importance of compatibility to fit into the style and needs of the citizen and not to conflict with their ideas so improve m-government adoption. Further, C. Wang et al. (2020) considered compatibility as a moderator impacting the relationship between relative advantage and perceived value. Hence, compatibility, being an influential factor due to the differences in user's experience and need, along with the contradicting results from previous works, it is vital to investigate further and prove its relationship. The hypothesis thus framed (H4) considering this is as given below:

H4: There is a significant influence of compatibility on the intention to use m-government.

3.7.2.4 Image

Image refers to the degree to which the use of m-government is expected to enhance a user's status in their social system (Liu et al., 2014). Many studies have considered the image as an influencer in m-government adoption studies (Liu et al., 2014; Mandari and Chong, 2018; Mandari et al., 2017; Shareef, Kumar, et al., 2016). Image is believed to influence the use of any innovation positively and is indicated in past studies (Kant and Jaiswal, 2017; Mohammadi, 2014; Moore and Benbasat, 1991). Further, using mobile for accessing the government information and services would enhance the image of a user, as he may be a source of information for others. It will result in the formation of social status and forces others (i.e., social pressure) to use the technology (Liu et al., 2014; Reddick and Zheng, 2017). Contrary, studies on m-government found the image to have an insignificant impact on the intention to use (Kapoor et al., 2015; Mandari and Chong, 2018; Mandari et al., 2017; Shareef, Kumar, et al., 2016). Hence, further investigation is required to ascertain the relationship of an image on the intention to use.

In their study, Liu et al. (2014) found a significant influence of image on social influence but not on the intention to use directly. It results in an indirect relationship between image and behavioural intention wherein social influence acts as a mediator. As mentioned earlier, Liu et al. (2014) also pointed on the relationship of social influence on trust. Thus, it further results in an indirect path of the image to intention to use m-government wherein social influence and trust serially act as mediators. The hypotheses (H5) framed under this variable considering both these direct and indirect relations of image:

H5: There is a significant influence of image on the intention to use m-government.

H5a: Social influence mediates the relationship between image and intention to use m-government.

H5b: The relationship between image and intention to use m-government serially mediates through social influence and trust.

3.7.3 Quality Factors

The perception in the service quality factors is another essential aspect that studies on m-government focused on (Al-Hubaishi et al., 2017; Chanana et al., 2016; Glood et al., 2016b; Kant and Jaiswal, 2017; Shareef et al., 2014; C. Wang and Teo, 2020). It helps in assessing the critical quality characteristics that need focus while implementing the m-government services. In m-government, service quality dimensions are broadly classified as interaction quality, environment quality, information quality, system quality, network quality, and outcome quality (Al-Hubaishi et al., 2017). But, in their research, T. Zhou (2013) highlighted the importance of two quality dimensions viz. information quality and system quality in accessing the technological perception of citizens towards m-government.

Further, it was found that these two dimensions to be the critical success factors (CSF) impacting the m-government adoption by users. These vital factors also form the focal points among the researchers and academicians compared to other potential success factors (AlBar et al., 2018; Almarashdeh, 2020; Kesavarapu and Choi, 2012). Further, Glood et al. (2016b) and Y. Zheng et al. (2009) in their research, considers system quality and information quality as two critical dimensions impacting usage and satisfaction of internet-based services. The study examined system quality as a hygiene factor and information quality as a motivational factor towards mobile data usage. Further, studies have highlighted the importance of information quality characteristics and channel characteristics (can be referred to as system quality) on developing trust and transparency towards a particular service (Azeez and Lakulu, 2018; Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016). Hence, with the past literature emphasizing more on the factors of information quality and system quality, this study considers these two dimensions under service quality characteristics.

3.7.3.1 Information Quality

Information quality reflects the ability of the system to convey the required information to the users (Al-Hubaishi et al., 2017). It reflects on the characteristics such as accuracy, sufficiency (i.e., completeness), relevancy, and timeliness (reflects on responsiveness) (Azeez and Lakulu, 2018; T. Zhou, 2013). Researchers have also used content quality as an alternative to information quality (Kesavarapu and Choi, 2012). Accuracy can be defined as the citizen's perception of the provision of specific information concerning the services by the government (Shahzad et al., 2019; Shahzad et al., 2020). It plays a critical role in enhancing information quality (Eid et al., 2020). Sufficiency or completeness refers to providing all the information needed to the users for efficiently using the m-government services (Sharma et al., 2018). Relevancy refers to the preciseness of the information obtained. Inaccurate and out-of-date information and the relative difficulty of using mobile for information search will impede the citizen's willingness to use m-government (T. Zhou, 2013). Studies also highlighted the need to provide information on time, reflecting the responsiveness of the system. An excellent responsive design will create a favourable attitude towards the system (Kant and Jaiswal, 2017; Venkatesh et al., 2016).

Many studies in the past have highlighted the significance of information quality and its dimensions in the area of m-government acceptance among the citizens (Al-Hubaishi et al., 2017; Almarashdeh, 2020; Almaiah et al., 2020; Azeez and Lakulu, 2018; Glood et al., 2016b; Shahzad et al., 2019; Shahzad et al., 2020; Sharma et al., 2018; C. Wang and Teo, 2020; Zamzami, 2019). Information quality is expected to increase the system's transparency and minimizes the face-to-face interaction of the users with service providers. Hence, transparency and integrity are also considered utilitarian dimensions (Ekaabi et al., 2020). It enhances the system's mobility and is beneficial in creating a favourable attitude among the citizens (Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016). However, few studies found information quality to have a non-significant impact on intention to use m-government (Ali and Al-Kabbi, 2018). Given the above discussions following hypothesis is framed (H6):

H6: There is a significant influence of information quality on the intention to use m-government.

3.7.3.2 System Quality

System quality refers to the citizen's perception of the technical level of communication (Al-Hubaishi et al., 2017). It reflects characteristics of the IS, such as convenience to use, access speed, personalization, and visual appeal (Kesavarapu and Choi, 2012; T. Zhou, 2013). Alternatively, researchers have also used the following dimensions reliability, flexibility, accessibility, and timeless (speed) under system quality (Al-Hubaishi et al., 2017). Few studies have also used a mix of factors from the two aspects mentioned above (Azeez and Lakulu, 2018). It is vital to observe that both the classifications reflect primarily on the assessment of the m-government system.

Convenience demonstrates a citizen's perception of the time and effort required to use m-government services (Shahzad et al., 2019; Shahzad et al., 2020). Accessibility reflects the ability to access the service at any time as needed by users. It considers the flexibility and ease at which a user can access the service and the required information for performing the task. The system should also perform the job in minimal time from anywhere at any time. These aspects are the key drivers that positively influence the willingness to use m-government services (Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016). Personalization can be defined as the degree to which the user can customize the information and services as per their need and preferences (Venkatesh et al., 2016). Lower access speed and poor visualization may result in an impression on citizens that the government has not adequately invested their effort and resources to offer quality service to citizens (T. Zhou, 2013).

These system quality parameters like speed, personalization, etc. will enhance the individual efficiency and improve the service effectiveness, thus impacting the usage intention of an individual (Shahzad et al., 2019; Shahzad et al., 2020; C. Wang and Teo, 2020; C. Wang et al., 2020). Contrary, negativity on system quality tends to lower the trust in the system and the government resulting in poor acceptance of the services (Shahzad et al., 2019; Venkatesh et al., 2016). For example, in their study, Hussain et al. (2019b) interviewed the users. They found findability reflecting on poor system quality as a critical reason for lower usability performance of m-government.

From the user perspective, studies have also considered these attributes under hedonic dimensions (Ekaabi et al., 2020). Past literature has satisfactorily proved the significant direct relation of system quality on satisfaction and intention to use m-government services (Al-Hubaishi et al., 2017; Alharbi et al., 2020; Almarashdeh, 2020; Azeez and Lakulu, 2018; Ekaabi et al., 2020; Glood et al., 2016b; C. Wang and Teo, 2020). It is a critical factor for the success of the m-government implementation (Ali and Al-Kabbi, 2018; Kesavarapu and Choi, 2012). However, few studies found system quality to have a non-significant impact on intention to use m-government (C. Wang and Teo, 2020). This study will consider the dimensions like convenience to use, access speed, personalization, and visual appeal to measure the perception of system quality. The hypothesis thus framed is as follow (H7):
H7: There is a significant influence of system quality on the intention to use m-government.

3.7.4 Means of Uncertainty Reduction

3.7.4.1 Transparency

Transparency can be defined as the extent to which the service providers provide information and clarity on the working of m-government services to the users (Z. Chen et al., 2016). Since m-government services reduce citizens' interaction with the service providers, it creates a need to be more transparent. The government needs to provide up-to-date and timely information about the services (Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016). It is a vital procedural characteristic of a service provider and has a direct bearing on the assessment of fairness and satisfaction by the users (Z. Chen et al., 2016; Ekaabi et al., 2020; Venkatesh et al., 2016). Transparency is believed to significantly influence the trust and willingness of the users towards the use of m-government (G. Wang et al., 2020). A study carried out in India also found transparency to be the main factor influencing m-government adoption (Chanana et al., 2016). In this regard, the study considers transparency to influence m-government adoption significantly (H8).

H8: There is a significant influence of transparency on the intention to use m-government.

3.7.4.2 Mediation of Transparency between IQ and BI

The degree of uncertainty prevailing among the users on technology directly influences the adoption of the same (Venkatesh et al., 2016). In m-government services, high information quality characteristics (like accuracy and completeness) of the service will help the citizens to understand the facility and its processes better, thereby developing trust in the system (Sharma et al., 2018). On the other hand, incomplete and inaccurate information will create confusion and lacks clarity on the service and its processes. Thus, a higher level of information quality will enable the citizens to understand the services better, leading to transparency in the system (Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016).

Definition of transparency implies that greater transparency will help to better understand the service and its processes, thereby developing trust and strengthening the intention to use m-government service (G. Wang et al., 2020). Thus, we can conclude that transparency will facilitate the process of information gathering and uncertainty reduction, which impacts adoption behaviour (Shahzad et al., 2019; Shahzad et al., 2020). Hence, though the perception of information quality directly influences intention, its relation can also be mediated through transparency and trust (H8a and H8b). The other indirect relationship that can be observed here is the role of trust as a mediator between transparency and intention to use (Venkatesh et al., 2016; G. Wang et al., 2020). It reflects on the importance of transparency in the development of system trust, and thus an indirect influence of transparency on the intention to use m-government through trust (H8c).

H8a: Transparency mediates the relationship between information quality and intention to use m-government.

H8b: The relationship between information quality and intention to use m-government serially mediates through transparency and trust.

H8c: Trust mediates the relationships between transparency and intention to use m-government.

4.7.4.3 Trust

Perceived trust is considered to be the most influential factor that impacts the use of any technology. It refers to the belief one has on the other party in an act that is as per the trusting party's expectation and in a socially responsible manner (Liu et al., 2014; Shahzad et al., 2019; Shahzad et al., 2020). In m-government studies, trust in the government (benevolence) and technology are two important aspects discussed in the previous literature (Almarashdeh, 2020; Reddick et al., 2020; C. Wang, 2014). Further, most studies have focused on the three dimensions of trust viz. competence, integrity, and benevolence (A. Kumar et al., 2018; Liu et al., 2014). Competence refers to the belief in the government's ability, skill, and expertise in performing the task. Integrity refers to the belief of citizens that the government will adhere to a set of principles and promises while delivering m-government services. Benevolence is the extent to which a trustee (i.e., government) is believed to want to do good to the trustor (i.e., citizens) (Beza et al., 2018; Liu et al., 2014).

Many studies in the past highlighted the importance of trust in m-government services owing to the risk of vulnerability and uncertainty in digital means of service (Ahmad and Khalid, 2017; Alharbi et al., 2020; Aloudat and Michael, 2011; Hung et al., 2013; Liang et al., 2021; Lopes et al., 2019; Reddick and Zheng, 2017; Saxena, 2017; Sharma et al., 2018; G. Wang et al., 2020). It is vital to know that a user generally finds difficulty accessing the benefits of any new technology. Hence, trust in the service provider serves as a foundation for increasing citizens' confidence, dependability, and accessibility to m-government services (Alharbi et al., 2020; Almaiah et al., 2020; Park and Lee, 2018).

Further studies have highlighted security, privacy, lower transparency, and reliability issues that may cause distrust among the citizens (Alqaralleh et al., 2020; Eid et al., 2020; Liang et al., 2021). Distrust thus acts as a significant barrier to the adoption of technology. Hence, one needs to focus on developing trust for the successful implementation of m-government services (Ahmad and Khalid, 2017; Almarashdeh, 2020; Beza et al., 2018; T. Lee et al., 2020; Park and Lee, 2018; Sharma et al., 2018; Writz et al., 2019). Tomer et al. (2016), in their study among the Indian farmers, showed the presence of distrust with the government and experts (service providers) and trusted more on their peers and vendors. Hence, trust is considered to positively influence the intention to adopt m-government under the three sub-dimensions, competence, integrity, and benevolence. The hypothesis, thus framed (H9) is as follows:

H9: There is a significant influence of trust on the intention to use m-government.

3.7.4.4 Mediation of Trust between SQ and BI

System quality characteristics, such as convenience and personalization, are expected to enhance the capability of m-government services. It reflects the government's commitment and caring to citizens. It positively affects the user's minds and helps build trust and confidence in m-government services (Ahmad and Khalid, 2017; Azeez and Lakulu, 2018). On the other hand, higher trust in government and technology is expected to increase the willingness of the citizens to adopt m-government services (Azeez and Lakulu, 2018; Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016). Contrary, a distrust will lead to the use of the traditional channel of services and lower acceptance of m-government services (Ahmad and Khalid, 2017). Though the perception of system quality directly influences m-government intention to use as hypothesized earlier, the mediating role of trust is also essential to consider. The system quality is expected to reflect the government's commitment and care to citizens. It will enhance the predictability of m-government service use, resulting in higher trustworthiness and consequently favourable intention to use m-government. The hypothesis (H9a) is:

H9a: Trust mediates the relationship between system quality and intention to use m-government.

3.7.5 Facilitating Condition

Facilitating condition (FC) refers to the degree to which the individual believes that the organizational and technical infrastructure exists to support the use of an m-government system (Sharma et al., 2018; Venkatesh et al., 2003). It is one of the vital determinants that directly influences the usage behaviour of the system (Park and Lee, 2018). It is an essential construct in UTAUT theory and TPB. Facilitating condition and self-efficacy are the two dimensions that measure the factor PBC (Ajzen, 1985). Many studies thus have considered this aspect as PBC (Y. Kim et al., 2013; Ohme, 2014; Singh and Srivastava, 2018). Prior research has shown the need to consider the factor FC along with attitudinal factors to have an exhaustive explanation of m-government adoption (Hung et al., 2013; Reddick et al., 2020; Saxena, 2017, 2018; Zhang et al., 2011). Lack of facilitating condition is expected to result in avoidance of the usage of m-government. Prior studies have proved the significant influence of FC on the intention to use m-government (Ohme, 2014; Sharma et al., 2018; Talukder et al., 2019; Talukder et al., 2020). But, some studies also found an insignificant relation of this factor towards m-government adoption (Almaiah et al., 2020; Hung et al., 2013; Park and Lee, 2018; Saxena, 2017).

Thus, FC is critical because individual access to internet and mobile data services varies, resulting in a varying level of FC impacting m-government service adoption (Park and Lee, 2018). The inconsistency in the findings on the relationship between FC and behavioural intention to use necessitates further investigation. Thus, this has been considered and hypothesized as (H10).

H10: There is a significant influence of facilitating conditions on the intention to use m-government.

3.7.6 Social Influence

Social Influence is another critical factor influencing the behavioural intention to use any technology. It can be defined as the degree to which an individual perceives that the essential others believe they should use the system (Venkatesh et al., 2003). Here, the superior influence, expert opinion, family, friends, and colleagues were the potential medium of influencers, affecting adoption (Park and Lee, 2018). The factor social influence has been derived from the construct subjective norm of TPB. Several studies have analysed the impact of subjective norms on the behavioural intention to use m-government (Lawson-body et al., 2014; Mohammadi, 2014; Ohme, 2014; Thongsri et al., 2018). With the newness of m-government services, individuals tend to have little or no experience in using these services. Hence, people tend to comply with their normative belief of whether or not their reference groups expect them to use the service or not (Ahmad and Khalid, 2017; Park and Lee, 2018; Sharma et al., 2018).

Prior research has found that people tend to adopt new technology for social approval in their social environment (referring to status gained by using the latest technology). It also results in perceived social pressure, which refers to social risk (i.e., loss of status in one's social group), which individuals are concerned about by their actions. Hence, social influence considerably affects m-government adoption (Kapoor et al., 2015; Park and Lee, 2018; S. Yang et al., 2018). Communication on mass media like the internet, television, radio, newspapers, etc. found to have a significant role in shaping the attitude towards m-government services. The success of others using the service also impacts the service's use by an individual and builds trust (Liu et al., 2014). Thus, trust can also mediate the relationship between social influence and intention to use m-government.

It is also important to note that the cultural characteristics (like collectivism or individualism) of an individual will have an impact on social influence (Arpaci, 2015). Individualistic people rely on their own for any decision-making. Contrary collectivistic people tend to rely on family or community opinion in making decisions (Hostefede, 2011). Prior studies such as Hung et al. (2013) in China, Ahmad and Khalid (2017) in UAE, Abu-Shanab and Haider (2015) in Jordan, and Ohme (2014) in Denmark, Hou et al. (2020) in the United States found to have a significant impact of social influence on m-government adoption. Contrary, studies like Almaiah et al. (2020) in Jordan, Beza et al. (2018) in Ethiopia, Sharma et al. (2018) in Oman, Saxena (2018) in India, Talukder et al. (2019), and Talukder et al. (2020) in Bangladesh, found social influence to have insignificant relationship with m-government adoption.

From the above discussion, it can be observed that the effect of social influence is vital in explaining m-government adoption. Further, due to the contrary results and cultural influence, there is a need for further investigation from an Indian perspective for better clarity. The hypotheses thus framed (H11) are as follow:

H11: There is a significant impact of social influence on the intention to use m-government.

H11a: Trust mediates the relationship between social influence and intention to use m-government.

3.7.7 Social Media

As discussed in previous section 3.6, social media is expected to influence awareness, transparency, trust, image, and social influence elements of m-government adoption. Hence, these factors are considered and discussed in detail below.

3.7.7.1 SM on Awareness

The ability of social media to disseminate information together with a large user base makes this as one of the most effective channels for raising awareness. Here, awareness reflects on an individual's level of understanding of m-government services and their uses (Rogers, 2010; Mandari et al., 2017). Social media advertising has gained prominence in this regard and is now one of the most popular means of promotion used by most organizations worldwide. However, government agencies have not effectively used these channels to raise public awareness of m-government services (Campbell et al., 2014; Chatterjee, 2020; Nomani et al., 2016; Zolait et al., 2014). Therefore, the government must raise awareness to improve the demand for these services and use channels such as social media for this purpose (Chatterjee, 2020; Nisar and Shafiq, 2019; Reddick and Zheng, 2017).

3.7.7.2 SM on Transparency

Social media use is primarily expected to improve citizens' transparency and trust in the government (Bertot et al., 2010). Transparency reflects service providers' openness and honesty and refers to the extent to which they provide information and clarifications on m-government services (Z. Chen et al., 2016). The ability of social media to disseminate information in real-time and provide citizens with all necessary information on a timely basis is critical for system transparency (Alryalat et al., 2017; Rahim, 2019). Improved collaboration and citizen participation, according to studies, can only lead to greater transparency. (Al-Aufi et al., 2017; Bonson et al., 2017; G. Wang et al., 2020). It develops a sound governance system and is crucial to any democratic nation (Goede and Neuwirth, 2014; Zavattaro and Brainard, 2019).

Furthermore, social media information increases the perceived knowledge and salient features of any government program and thus creates a positive attitude towards government (Fullerton et al., 2017). Any knowledge and information on m-government services shared through social media also make it easier for users to use m-government services (Fullerton et al., 2017; Nisar and Shafiq, 2019). With reduced interaction in these services, timely information is essential, reflecting the criticality of transparency and social media assists in this aspect effectively (Shahzad et al., 2019; Shahzad et al., 2020; Venkatesh et al., 2016). It is thus a critical function for service providers and significantly impacts user fairness and satisfaction (Z. Chen et al., 2016; Venkatesh et al., 2016). It also creates a favourable attitude towards the services and their providers, thereby developing trust (Al-Aufi et al., 2017; Porumbescu, 2017). Transparency is, therefore, one of the essential factors in the assessment of social media influence, and is also demonstrated in previous literature (Alryalat et al., 2017; Bonson et al., 2017; Goede and Neuwirth, 2014; C. Song and Lee, 2016; G. Wang et al., 2020).

3.7.7.3 SM on Trust

The other necessary condition for the success of government social media channels is trust in social media sites and the government (Wirtz et al., 2018). Here, trust in the skills and expertise of the government agency, confidence among the public that the government will abide by its stated values and promises, and belief in these SM based activities are key dimensions under a trust (Beza et al., 2018; A. Kumar et al., 2018; Liu et al., 2014). Therefore, much of the earlier literature on understanding the effect of social media on government has considered trust a critical factor (Gibreel et al., 2018; C. Song and Lee, 2016; G. Wang et al., 2020).

Here, social media use will improve the operational efficiency of these services through enhanced accessibility and customized services, and customer support and thus build confidence in these services (Al-Aufi et al., 2017; Evans et al., 2018; Hung et al., 2020; S. Kim et al., 2015). Furthermore, the use of social media in the provision of services and related information will improve the public's reach and ease the use of these digital services (Bertot et al., 2012; Criado and Villodre, 2021; Elvira et al., 2014). Besides, in their study, G. Wang et al. (2020) demonstrated the importance of trust and transparency in developing government reputation and citizen compliance with m-government services. Also, the type of social media usage and channel experience of an individual plays a crucial role in developing trust (G. Wang et al., 2020; Hong, 2013). Furthermore, the self-efficacy and demographic profile of the individual influence the online experience (S. Kim et al., 2015; T. Lee et al., 2019; C. Song and Lee, 2016).

Moreover, the presence of the government departments on social media for various functions and their involvement directly impacts the citizen's trust towards these applications (Abdelsalam et al., 2013; Kietzmann et al., 2011). Here, the engagement referring to government availability when citizens require information and prompt responses to issues (i.e., responsiveness) are two critical aspects of developing trust (Al-Aufi et al., 2017; Bonson et al., 2017; Elvira et al., 2014; S. Kim et al., 2015). However, most studies have found that the government's social media sites had a lower presence and involvement, hampering the development of trust towards these new technologies (Abdelsalam et al., 2013; Al-Aufi et al., 2017; Nomani et al., 2016).

Moreover, perceived risks in terms of safety and confidentiality of information lead to distrust among citizens. Studies have further shown the effect of the ‘image of the service provider’ on the acceptance of services by the consumers (T. Lee et al., 2019; Nisar and Shafiq, 2019; G. Wang et al., 2020). It is, therefore, crucial to review and streamline government policies on social media for its effective implementation, thereby developing trust and transparency (Bennett and Manoharan, 2017; Campbell et al., 2014).

3.7.7.4 SM on Image and Social Influence

The influences of others (i.e., social influence) through discussions and sharing on social media platforms is another crucial aspect that plays a significant role in adopting m-government services. It generally refers to e-WOM and is another critical feature of social media. The sizeable virtual community formed by social media plays a vital role in the dissemination of information rapidly among many. It is a new form of social influence which impacts the adoption of m-government (P. Wang et al., 2020). Hence, social media is a vital add-on to the provision of citizen-centric services in m-government (Wirtz et al., 2018). It has led to the development of government microblogging services for citizen interaction and engagement (Y. Li et al., 2018; Peng et al., 2021; S. Yang et al., 2018; Y. Yang et al., 2020).

In addition to regular conversations with the virtual social group, such as sharing experiences and opinions, it is also possible to promote and build trust in these services through information sharing and support using opinion leaders or experts (Erkan and Evans, 2016). The enhanced interactivity features on social media, such as audio or video chats, postures, and facial expressions, would also improve the participation of individuals on social media platforms for these services (W. Wang et al., 2019). A study in India found that e-WOM plays a vital role in raising awareness and adopting new digital technologies such as social media and the Internet of Things used by the government (Chatterjee, 2020). Overall, social media can significantly impact awareness building and the acquisition of m-government service information with the help of new and large virtual social groups (Chatterjee, 2020; Hutter et al., 2013; Wirtz et al., 2018).

Moreover, individuals have minimal experience with the use of these services, as they are new. Hence, the opinions and reviews shared by users and experts on these social media platforms act as trust builders (Hajli et al., 2014). Furthermore, the regular sharing of information and the involvement of citizens through virtual groups of experts or officers on these social media platforms also promotes transparency in the system (Agostino et al., 2017; Valle-Cruz et al., 2016; Valle-Cruz, 2019). Thus, the use of social media is vital in creating a favourable outlook towards the government social media use and m-government services (Gibreel et al., 2018). The use of social media is also considered an image enhancer in an individual's social life (Al-Aufi et al., 2017; Bertot et al., 2012). These aspects reflect the significance of social media in building the social influence and image of any service.

3.7.7.5 Hypotheses on Social Media Influence

As mentioned earlier, it is critical to measure the citizen's perception towards social media use by the government, which will assist the government in leveraging their strategies on these mediums (Al-Aufi et al., 2017; Criado et al., 2013; Dwivedi et al., 2017; Park and Lee, 2018). Although the research on the government's use of social media is prevalent, little research has been carried out in integrating this with m-government services (Alryalat et al., 2017; Dwivedi et al., 2017).

This study looks into citizens' perceptions of the government's use of social media to bridge that gap. The role of social media in creating awareness, improving transparency, and leveraging the trust in m-government services are analysed. Next, Social media is also expected to significantly influence the social environment of the citizen, which will affect the factors Image and Social influence. The hypotheses thus framed are as follows:

H12a: Social media has a significant influence on awareness.

H12b: Social media has a significant influence on trust.

H12c: Social media has a significant influence on transparency.

H12d: Social media has a significant influence on social influence.

H12e: Social media has a significant influence on the image.

Further, the relationship between social media with awareness, image, social influence, and trust also has many indirect relationships on these variables which are described below.

- The relationship between social media and image is mediated through awareness.
- The relationship between social media and social influence is mediated through the image. Also, awareness and image serially mediate between social media and social influence.

- The relationship between social media and trust is mediated through social influence. Also, image and social influence serially mediate between social media and trust. Further, the relationship between social media and trust is mediated serially through awareness, image, and social influence.
- Lastly, transparency also mediates the relationship between social media and trust.

The hypotheses thus defined for the analysis are listed below (H12f to H12j):

H12f: Awareness mediates the relationship between social media and image.

H12g: Image mediates the relationship between social media and social influence.

H12h: The relationship between social media and social influence is serially mediated through awareness and image.

H12i: Social influence mediates the relationship between social media and trust.

H12j: The relationship between social media and trust is serially mediated through image and social influence.

H12k: The relationship between social media and trust is serially mediated through awareness, image, and social influence.

H12l: Transparency mediates the relationship between social media and trust.

3.7.8 Moderators

Prior studies on m-government have shown the significant influence of demographic factors in the adoption behaviour of citizens. Analysing the differences in behaviour across different socio-demographic categories regarding the adoption of technology, satisfaction, and channel choices for using these government services is a crucial aspect that most researchers focused on (Mossey et al., 2019; Muller et al. 2021; Reddick et al., 2020). The demographic characteristics such as age, gender, education level, income level, experience, and place are the key factors which are mainly examined by most of the prior researchers (Beza et al., 2018; Ding et al., 2019; Hou et al., 2020; Mensah and Adams, 2020; Ohme, 2014; Reddick et al., 2020; Saxena, 2017; W. Zhou et al., 2018).

Results of the past studies indicated the significant influence of age, gender, income, and experience on behavioural intention (Beza et al., 2018; Liu et al., 2014; Mandari and Chong, 2018; Martins and Al-Shekaili, 2019; Mwalukasa et al., 2018; Saxena, 2018). Contrary, Reddick and Zheng (2017) and W. Zhou et al. (2018) found no significant influence of demographic factors like Age, Gender, and Socioeconomic status (measured through education, income, and occupation) on the behavioural intention of a citizen.

Further, Jaradat et al. (2018) and Mandari and Chong (2018), in their study, found mixed results where RA, EOU, and government support had a moderating effect by age, while compatibility and image didn't show the moderation towards the use of mobile government. On the other hand, gender moderated for the factors RA, EOU, and compatibility and had no moderation for factors image and government support. Similarly, Ahmad and Khalid (2017) found the significant influence of demographic variables as moderators. The demographic variables here had a substantial impact on the relationship of trust with BI than the social influence relation on BI. These results imply a need for further investigation of demographic characteristics and their relationships to individual behaviour.

The social environment, cultural and subcultural aspects, and the attitude towards the local government influence individual behaviour (Bachrach, 2014; De Blasio, 2008; S. Gupta et al., 2017; Mwalukasa et al., 2018; Saxena, 2018). Hence, considering the place as a moderator will assist in capturing these variations (Munyoka and Maharaj, 2017; Mwalukasa et al., 2018). Past literature also highlighted the need to perform demographic analysis in future research on m-government (Ahmad and Khalid, 2017; Chanana et al., 2016; Ghosh Roy and Upadhyay, 2017; Shahzad et al., 2019).

The review of these studies infers that the effect of demographics on the use of m-government needs further investigation. Hence, this study considers demographic variables like age, gender, income, place, and experience (such as EG experience, m-government experience, SM experience) as moderators between independent variables and behavioural intention (H13).

H13a: The relationships between variables of m-government adoption show statistically significant differences between males and females.

H13b: The relationships between variables of m-government adoption show statistically significant differences across age groups.

H13c: The relationships between variables of m-government adoption show statistically significant differences across education categories.

H13d: The relationships between variables of m-government adoption show statistically significant differences across occupation categories.

H13e: The relationships between variables of m-government adoption show statistically significant differences across groups with different income levels.

H13f: The relationships between variables of m-government adoption show statistically significant differences between people from various smart cities of Karnataka.

H13g: The relationships between variables of m-government adoption show statistically significant differences between people of Bengaluru and other cities.

H13h: The relationships between variables of m-government adoption show statistically significant differences between people with and without EG experience.

H13i: The relationships between variables of m-government adoption show statistically significant differences across citizens with varying m-government experiences.

H13j: The relationships between variables of m-government adoption show statistically significant differences across citizens with varying SM experiences.

3.8 CONCEPTUAL MODEL

The model developed by identifying the relevant factors and theories through a systematic review is given below in Figure 3.8. The constructs' definitions and the hypotheses framed for the study are given in Table 3.5 and Table 3.6.

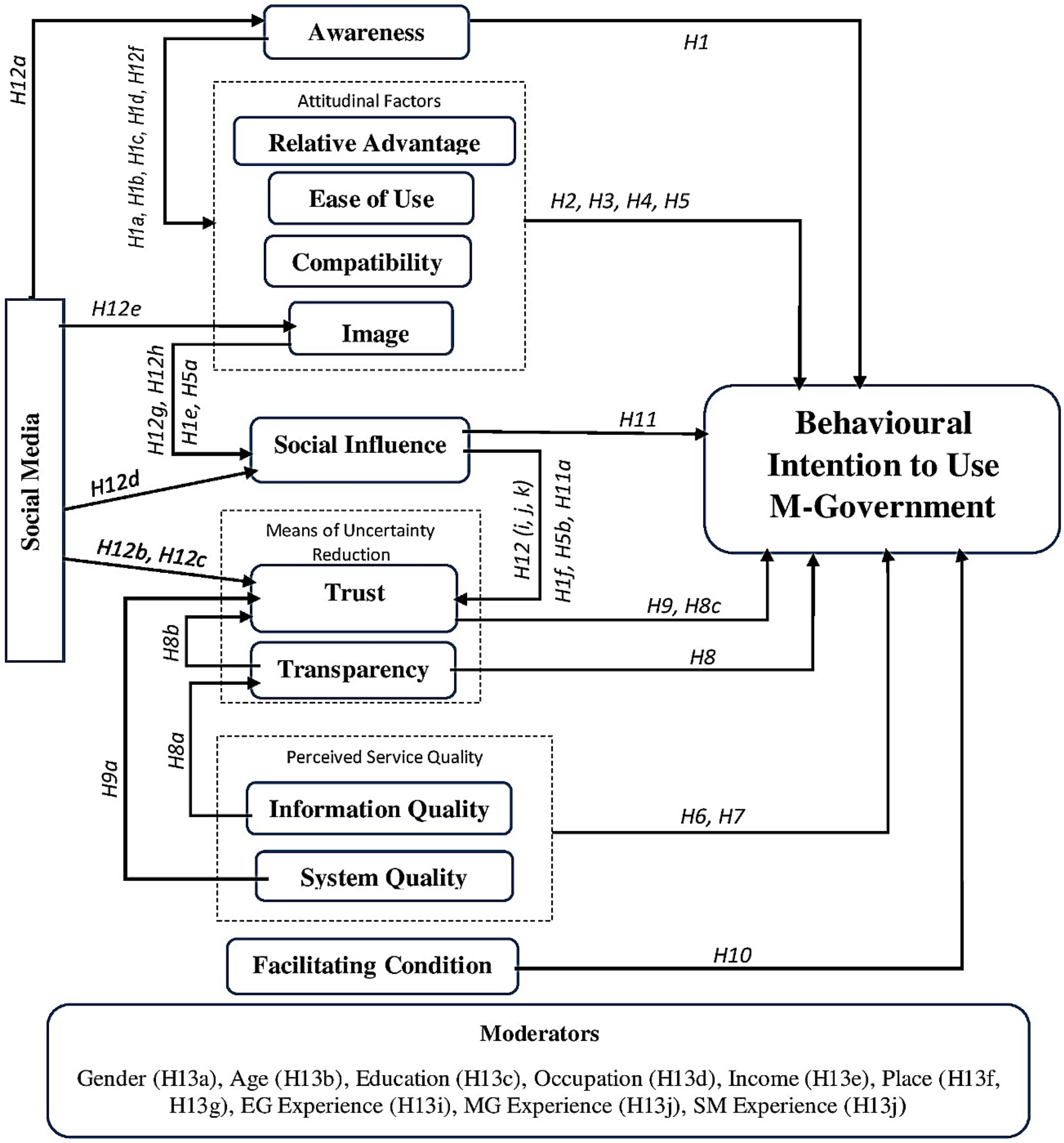

Figure 3.8: Conceptual model for the study (Source: Author)

Table 3.5: Definition of the constructs used in the conceptual model

Constructs	Definition	Sources
Awareness	The level of knowledge an individual has about the m-government service and its use	Rogers (2010)
Relative Advantage	Relative advantage refers to how m-government is perceived to be better than the idea it supersedes.	Kapoor et al. (2015), Rogers (2010)
Ease of Use	The extent to which m-government would be free from physical and mental efforts	Mandari et al. (2017), Rogers (2010)
Compatibility	The degree to which the m-government services are considered to be consistent with the existing values, experiences, and needs of the citizens	
Image	Image refers to the degree to which the use of m-government is expected to enhance a user's status in their social system.	Liu et al. (2014)
Information Quality	Information quality reflects the ability of the system to convey the required information to the users. It reflects on the characteristics such as accuracy, sufficiency (i.e., completeness), relevancy, and timeliness (reflects on responsiveness)	Al-Hubaishi et al. (2017), Kesavarapu and Choi (2012), T. Zhou (2013),
System Quality	System quality refers to the citizen's perception of the technical level of communication. It reflects characteristics of an information system such as convenience to use, access speed, personalization, and visual appeal.	
Transparency	Transparency is the extent to which the service providers provide information and clarity on the working of m-government services to the users.	Z. Chen et al. (2016)
Trust	It refers to the belief one has on the other party in an act that is as per the trusting party's expectation and in a socially responsible manner.	Liu et al. (2014), Shahzad et al. (2019)
Facilitating Condition	Facilitating condition (FC) refers to the degree to which the individual believes that the organizational and technical infrastructure exists to support the use of the m-government system.	Sharma et al. (2018), Venkatesh et al. (2003)
Social Influence	It is the degree to which an individual perceives that the important others believe they should use the m-government system.	Venkatesh et al. (2003)
Social Media	It refers to computer-mediated technologies which facilitate the creation and sharing of information, ideas, and other forms of expression through virtual communities and networks.	Voramontri and Klieb (2019)
Behavioural Intention	It refers to an indication of a person's readiness or likelihood to perform a given behaviour. It is considered to be an antecedent of actual behaviour.	Ajzen (1991)

Table 3.6: List of hypotheses for the current study

H1:	There is a significant influence of awareness on the intention to use m-government.
H1a:	Relative advantage mediates the relationship between awareness and intention to use m-government.
H1b:	Ease of use mediates the relationship between awareness and intention to use m-government.
H1c:	Compatibility mediates the relationship between awareness and intention to use m-government.
H1d:	Image mediates the relationship between awareness and intention to use m-government.
H1e:	Image and social influence serially mediates the relationship between awareness and intention to use m-government.
H1f:	The relationship between awareness and intention to use m-government services serially mediates through image, social influence, and trust.
H2:	There is a significant influence of relative advantage on the intention to use m-government.
H3:	There is a significant influence of ease of use on the intention to use m-government.
H4:	There is a significant influence of compatibility on the intention to use m-government.
H5:	There is a significant influence of image on the intention to use m-government.
H5a:	Social influence mediates the relationship between image and intention to use m-government.
H5b:	The relationship between image and intention to use m-government serially mediates through social influence and trust.
H6:	There is a significant influence of information quality on the intention to use m-government.
H7:	There is a significant influence of system quality on the intention to use m-government.
H8:	There is a significant influence of transparency on the intention to use m-government.
H8a:	Transparency mediates the relationship between information quality and intention to use m-government.
H8b:	The relationship between information quality and intention to use m-government serially mediates through transparency and trust.

H8c:	Trust mediates the relationships between transparency and intention to use m-government.
H9:	There is a significant influence of trust on the intention to use m-government.
H9a:	Trust mediates the relationship between system quality and intention to use m-government.
H10:	There is a significant influence of facilitating conditions on the intention to use m-government.
H11:	There is a significant impact of social influence on the intention to use m-government.
H11a:	Trust mediates the relationship between social influence and intention to use m-government.
H12a:	Social media has a significant influence on awareness.
H12b:	Social media has a significant influence on trust.
H12c:	Social media has a significant influence on transparency.
H12d:	Social media has a significant influence on social influence.
H12e:	Social media has a significant influence on the image.
H12f:	Awareness mediates the relationship between social media and image.
H12g:	Image mediates the relationship between social media and social influence.
H12h:	The relationship between social media and social influence is serially mediated through awareness and image.
H12i:	Social influence mediates the relationship between social media and trust.
H12j:	The relationship between social media and trust is serially mediated through image and social influence.
H12k:	The relationship between social media and trust is serially mediated through awareness, image, and social influence.
H12l:	Transparency mediates the relationship between social media and trust.
H13a:	The relationships between variables of m-government adoption show statistically significant differences between males and females.
H13b:	The relationships between variables of m-government adoption show statistically significant differences across age groups.
H13c:	The relationships between variables of m-government adoption show statistically significant differences across education categories.
H13d:	The relationships between variables of m-government adoption show statistically significant differences across occupation categories.

H13e:	The relationships between variables of m-government adoption show statistically significant differences across groups with different income levels.
H13f:	The relationships between variables of m-government adoption show statistically significant differences between people from various smart cities of Karnataka.
H13g:	The relationships between variables of m-government adoption show statistically significant differences between people of Bengaluru and other cities.
H13h:	The relationships between variables of m-government adoption show statistically significant differences between people with and without EG experience.
H13i:	The relationships between variables of m-government adoption show statistically significant differences across citizens with varying m-government experiences.
H13j:	The relationships between variables of m-government adoption show statistically significant differences across citizens with varying SM experiences.

Chapter 4
RESEARCH METHODOLOGY

4.1 OVERVIEW

This section provides an overview of the research process adopted in the study. The research process may be conceived of in terms of the research paradigm, research philosophy, approaches, and techniques used to attain the desired objectives of the study. Here, research methodology refers to researching in a systematic way to achieve valid and reliable results that address the research questions and objectives. However, it is essential to provide the evidence in the methods adopted with appropriate justifications for the choice of these methods. Hence, this chapter elucidates the aspects such as

- The review on research philosophy and assumptions and rationale of research philosophy adopted in this study.
- Description of the research strategy and methodologies adopted.
- Details on instrument development and data collection approaches.

4.2 RESEARCH PHILOSOPHY

It is critical in research first to understand and know the basis and assumptions on which the study is being conducted in terms of research philosophy and paradigm. Research philosophy is a system of principles and beliefs regarding the advancement of knowledge (Saunders et al., 2015). It focuses on a researcher's thinking process, resulting in new and accurate knowledge about the research object being studied. The choice of research strategy, formulation of the research issue, use of appropriate research methods to collect data, and analysis of the data are all based on these philosophical assumptions (Zukauskas et al., 2018).

Previous research studies have primarily discussed four important research philosophies. However, to better understand research philosophy, it is necessary first to understand its assumptions. The ontological, epistemological, and axiological assumptions are vital elements (Guha Thakurta & Chetty, 2015; Saunders et al., 2015).

- *Ontology* refers to the assumptions of reality which is a more abstract concept. It, however, shapes how a researcher sees and studies the research object.
- *Epistemology* refers to the assumptions about acceptable, valid, and legitimate knowledge and how to communicate the knowledge.
- *Axiology* is about values and ethics. It mainly focuses on how the values of both researcher and participants are being dealt with in the process.

4.2.1 Positivist Research Philosophy

It refers to objectively comprehending the social world. In this case, positivism assumes that institutions and social entities are real, as seen in a physical entity or natural phenomena (Saunders et al., 2015). As a result, it attempts to derive pure evidence and information for which causal interactions are investigated to generate law-like generalizations. It can then be used to justify behaviour and events in organizations or objects being studied. It employs a scientific empiricist method in which current theories are used to establish hypotheses, which are then checked and proven using evidence and proof. The process thus extends the existing theories, wherein researchers try to remain impartial and distant from the study item (Saunders et al., 2015). This philosophy's typical approaches are deductive, highly organized, large sample, measurement, and quantitative method of study (Saunders et al., 2015).

4.2.2 Interpretivist Research Philosophy

In contrast to positivism, the interpretivism theory assumes institutions and social entities to be subjective. It believes that humans are distinct from physical phenomena in that they generate meaning and can therefore be evaluated subjectively (Saunders et al., 2015). It asserts that people are different, with different cultural backgrounds. Depending on circumstances and time, they enact differently, resulting in distinct meanings that cannot be determined by simplifying the complexities into a set of law-like generalizations (Saunders et al., 2015). As a result, interpretivism seeks to elicit new, subtler understandings and meanings of social entities. Consequently, this method extracts data based on participants' perceptions and what is meaningful to them. In this case, the inductive techniques, with small samples and in-depth inquiries, mainly using qualitative methods are adopted by researchers (Saunders et al., 2015).

4.2.3 Pragmatist Research Philosophy

This approach focuses primarily on the facts and study issue under review, from which the theory of choice is derived. It attempts to follow theories, principles, and ideas, identifies hypotheses, and arrives at empirical conclusions based on their functional significance and implications to a particular context or issue under investigation (Saunders et al., 2015). As a result, the researchers are free to choose any of the tools, strategies, or procedures that best meet the needs and objectives of the analysis. The method is less concerned with abstract distinctions and more concerned with realistic consequences, and it does not regard the universe as an absolute object (Saunders et al., 2015). The approaches used in this analysis are based on the issue under study and the goals to be achieved. They employ mixed, multiple, qualitative, quantitative, or intervention research based on practical solutions and outcomes (Saunders et al., 2015).

4.2.4 Realistic Research Philosophy

The method is primarily based on the concepts of both positivist and interpretivist research philosophies. It is primarily focuses on the premise that truth is independent of the human mind (Saunders et al., 2015). These are focused on assumptions required to understand a complex subjective social entity and are of two types.

First, *Direct realism* assumes that what depicts the real world solely depends on what we see and feel through our senses. Second, *Critical Realism* contradicts direct realism by assuming that the actual world cannot be explicitly observed. It rather depends on our underlying perceptions and structures of reality, which form the observable events. Truth is external and self-contained, and what we see and feel is merely an objective reality. There are perceptions of things in the real world rather than the actual things themselves (Saunders et al., 2015). Under this premise, the approaches used are reproductive, with in-depth analysis of historically situated pre-existing systems, using various methods and data types appropriate for the research (Saunders et al., 2015).

4.2.5 Assumptions and Rationale of this Study

The above mentioned research philosophies are more commonly used in IS research, and this analysis is mainly oriented toward a positivist approach since it is primarily designed for the quantitative method. As previously mentioned, the primary aim of this study is to collect information from people about their perspectives, policies, and situations regarding the m-government system in Karnataka's smart cities. A Questionnaire is used for this survey process, then evaluated and analysed to prove the hypotheses identified based on established relationships and theories. As a result, these are quantitative approaches that primarily meet some of the core assumptions of positivist theory.

Positivist theory assumes that knowledge is conjectural. Here, research statements are made based on established theories and then further developed after analysis, data, and proof. Furthermore, it believes that knowledge is shaped by logic, in which researchers attempt to be objective and then create relevant and factual statements (such as hypotheses). The researchers also look for bias in the methods and conclusions (Al-Busaidi, 2012; Phillips & Burbules, 2000). The present analysis, primarily focuses on these assumptions mentioned above, thus defends the study to be a positivist research.

4.3 RESEARCH DESIGN

Research design is the adoption of an overall strategy or plans to integrate the different components of the study coherently and logically to ensure that the research problem is effectively addressed. It is broadly classified under two categories: exploratory research design and descriptive research design (Chawla & Sondhi, 2011).

The current research is an empirical study that embraces a descriptive research design under conclusive research. It advocates a survey method primarily and will be a cross-sectional study. Descriptive research is used to describe the characteristics of the population or phenomenon being studied in a structured and formal way (Chawla & Sondhi, 2011). A survey method is the most popular and accepted method in descriptive research, especially for collecting data at an individual level. It focuses on obtaining views, attitudes, or concerns on specific aspects of the study in a structured manner. It is a cross-sectional study because data will be collected from the sample at a particular time, and the study will analyse only this data.

A questionnaire survey, which is the most popular method in survey-based studies, will be adopted in the current study. Further, the study uses a systematic review in the initial research stages to clearly understand the problem under consideration. Later, the study identifies suitable theories and variables that help address these problems considered.

4.4 RESEARCH APPROACH

The research approach is the complete set of procedures based on which research will rely (Cresswell, 2014). It is generic and summarises the steps of broad assumptions to the data collection, analysis, and interpretation method and comprises limited information on the same. It is based on the nature of the research problem being addressed. The research approach is essentially divided into two categories:

1. The approach of data collection: Quantitative and Qualitative.
2. The approach of data analysis or reasoning: Inductive and Deductive (Neville, 2007).

4.4.1 Approach of Data Collection

This study primarily uses a quantitative data collection technique in the form of a questionnaire survey. Here, the study seeks a set of close-ended questions among the respondents, and answers are obtained in numerical data (i.e., Likert scale). The data gathered will be analysed and interpreted using appropriate statistical techniques. The following sections of the chapter go into detail about the methods used during the data collection process.

4.4.2 Approach of Data Analysis

The research employs a deductive approach, studying and analysing existing theories, constructs, and findings from previous proven research works. Based on this knowledge, research hypotheses are defined, then tested and proved in the current study. The conceptual model and hypotheses framed are relevant and significant to the population of the study. This approach helps in assessing the impact of critical factors on the adoption of m-government services among the citizens effectively, thereby validating and solidifying the existing research theories and gaps.

The deductive approach is suitable as the area of Technology Adoption and Information System research entails many well-accepted and proven theories. The researcher widely uses these theories to build constructively the project and the reader to comprehend more thoroughly the survey outcome. The essential stages that are generally followed in a deductive approach are (Neville, 2007):

1. Deducing hypothesis from theory.
2. Formulating hypotheses in operational terms and proposing relationships between two specific variables.
3. The testing hypothesis with the application of a suitable method(s). These are quantitative methods such as regression and correlation analysis, mean, mode and median, and others.
4. Examining the outcome of the test and thus confirming or rejecting the theory. When analysing the result of tests, it is vital to compare research findings with the findings of previous studies.
5. Modifying theory in instances when the hypothesis is not confirmed.

4.5 RESEARCH METHODS

Research methods refer to a specific set of procedures or strategies followed while researching to implement the research design. It includes all aspects of sampling and data collection and its analysis. It also comprises a description of the extent to which the results will be reliable and valid and how to interpret the results. Different types of research methods adopt various tools for data collection. The essential types are the qualitative method, quantitative method, and mixed methods of research.

This study applies a quantitative data collection method, which will be later tested using the appropriate statistical tool. The quantitative data is collected through a questionnaire with closed-ended questions from the sample under consideration which is the citizens from the smart cities of Karnataka.

4.5.1 Questionnaire Design

The questionnaire for the study is developed with the help of existing literature. It's worth noting that the questions in the instrument should be simple and easy to understand to improve the effectiveness of the survey (Chawla & Sondhi, 2011). The questionnaire in the study majorly consists of closed-ended questions, framed based on the independent and dependent constructs in the study, along with descriptive information of the respondents. Further, both the electronic and print form of the questionnaire is used for the data collection. The instrument is first tested on the dimensions like structure, validity, and reliability in a pilot study. The pilot study's results are then used to modify the questionnaire, which is then used for primary data collection using the appropriate sampling method (Appendix I).

Further, the instrument is translated to the local language of the study area, Kannada, with a language expert's help (Appendix II). It is one of the critical criteria in the survey process to enhance the effectiveness of the data collection process, which improves response rate and quality. Both the English and Kannada language questionnaire are then used to obtain the required data for the final study based on the respondents' preferences.

4.5.1.1 Structure of the Questionnaire

The questionnaire developed is a self-administered questionnaire which is of the type formalised-unconcealed with closed-ended questions. A five-point Likert scale has been mainly used for the purpose, a well-accepted and commonly used scale in survey-based studies in business management (Chawla & Sondhi, 2011). The questionnaire tries to extract information on the following aspects,

a) Questions regarding the use of smartphones and electronic government. Details on m-government and social media use and experience (8 items).
b) Questions on the determinants of m-Government adoption (48 items).
c) Demographic details of the respondents (7 items).

The questions or items in the instrument are taken from a standard questionnaire. A standard questionnaire represents an instrument that is used by the previous researchers and is tested and validated. The items used for measuring the constructs and the sources of reference are described below (Table 4.1). The questionnaire is then tested in preliminary research (pilot study) mainly to test the quality of the questionnaire in terms of its structure, scales, and correctness of the questions used to measure the variable. The final developed instrument after the pilot study is provided below (Appendix I).

Table 4.1: Details of the items in the questionnaire

Constructs	Sources
Awareness (AW)	Shahzad et al., 2019
I am aware of various m-government services in India.	
I know the advantages of using m-government services.	
Relative Advantage (RA)	Saadi et al., 2017; Shareef et al., 2012
Using m-government services increases efficiency compared with personal interaction with physical offices.	
Using m-government services will save citizens' time compared with personal interaction with physical offices.	
I can use the m-government services from anywhere.	
Ease of Use (EU)	Saadi et al., 2017; Saxena, 2017
Learning to use government services through mobile phones is easy for me.	
It is easy for me to access and avail of government services through mobile phone.	
Compatibility (CMP)	Saadi et al., 2017; Shareef, Kumar et al., 2016
Seeking government service through mobile phone would fit into my lifestyle.	
I think seeking government service through mobile phone would fit well with the way that I like to operate.	
I like to seek government service through mobile phones more than personal interaction with physical offices.	
Image (IM)	Liu et al., 2014; Shareef, Kumar et al., 2016
People who adopt mobile government have a high profile.	
People who adopt mobile government have a higher level of prestige.	
People who adopt mobile government have a better social status.	
Trust (T)	Shahzad et al., 2019; Sharma et al., 2018
Transactions using m-government applications are safe.	
User's privacy is well protected in m-government applications.	
I believe that the m-government services are reliable.	
Security measures in m-government services are enough	
I believe that m-government services are trustworthy.	
Transparency (TRN)	Shahzad et al., 2019
I expect the working processes of m-government would be transparent.	
I expect the government would give a clear idea of how m-government services work.	
I believe the government will provide me with complete guidance on the operation of m-government services.	
I believe I will have opportunities to provide feedback on m-government services.	
I believe the government will provide reliable information about its m-government services.	

Social Influence (SI)	Ahmad & Khalid, 2017
My friends and family think I should use m-government.	
My colleagues/peers think I should use m-government.	
People who are important to me think that I should use mobile government.	
Facilitating Condition (FC)	Park, & Lee, 2018
I have the necessary resources (like mobile, internet etc.) to use m-government applications.	
I have the necessary knowledge to use m-government applications.	
Information Quality (IQ)	Shahzad et al., 2019; T. Zhou, 2013
I expect information provided by m-government applications to be accurate.	
I expect information provided by m-government applications are relevant to my needs.	
I expect m-government applications provide me with sufficient information.	
I expect the government will rectify the information error if any regularly.	
I expect to connect with the authority concerned for any clarification using m-government applications whenever needed.	
System Quality (SQ)	Shahzad et al., 2019; T. Zhou, 2013
I expect the interface of m-government applications would be easy to use.	
I expect the m-government applications to quickly load text and graphics.	
I expect m-government to allow me to personalise notifications and presentation of information that I use	
I expect the m-government sites to be visually attractive.	
Social Media (SM)	Al-Aufi at al. 2017; Voramontri & Klieb, 2019
I believe that social media will help to raise awareness about m-government services.	
Social media helps to obtain information and knowledge about m-government services.	
I believe government communication regarding m-government services on social media is reliable.	
Individual trust can be earned if the government's presence on social media is sincere.	
I believe the government on social media provides accurate information.	
I believe that transparency between citizens and the government is obtainable in social media.	
Discussions with friends and others on Social media platforms made me aware of m-government services.	
Expert's opinions and reviews about the services on social media are credible and accurate.	
Sharing m-government user feedback on social media is useful.	
Behavioural Intention (BI)	Liu et al., 2014; Shahzad et al., 2019
I intend to use m-government services in the future.	
I believe using m-government services is very helpful.	

4.5.2 Sampling Design

A large population and limited time necessitate the need to identify a smaller group of the population for data collection that represents the entire population. This smaller group of people or the portion of elements taken from a whole population, which is considered representative of the population, is known as a sample (Chawla & Sondhi, 2011). Hence, the study resides in the inputs acquired from the 'sample' selected for data collection to reach a broad conclusion about the population.

The study focuses on understanding citizens' attitudes toward m-government services in Karnataka's smart cities. Since m-government is vital to the development of smart cities, the success of these technology-based projects is critical. As a result, studies specific to these cities will aid in the effective implementation of these m-government projects in smart cities. Hence, the study selects the smart cities of Karnataka, such as Belagavi, Bengaluru, Davangere, Hubballi-Dharwad, Mangaluru, Shivamogga, and Tumakuru, as the study location to understand the adoption behaviour of the m-government. Hence, the total population of these cities forms the population of the study. Details of the population of these cities are provided in Table 4.2. The sample will be decided based on the appropriate sample design procedure and sample size estimation formula. Therefore, the sampling process results are a reference to the number and how the data needs to be collected from these cities.

4.5.2.1 Sampling Method

The total number of people living in these smart cities is the population of the study and is used to measure the sample size. Further, the sample size from each stratum is proportionate to the population of each of these cities. This method is popular and widely used by many researchers and refers to the proportional stratified sampling approach. Further, because it is challenging to locate a particular person in a specific area, which is also an unfeasible choice, a non-probability sampling method is adopted. Here, the study mainly adopts convenience sampling and snowball sampling methods to identify the respondents from each city. Under the conditions of large population size and uncertainty in finding a particular respondent, these techniques are believed to be appropriate and acceptable methods and the past studies have commonly adopted the same (Chauhan et al., 2018; Z. Chen et al., 2016; A. Kumar et al., 2018; Ochara & Mawela, 2015; Sharma, 2015).

4.5.2.2 Sample Size Estimation

Since the population is vast, it is essential to use an adequate sample size estimation method to calculate the sample size. Here, the two formulas Cochran and Solvin are primarily used to estimate the sample size under these conditions. Both of these formulas were used along with two standard thumb rules in SEM analysis to calculate the sample size. Based on the results from these equations, the most suitable one was chosen (Table 4.2).

Cochran's formula (Cochran, 2007)	Slovin's formula (T. Ryan, 2013)
$Sample\ size\ (n) = \frac{Z^2 * P(1-P)}{e^2}$	$Sample\ size\ (n) = \frac{N}{(1+ne^2)}$

Where,

Z is the standard normal ordinate which is 1.96 for a 95% confidence level

P is the (estimated) proportion of the population with the attribute in question, where 0.5 is the maximum variability that can be considered under no information condition.

e is the margin of error

N is the total population size

Here, a 95% confidence interval with a five percent margin of error (MOE) is considered an acceptable limit and is used in most previous literature (Al-Hubaishi et al., 2018; Sharma et al., 2018). With this consideration, the sample size required results to 400 (Table 4.2). Further, in SEM there is thumb rule for estimating sample size, which specifies a minimum sample required to be at least 10 times the number of items to obtain reliable results (Hair et al., 2010). Therefore, a sample size of 630 is required based on 63 items, including demographic data, of the questionnaire. Furthermore, Hair, Hult, et al. (2017) highlighted the need for the sample size to be 20 times the number of items, resulting in 1260 as the required sample size for the study. Hence, the current research considers the sample size needed as 1260 as it is the highest number of the all. Here, using the proportional stratified sampling approach, the requirement for each city is estimated and is provided in Table 4.2. However, the sample size in the range of 630 - 1260 is acceptable in the context of time and resource constraints.

Table 4.2: Population details and sample size estimations

	Population	Solvin's Formula	Cochran's Sample Size	Hair et al. 2011
		5% MOE & 95% CL		20*No. of Items
Smart Cities of Karnataka	11758207	**400**	**385**	**1260**
Belagavi	6,10,350	21	20	65
Bengaluru	85,20,435	290	279	913
Davanagere	4,35,000	15	14	47
Hubbali – Dharwad	9,43,788	32	31	101
Mangaluru	6,23,841	21	20	67
Shivamogga	3,22,650	11	11	35
Tumakuru	3,02,143	10	10	32

4.5.3 Data Collection

As described earlier, the study mainly focuses on acquiring the primary data for testing and analysing the hypotheses defined in the study. Further, the study uses secondary data to know existing information in m-government research to acquire knowledge. It is also used to perform a systematic review that helps obtain the desired knowledge on the field, identify the relevant variables, and develop a suitable theoretical model for the study using appropriate theories in practice (deductive research approach).

The primary data is collected through a self-administered questionnaire which is one of the most prominent quantitative research methods (Chawla & Sondhi, 2011). Quantitative research refers to an empirical study where the data is acquired in measurable units (i.e., in numbers) on the theme of interest (Chawla & Sondhi, 2011). The developed questionnaire is administered for data collection in both English and the local language (Kannada). Both online forms (Google Forms) and printed questionnaires are used to acquire the data.

The link address is given to friends and family members through social sites (i.e., WhatsApp, Facebook, Instagram) and e-mail for online forms. They were also asked to share the link address with their friends and colleagues. Furthermore, based on the response rate, each known individual is followed up with and asked to send a reminder to their friends and other members with whom they have shared the online forms. This process was carried out in a phase-wise manner based on the location. Even though the online forms are inexpensive, quick, and simple to share, the response rate was low, hovering around 20%.

As a result, printed forms are also used to collect responses, in which friends and family members from the desired locations are approached, and responses are obtained from their contacts (peers and colleagues). This data collection method yielded 781 online responses and 779 printed forms for the main study. As a result, while the technique can be referred to as a convenience sampling approach, it also incorporates a snowball sampling technique. This data collection process began around the middle of March 2020 and ended in February 2021, about eleven months. The delay in this process was primarily caused by the nationwide lockdown imposed due to the Covid-19 pandemic. However, the study obtained responses well above the required sample size and at a reasonably good rate and timeframe.

4.6 PILOT STUDY

The pilot study refers to a small-scale preliminary study conducted to verify the capabilities and performance characteristics of the design, steps, procedures, and operational strategies to be implemented in the main survey (Fraser et al., 2018). It generally evaluates the viability of strategies, processes, questionnaires, and interviews and how they fit together in a particular context; they can also expose ethical and practical issues that might delay the main study (Doody & Doody, 2015). It helps in the identification of flaws in the design, data collection, and analysis plans. Further, it provides insights into the participant's experiences, which may indicate the need to simplify the instrument if found burdening. To ease the participant's experience, we can generally adjust the number of items, item wording, questions' order, and the instrument format. Primarily it tests the feasibility of the procedures for recruitment and retention of participants, testing for content validity and face validity of the questions, and assessing the usability (including ease of access and navigation) of the technology employed for administering the questionnaire.

Thus, although the items are taken from the previously tested and validated literature in the study, a pilot study is carried out to assess their validity and reliability in the context of the existing study environment. The following sections describe the steps involved in the pilot study.

4.6.1 Face and Content Validity

Face validity refers to the process of checking whether the existing instrument is capable of measuring what it is intended to measure (Johnson, 2013). It helps to assess the specificity, mistakes, readability, impartiality, the suitability of the query's type and structure, and the time needed to complete the questionnaire (Fraser et al., 2018). Two standard methods used for face validity are expert opinion and respondent's view on the instrument developed for the study. Summary of the critical observations and suggestions recommended by the respondents, technical experts, and subject area experts are described below. Further, Appendix III provides the complete details of experts involved in the face validity process.

However, face validity simply confirms whether the questions in the instrument represent what it aims to calculate and does not verify its content validity. The content validity refers to an investigation on whether the items in the questionnaire reflect a proper sample of a construct's domain (Hardesty & Bearden, 2004). Here, the validity tests such as discriminant and convergent validity play a critical role. Section 5.4 describes the procedure adopted to perform content validity.

4.6.1.1 Outcomes from Expert Opinion

The subject area experts have outlined and advised a range of essential pointers related to the content and structure of the instrument, which are considered and updated. The experts, however, have provided positive and constructive feedback on the conceptual model developed for the study. Some of the suggestions provided by the experts are enlisted below:

- Use generalized names of the services and not reveal the identity of any specific service provider. Also, include the consent form at the beginning of the questionnaire.
- Include a few qualitative questions in between the primary Likert scale items, which may improve the engagement level of the respondents.
- Mention the five scales clearly on every page to make it easier for the respondents
- Reduce the repetitions by combining the questions on use and frequency of use of m-government/EG
- Avoid the use of double-barrel questions. For example, questions under factor awareness (AW4), relative advantage (RA4), ease of use (EU1, EU2), and compatibility (CMP1, CMP2, CMP3) etc.
- Refrain from the use of complex words that hinder common respondents' comprehension; instead, use simple structure and vocabulary. For instance, the use of the word 'skilful' is not apparent in CMP3; the term 'knowledge' has a deeper meaning which is not understandable for an ordinary individual.
- Verify the options used in multiple-choice questions concerning its standards.

4.6.1.2 Outcomes from Respondents Opinion

Five respondents were asked to complete the questionnaire, and their completion time is recorded. The respondents, on average, took about 20 minutes to complete the survey. In addition, their experience during the process has been asked and documented. The length of the questionnaire was a common concern addressed by most participants. In a few instances, respondents also raised concerns about the clarity of the items. For example, one of the respondents suggested that the descriptive questions on e/m government use and frequency should be simplified and properly arranged. Similarly, questions are raised about the accuracy of item RA3. Finally, a few have recommended adding question numbers to the questionnaire.

4.6.2 Sampling and Sample Size for Pilot Study

The sample selected for the pilot study should be representative of the actual target population for the study. However, since time and resources are limited, it may not always be possible to pick a sample that is a total representation of the population and sample chosen for the main study. For example, it may not be possible to visit all locations to collect data for a pilot study. In these situations, a sample closest to the actual population can be considered (Van-Teijlingen & Hundley, 2002).

Furthermore, there are no clear guidelines to be followed to decide on the sample size for the pilot test. Research on the estimation of sample size based on a simulation method found that the sample size of 145 is appropriate, considering the power of the test with a medium effect size of 0.2 and 95 percent confidence interval (Whitehead et al., 2016). However, most studies have found that a sample size larger than 30 is sufficient for scale development irrespective of the number of items (Browne, 1995; Johanson & Brooks, 2010). Thus, this study considers the assumption of sample size requirement above 30 as the condition for the pilot study.

The study initially obtained approximately 106 responses for the first pilot study. Here, only around 95 responses were complete after screening for missing and unengaged responses. Later, the study again acquired the data following the instrument adjustment based on the previous analysis results. In the second pilot study, approximately 140 responses through electronic forms, and 50 replies in print were obtained. It resulted in a sample size of 182 responses after screening (8 responses were inappropriate).

4.6.3 Statistical Tests and Analysis of Pilot Study 1

The data is obtained from a small sample using an electronic form (i.e., Google Form) to check and validate the established instrument. Social networking platforms such as WhatsApp and Facebook are used mainly to contact respondents. Nevertheless, in a few instances, personal mails have also been used. The form was sent to approximately 600 respondents, of which only 106 responses were received (18 percent response rate). It represents a lower response rate in these communication channels, inferring the need for a field survey to collect the responses in the main study. The data collected are then used for Reliability and Exploratory Factor Analysis (EFA) to validate the instrument and check its suitability for the purpose. The steps followed are as explained in the sections below.

4.6.3.1 Screening Data

The obtained data is screened to ensure its suitability for use in the analysis. In this case, incomplete data and unengaged responses from respondents are primarily sought. The specifics of which are given below.

- Missing data in row

Around seven rows in the datasheet had more than twenty percent missing data, which were deleted due to its irrelevance for analysis purposes.

- Unengaged responses

Due to non-engagement, the data of two respondents (no. 27 and no. 68) were removed (they answered strongly agree for all the Likert scale).

- Missing data in columns

Approximately 15 responses had one or two missing values, which are sorted individually by evaluating each missing answer. Here, responses to similar questions on that factor are screened, and a mode value of the same is used to substitute blank spaces. It resulted in a final count of 95 responses.

4.6.3.2 Reliability Analysis

Reliability analysis refers to the process of assessing the internal consistency of the questionnaire objects. Cronbach alpha is the parameter used for this function, the minimum value of which should be greater than 0.7 (Hair, Hult, et al., 2017). The results indicated the reliability of all the thirteen factors considered in the model (Table 4.3), with the alpha value being higher than the threshold value (0.7). Nevertheless, the analysis also suggested the possibility of eliminating a few items to improve the reliability of the factors in the questionnaire. It is an excellent indicator that helps identify elements that deviate or do not contribute significantly to measuring a factor. Appropriate corrections/actions would improve the quality of the instrument.

Table 4.3: Results of the reliability analysis

Factor	Cronbach's Alpha	Suggestions for improvement
Awareness	0.637	If item 3 (AW3) is deleted alpha value improves to 0.753
Relative Advantage	0.739	If deleted, alpha value reduces
Ease of Use	0.850	EU3 if deleted, the alpha value will be 0.855
Compatibility	0.883	If deleted, alpha value reduces
Image	0.880	If deleted, alpha value reduces
Trust	0.806	If deleted, alpha value reduces
Transparency	0.855	If deleted, alpha value reduces
Social Influence	0.850	If SI4 is deleted, the alpha value will be 0.907
Facilitating Condition	0.801	FC3 if deleted, the alpha value will be 0.810
Information Quality	0.871	If deleted, alpha value reduces
System Quality	0.871	SQ1 if deleted, the alpha value will be 0.891
Social Media	0.809	SM3 if deleted, the alpha value will be 0.853
Behavioural Intention	0.894	BI3 if deleted, the alpha value will be 0.897

4.6.3.3 Exploratory Factor Analysis

EFA is a technique used to identify, reduce, and organize many items into a smaller number of specific constructs or factors in the study (Osborne, 2014). It is an iterative process where the iterations are performed until the results are improved and are at acceptable conditions. EFA mainly gives insights on inter-item correlation with high correlation among subsets of items reflecting the presence of more than one factor. Here, the specification of which items to load onto a particular factor are not specified, and all items are checked against each other for factor formation.

In particular, EFA offers guidance on two key issues, first on the loading of items. Here, the lower item loadings can be omitted or changed. The second is on cross-loading, where items are loaded on more than one factor. In this case, an item that loads heavily on one factor can be considered. However, cross-loading may weaken the power of the model in measuring the concepts. Hence, this procedure verifies the correctness of the questions and reflects on the questionnaire's strength. It is, therefore, a good practice to test the instrument even though it is based on existing literature and theories, especially in the initial phase of research like the pilot test (Gerbing & Hamilton, 1996; Walker & Maddan, 2008). Nonetheless, it is vital to conduct a Confirmatory Factor Analysis

(CFA) before the hypotheses test or main study to assess how well the data fits the specified factor.

The EFA has various decision points, first is deciding on the number of factors, where the number of factors is usually chosen based on the Eigen value, which should exceed one. Second, the extraction method referring to the statistical algorithm for factor extraction. Here, generally, the principal axis factoring or maximum likelihood method is said to perform better. Third, rotation methods specify whether factors are correlated (oblique) or uncorrelated (orthogonal) and are a mathematical scaling process for loadings. Generally, the presence of correlation between factors is a more realistic assumption and works well (Osborne, 2014).

In the current study, several iterations are performed to test the suitability and strength of the items considered in the construct. In EFA, the sampling adequacy is tested to check the suitability of the sample for factor analysis through the Kaiser-Meyer-Olkin (KMO) Test, whose value should be greater than 0.5. Bartlett's Test of Sphericity should be large and significant (i.e., p-value ≤ 0.01). It reflects on the existence of at least two variables for each factor which is a necessary condition. Finally, each item's loadings (correlation between variable and factor) should be higher than 0.3 if the item is to be considered under a factor. It is also appropriate for each item to have a minimum cross-loading (both indicated in the pattern matrix of the EFA result) (Yong & Pearce, 2013).

The results of this trial indicated an acceptable KMO value of 0.770, which is higher than the threshold (0.5), indicating the sampling adequacy. Further, Bartlett's Test of Sphericity was found to be significant with a p-value of less than 0.01. Overall it reflects on the suitability of the data to perform the factor analysis. The pattern matrix (Table 4.4) suggested 13 factors with a slightly different factor structure from the theoretical model. Items also had cross-loading issues, examined, and appropriate measures are taken to improve the instrument.

❖ **Trial 1:** Initial condition results

Table 4.4: Pattern matrix of EFA for Trial 1

Factor→	1	2	3	4	5	6	7	8	9	10	11	12	13
Aw1								.979					
Aw2								.807					
Aw3													.424
RA1		.658											
RA2		.632											
RA3		.478											
RA4		.330											
EU1		.349							.820				
EU2									.786				
EU3							.300		.346				
CMP1		.822											
CMP2		.770											
CMP3		.836											
IM1				.779									
IM2				.926									
IM3				.859									
T1		.413		.354									
T2		.378								-.301			
T3							.419	.326					
T4							.778						
T5							1.031						
TSP1						.507							
TSP2						.748							
TSP3						.708							
TSP4						.561							
TSP5						.648							
S11					.740								
SI2					.864								
SI3					.832								
FC1										.650			
FC2						.303				.646		.378	
FC3										.511			
IQ1	.337											.577	
IQ2												.609	
IQ3												.560	
IQ4	.761											.309	
IQ5	.786												
SQ1			.373										
SQ2	.774												
SQ3	.928												
SQ4	.734												
SQ5	.765												
SM1		.317	.878										
SM2			.790										
SM3										-.450			
SM4			.548										
SM5			.558				.321						
SM6			.753										
SM7			.377									.414	
SM8			.675										
SM9			.488										
BI1											.650		
BI2											.778		
SI4			.509		.317								
BI3											.617		

Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.

The key observations are:

- Factor 1 represented system quality, but items IQ4 and IQ5 were also part of this factor. These two items also loaded poorly under its factor (factor 12). Further, Item IQ1 also had a minor cross-load on this factor.
- Factor 2 consists mainly of relative advantage and compatibility items, reflecting the 'usefulness' in broader terms. However, items EU1, T1, T2, and SM1 also fell under this factor (cross-loading).
- Item SM3 under social media (factor 3) and item SI4 on social influence (factor 5) had very poor loading on the respective factor (less than 0.3).
- The items T1 and T2 under trust were not forming under its factor (factor 7).
- Factor 9 reflected ease of use where item EU3 had a significantly lower loading than its other two items.
- Factor 13 did not have any theoretical meaning and was neglected at the moment.

Items AW3, SI4, EU3, FC3, SQ1, SM3, and BI3 were therefore deleted for further iterations, considering even the suggestions of a reliability analysis (Table 4.3).

❖ **Trial 2:** Pattern matrix after item deletion based on the suggestion in reliability analysis

The KMO and Bartlett's tests met the desired acceptable values of 0.77 and $p<0.01$, respectively. Further, there was an improvement in the pattern matrix (Table 4.5) though the factor extracted was only eleven, differing from the theoretical model. The key observations here are:

- Factor 1 on system quality even had items IQ4 and IQ5 from information quality. Further items TRN3 and TRN4 had minor cross-loading on the same.
- Factor 2 consisted of items from relative advantage and compatibility with minor cross-loading (items of EU1, T1, and T2). Also, RA4 had lower loading when compared to other items on the respective factor.
- The item SM7 on social media (factor 3) had lower loading when compared to other items of this construct.

Table 4.5: Pattern matrix of EFA for Trial 2

Pattern Matrix											
	Factor										
	1	2	3	4	5	6	7	8	9	10	11
Aw1									.873		
Aw2									.701		
RA1		.749									
RA2		.777									
RA3		.572									
RA4		.410								.350	.345
EU1		.334								.540	
EU2										.812	
CMP1		.698									
CMP2		.696									
CMP3		.877									
IM1				.765							
IM2				.898							
IM3				.848							
T1		.335		.347							
T2		.431				.341	-.303				
T3						.586			.311		
T4						.893					
T5						.846					
TSP1								.421			
TSP2								.670			
TSP3	.324							.636			
TSP4	.359							.345			
TSP5								.438			
S11					.729						
SI2					.825						
SI3					.890						
FC1							.751				
FC2							.910				
IQ1	.377						.423				
IQ2							.449				
IQ3							.322				
IQ4	.728										
IQ5	.857										
SQ2	.855										
SQ3	.989										
SQ4	.788										
SQ5	.808										
SM1		.371	.773								
SM2			.637								
SM4			.537								
SM5			.521								
SM6			.742								
SM7			.385								.567
SM8			.655								
SM9			.561								
BI1		.308					.315				
BI2		.368									
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.											

- Factor 6 reflected on trust where the item T1 was not forming under it and item T2 had lower loading.

- Factor 7 on facilitating condition had items that should be looked for, such as IQ1, IQ2, and IQ3. Finally, factor 11 was neglected as it did not have a theoretical relevance at this stage.

Hence, the next iteration is carried out under the forced condition of extracting 13 factors (as per the theoretical model) to understand the factor formation.

❖ **Trial 3:** Item elimination with 13 factors extraction

The KMO and Bartlett test results were similar to trial two and are well above the acceptable value. The pattern matrix is provided in Table 4.6 below. The key observations from the pattern matrix (Table 4.6) are:

- The formation of factor 1 (system quality) was similar to the previous trial, with items IQ4 and IQ5 forming under this construct.
- Factor 2 reflected compatibility, and the relative advantage was separated and formed under factor 11. Here, though RA1 had significant loading on factor 1, the separation is a good sign.
- The item SM7 on social media (factor 3) further weakened and had cross-loading with factor 13, which reflected electronic word of mouth (e-WOM), a sub-factor on social media.
- Again, the items T1 and T2 did not form under the factor trust (factor 6).

Overall, the pattern formation improved and is acceptable at this stage of the pilot study, and thus its correlation matrix is also extracted (Table 4.7). The correlation matrix also formed appropriately where the inter-item correlation was lower as desired (i.e., values below and above the diagonal value of 1 should not be greater than 0.7). However, insight on the factor formation considering only the factors such as trust, transparency, system quality, and information quality will provide further inputs, which will be the next iteration.

Table 4.6: EFA results for Trial 3

Pattern Matrix													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Aw1									.864				
Aw2									.720				
RA1		.632									.399		
RA2		.416									.647		
RA3											.693		
RA4								.320					
EU1		.433								.701			
EU2										.732			
CMP1		.660											
CMP2		.587											
CMP3		.827											
IM1				.799									
IM2				.874									
IM3				.817									
T1				.314									
T2		.600											
T3						.715			.328				
T4						.883					-.351		
T5						.977							
TSP1							.405						
TSP2							.679						
TSP3							.846						
TSP4							.461						
TSP5							.566						
S11					.766								
SI2					.944								
SI3					.827								
FC1												.549	
FC2												.837	
IQ1								.451					
IQ2												.359	.345
IQ3													
IQ4	.736												
IQ5	.804												
SQ2	.710							.313					
SQ3	.970												
SQ4	.825												
SQ5	.869												
SM1			.800										
SM2			.749										
SM4			.591										
SM5			.532			.308							
SM6			.729										
SM7													.448
SM8			.721										
SM9			.491										.508
BI1								.884					
BI2								.822					
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.													

Table 4.7: Factor correlation matrix

Factor	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.000												
2	.253	1.000											
3	.310	.176	1.000										
4	.005	.048	-.117	1.000									
5	.367	.347	.349	.215	1.000								
6	.485	.291	.406	.266	.426	1.000	.						
7	.492	.350	.159	.064	.431	.411	1.000						
8	.539	.385	.335	-.019	.501	.488	.324	1.000					
9	.021	.290	.037	.113	.054	.102	-.004	.130	1.000				
10	.106	.208	.316	.202	.286	.301	.162	.122	.207	1.000			
11	.230	.178	.232	-.008	.354	.429	.267	.556	.106	.159	1.000		
12	.433	.435	.361	.009	.488	.413	.347	.541	.047	.084	.334	1.000	
13	-.006	-.193	-.051	.053	-.073	-.047	.082	-.073	-.113	-.270	-.169	.002	1.000
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.													

❖ **Trial 4:** Iteration considering service quality and trust-related factors

The item formation for the service quality, trust, and transparency were unclear in above iterations. Hence, the iteration was conducted considering only the items of these factors (Table 4.8).

Table 4.8: EFA results for Trial 4

Pattern Matrix					
	Factor				
	1	2	3	4	5
T1			.400		
T2		.331			
T3			.750		
T4			.767		
T5			.876		
TSP1		.657			
TSP2		.787			
TSP3		.730			
TSP4		.617			
TSP5		.797			
IQ1					.825
IQ2					.563
IQ3		.316			.474
IQ4	.557				.476
IQ5	.643				.327
SQ1					
SQ2	.603				
SQ3	.844				
SQ4	.788				
SQ5	.833				
BI1				.875	
BI2				.823	
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.					

The results show that the information quality (factor 5) and system quality (factor 1) formed as two separate factors. However, the items IQ4 and IQ5 of information quality still had stronger cross-loading with system quality construct. Further, item T2 had cross-loading with factor transparency. Overall, pattern formation was appropriate.

4.6.3.4 Summary

The last two iterations of EFA (trial 3 and trial 4) almost confirmed the theoretical model as the resulted pattern matrix in EFA resembled the same. Further, the loading of the items under factor has attained the desired minimum level indicating the convergent validity. The minimum cross-loading of the items validates the discriminant validity. Further, Cronbach's alpha value was above the threshold value, thus confirming the instrument's reliability. Hence the actions recommended from the reliability analysis are considered, and accordingly, the questionnaire is modified. A summary of the critical observations and the corrective actions performed in EFA to improve the questionnaire quality is presented in Table 4.9 below.

Table 4.9: Summary of the EFA for pilot study 1

	Observations	Corrective Actions
1	RA4 had a loading issue in most of the iteration and thus required to relook	RA4 is modified to simplify the language and improve clarity.
2	Items T1 and T2 also had loading issues, with T2 being more critical than T1, and both require a relook.	The items in the trust are reframed and arranged appropriately to improve clarity and understanding.
3	IQ4 and IQ5 falling under service quality and hence needs attention, and also IQ3 has a minor cross-loading issue.	Items in information quality are reframed to improve clarity and understanding.
4	SM3 had a critical loading issue and was found to have an inverse question, and SM7 had a cross-loading problem.	Since the items in social media are essential, both the items are reframed and are not deleted.

5	The critical items such as AW3, EU3, SI4, FC3, SQ1, and BI3 had significant loading issues, which are even reflected in reliability analysis.	The items mentioned are deleted as it improves the instrument's reliability, as indicated by reliability analysis and EFA.

4.6.4 Statistical Tests and Analysis of Pilot Study 2

Before using the questionnaire for the data collection, the modified questionnaire was subjected again to validation procedures. The tests such as EFA (using SPSS), convergent, and discriminant validity of using structural equation modelling (SEM) approach are adopted. Here, the partial least square (PLS) approach using Smart PLS 2 was adopted (Ringle et al., 2005). The PLS approach is primarily an exploratory method, and it does not have any normality constraints. Thus it can analyse the multi-collinearity in empirical models and is suitable for the current pilot study to validate the model and the instrument used. Further, the approach provides a fair accuracy in results with a smaller sample size (Hair et al., 2017).

4.6.4.1 Sample Size and Data Screening

The data was collected among 140 respondents through e-form using social media sites such as Facebook and WhatsApp for analysis. Further, around 50 responses were obtained through the print form. The data was then screened for missing data (more than 20%) and unengaged responses, during which twelve responses were eliminated. A total of 182 complete responses were obtained, which was used for the analysis purpose. The sample size formed is adequate for the SEM analysis, especially at the pilot stage, supporting the required minimum sample size of 145 as per the study by Whitehead et al. (2016).

4.6.4.2 Exploratory Factor Analysis

EFA was performed using the maximum likelihood extraction method and Promax rotation algorithm. The pattern matrix is provided in Table 4.10 above. The EFA results indicated the suitability of data for factor analysis with a KMO test value of 0.877, which is greater than 0.5, and the Bartlett test being significant with $p<0.01$. The pattern matrix, too, had improved factor formations and their loadings.

Table 4.10: Pattern matrix of EFA for pilot study 2

Pattern Matrix											
	Factor										
	1	2	3	4	5	6	7	8	9	10	11
AW1							.770				
AW2							.978				
RA1		.599									
RA2		.518									
RA3		.352								-.366	
RA4		.544									
EU1		.863									
EU2		.817									
CMP1		.915									
CMP2		.864									
CMP3		.606									
IM1					.818						
IM2					.995						
IM3					.776						
T1				.715							
T2				.822							
T3				.769							
T4				.595							
T5				.433							
TRN1	.784										
TRN2	.773										
TRN3	.935										
TRN4	.833									-.426	
TRN5	.964										
SI1						.827					
SI2						.707				.368	
SI3						.718					
FC1										.529	
FC2										.544	
IQ1	.573								.482		
IQ2	.356								.800		
IQ3	.384								.625		
IQ4	.604										
IQ5	.715										
SQ1	.545										.575
SQ2	.618										.460
SQ3	.607										.326
SQ4	.523										.342
SM1			.528	-.310				.384			
SM2			.623								
SM3			.864								
SM4			.734								
SM5			.668								
SM6			.744								
SM7			.576								
SM8			.593								
SM9			.443								
BI1								.636			
BI2								.899			
Extraction Method: Maximum Likelihood. Rotation Method: Promax with Kaiser Normalization.											

However, few key observations are:

- Factor 1 had items of the constructs transparency. However, there were items from information quality and system quality with significant loadings on the same. However, their loadings on its respective factor were lower.
- Factor 2 represented attitudinal construct with relative advantage, ease of use, and compatibility forming under this factor. Further, item RA3 had poor loadings as compared to other items in the construct.

Overall, the factor formation was only 11 factors as attitudinal factors like relative advantage, ease of use, and compatibility came under one construct. Further, the factors transparency, information quality, and system quality had a significant correlation and thus require attention though acceptable. To further validate the measurement model and its items (check on the model fit), SEM analysis using SmartPLS2 is performed (Figure 4.1).

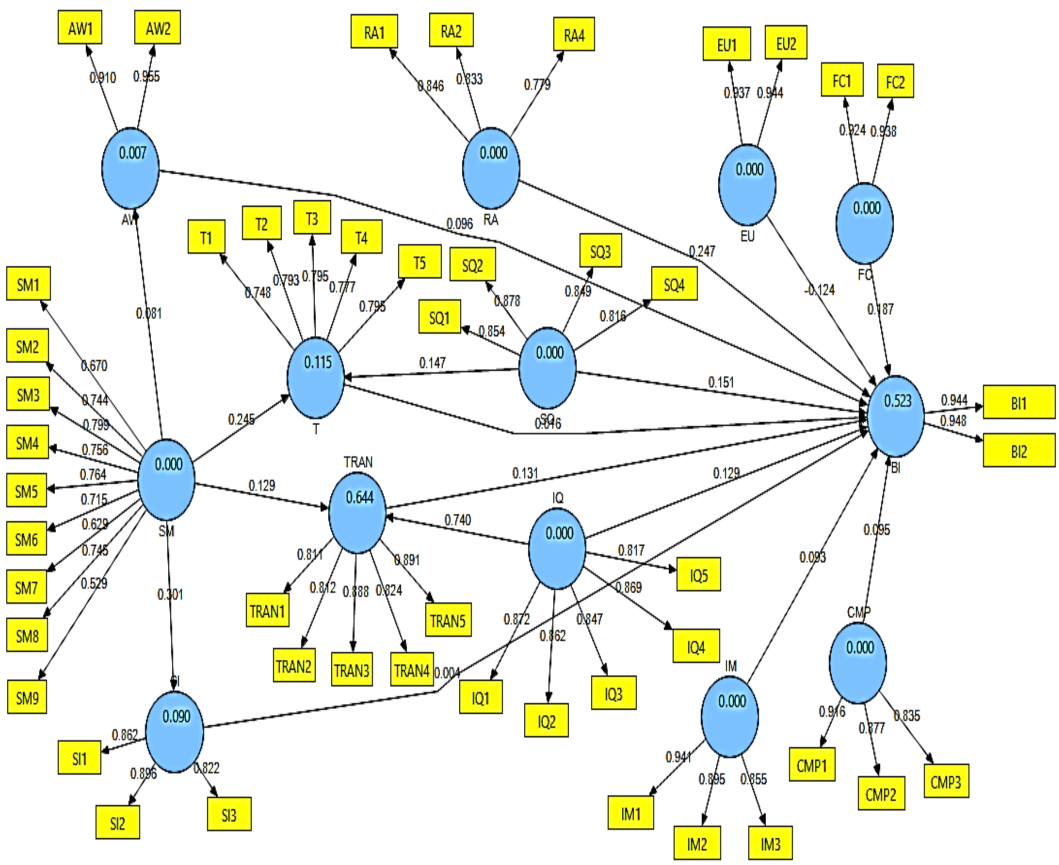

Figure 4.1: SEM model and its path loadings for the pilot test (Source: Author)

4.6.4.3 Validation of Measurement Model

The measurement model is validated using convergent and discriminant validity tests.

Table 4.11: Results of convergent validity tests of the pilot study (Source: Author)

Constructs	Items	Loadings	Cronbach's Alpha	CR	AVE
Social Media (SM)	SM1	0.67	0.88	0.90	0.50
	SM2	0.74			
	SM3	0.80			
	SM4	0.76			
	SM5	0.76			
	SM6	0.72			
	SM7	0.63			
	SM8	0.75			
	SM9	0.53			
Awareness (AW)	AW1	0.91	0.86	0.93	0.87
	AW2	0.96			
Relative Advantage (RA)	RA1	0.83	0.76	0.86	0.67
	RA2	0.83			
	RA3	0.47			
	RA4	0.78			
Ease of Use (EU)	EU1	0.94	0.87	0.94	0.88
	EU2	0.94			
Compatibility (CMP)	CMP1	0.92	0.85	0.91	0.77
	CMP2	0.88			
	CMP3	0.84			
Image (IM)	IM1	0.86	0.89	0.93	0.81
	IM2	0.88			
	IM3	0.94			
Social Influence (SI)	SI1	0.94	0.83	0.90	0.74
	SI2	0.90			
	SI3	0.86			
Facilitating Condition (FC)	FC1	0.92	0.85	0.93	0.87
	FC2	0.94			
Trust (T)	T1	0.75	0.85	0.89	0.61
	T2	0.79			
	T3	0.80			
	T4	0.78			
	T5	0.80			
Transparency (TRN)	TRN1	0.81	0.90	0.93	0.72
	TRN2	0.81			
	TRN3	0.89			
	TRN4	0.82			
	TRN5	0.89			
Information Quality (IQ)	IQ1	0.87	0.91	0.93	0.73
	IQ2	0.86			
	IQ3	0.85			
	IQ4	0.87			
	IQ5	0.82			
System Quality (SQ)	SQ1	0.85	0.87	0.91	0.72
	SQ2	0.88			
	SQ3	0.85			
	SQ4	0.82			
Behavioural Intention to use (BI)	BI1	0.94	0.88	0.95	0.90
	BI2	0.95			

The convergent validity reflects on the internal consistency of the items measuring a factor. Here, the parameters such as Average Variance Extracted (AVE) greater than 0.5, Composite Reliability (CR) greater than 0.7, Cronbach's alpha greater than 0.7 (Hair et al., 2017), and path loadings greater than 0.6 (Lee et al., 2013) are adequate measures for convergent validity. The results indicated the reliability and convergent validity of the constructs and their items for assessing the desired concepts (in Table 4.11 above). The degree of distinctiveness and relatedness of the concepts/measurements refers to discriminant validity. Here, the square root of the AVE value for a factor (diagonal values) should be higher than its correlation values with other factors, as in Table 4.12 (Fornell & Larcker, 1981). Hence, the results indicate the instrument's validity and the model fitness at the pilot stage.

Table 4.12: Discriminant validity as per Fornell and Larcker criterion (*source: author*)

	AW	BI	CMP	EU	FC	IM	IQ	RA	SI	SM	SQ	T	TRN
AW	**0.93**												
BI	0.32	**0.95**											
CMP	0.23	0.49	**0.88**										
EU	0.30	0.39	0.69	**0.94**									
FC	0.20	0.54	0.55	0.45	**0.93**								
IM	0.13	0.16	0.17	0.10	0.09	**0.90**							
IQ	0.22	0.59	0.43	0.44	0.56	0.03	**0.85**						
RA	0.43	0.56	0.64	0.61	0.43	0.07	0.51	**0.82**					
SI	0.20	0.32	0.31	0.23	0.41	0.21	0.33	0.27	**0.86**				
SM	0.08	0.51	0.35	0.32	0.36	0.17	0.42	0.30	0.30	**0.71**			
SQ	0.19	0.57	0.45	0.44	0.55	0.06	0.71	0.46	0.33	0.46	**0.85**		
T	0.37	0.33	0.38	0.28	0.33	0.33	0.29	0.31	0.29	0.31	0.26	**0.78**	
TRN	0.16	0.55	0.40	0.38	0.47	0.02	0.79	0.40	0.26	0.44	0.74	0.26	**0.85**

4.6.4.4 Summary

The analysis validated the model in all respects and looked for few crucial elements. First, item RA3 had a poor loading (as reflected in the EFA and SEM analysis) and is deleted. RA3 tried to access the advantages of m-government in terms of productivity that was very close to efficiency (RA1), consequently deemed redundant. Also, the item SM9 had lower loading, which was decided to modify due to its importance. Further, the item T5, TRN3, FC1, SM3, and SM4 were also improved on its clarity. The final modified questionnaire is presented below (Appendix I).

Chapter 5

RESULTS AND ANALYSIS

5.1 OVERVIEW

This chapter provides an overview of the research findings of this study. The chapter starts with the description of the data screening process, test for normality, managing outliers, descriptive analysis of the respondents. Later, the assessment of measurement and structural model is carried out. Lastly, the chapter analyzes and summarizes on research findings of this study.

5.2 DATA ANALYSIS AND SCREENING

5.2.1 Overview

After removing repetitive responses, the final survey in Karnataka's smart cities received was about 1560 responses from both online and print forms. A total of 779 responses were obtained through the physical forms. In addition, 781 responses were obtained via an online survey using the Google Forms application. Even though most respondents preferred the English language questionnaire, around 100 responses were in Kannada forms. This data is then subjected to a screening process to detect incomplete, unengaged, and outliers, making it suitable for further analysis. The descriptive analysis section below includes details on responses from each city and demographic information on respondents.

5.2.2 Data Screening

Data screening is the process of ensuring that the primary data obtained from the survey is clean and ready to be analyzed before proceeding with further statistical analysis. It is screened to ensure that the data is usable, reliable, and valid for testing causal theory (Chawla and Sondhi, 2011). Initially, these 1560 responses were screened for incomplete data (i.e., missing data of about 20 percent). As a result of the process, 11 replies were deleted because they were insufficient and unsuitable for analysis. The next aspect is identifying unengaged responses, which reflect an individual's lack of engagement while filling out the questionnaire. For example, if a respondent answers the same value (like 3 or 4) for all scale items, they are assumed to be unengaged. About 30 responses were discovered to be unengaged and thus excluded from further analysis, leaving 1499 responses usable.

5.2.3 Missing Data in Columns

Approximately seven responses had one or two missing values, which were imputed with appropriate values. Each case was examined in detail with the surrounding values of other indicators for that latent factor, and the mode value for that respondent was used to impute the missing values.

5.3 SKEWNESS AND KURTOSIS

Skewness and kurtosis values are mainly used to assess the normality of the data. Here, skewness indicates the degree of distortion from the normality curve, reflecting the lack of symmetry in the data distribution. Kurtosis indicates whether the data is heavy or light-tailed (flatness) relative to the normal distribution. It reflects on outliers as it represents the extreme values of the two tails (Hair et al., 2017).

The data for the latent factors showed mild skewness and kurtosis for a few of the items, including RA2, FC1, BI1, and BI2, with maximum values of 1.251 and 1.639, respectively (Appendix IV). Even though this violates the strict rules of normality, it is well within the acceptable normality rules proposed by Sposito et al. (1983), who recommended 3.3 as the upper threshold value for normality.

5.4 OUTLIERS

The next step in the screening process is to eliminate the outliers. An outlier is a data point that deviates markedly from others, thereby resulting in a disproportionate influence on substantive conclusions in the analysis (Aguinis, 2013). Since SEM data obtained is based on the Likert scale, it is not critical to check for univariate (extreme value on one variable) outliers test. However, detecting multivariate outliers (combination of unusual scores with two or more variables) is necessary as it substantially impacts model fit indices (Kline, 2015). Here, the error or influential outliers are critical ones that deviate significantly from others and are caused by inaccuracies. These outliers are to be identified and eliminated, for which Cook's distance and Mahalanobis distance (MD) are commonly used (Aguinis, 2013; Leys et al., 2019). For this purpose, the SPSS software (version 21) has been used wherein regression analysis is performed extracting the Cook's distance and MD values for the indicators.

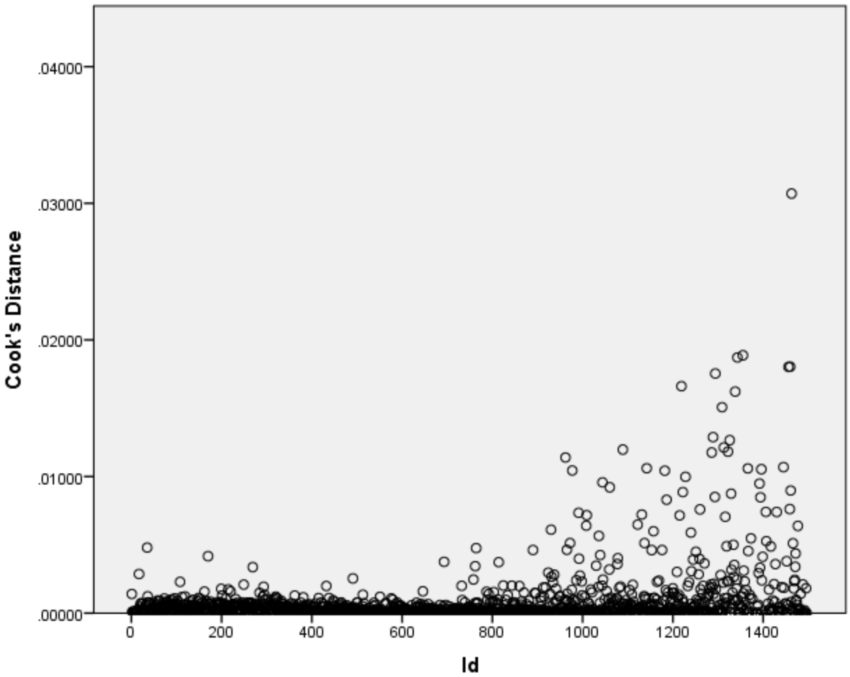

Figure 5.1: Cook’s distance plot for all the responses

In the process, about 55 responses were deleted considering three crucial aspects. First, the MD value must be significantly higher than the critical value. As the MD value has a chi-square distribution with k degrees of freedom (df), the critical value is the function of Chi-Square Inverse (1-p, k). Here, p is the significance level (i.e., 0.001), and k = 48, the number of items referring to df (Brereton, 2015). The critical value of 84.1 was obtained using this function in the study.

The second aspect is determining the point at which the MD value significantly decreases compared to previous values. In this case, the critical value falls from 134 to around 128 which is considerably lower than its subsequent value, forming a distinct pattern. Furthermore, when compared to others, the number of responses falling within a specific range of values is lower (i.e., values around 134 are lesser than around 128 onwards) (Ghorbani, 2019). Lastly, the datasets were observed for model fit measures and validity measures (convergent and discriminant validity) before and after eliminating these outliers.

Because the deviations were significant for both aspects mentioned above, these 55 responses, as stated above, were deleted. Later, this deletion had no significant impact on these two measures. Furthermore, Cook's distance plot (Figure 5.1) shows no significant outliers, with all responses falling within the acceptable range of 1 with the maximum value of 0.031 (Cook, 1977). After removing outliers, a total of 1444 responses were left out, which is significantly more than the desired sample size for the study (n=1250), as calculated in the previous section.

5.5 DESCRIPTIVE ANALYSIS

This section describes the demographic characteristics of the 1444 respondents whose data will be used in the statistical analysis of the main study. The study used a proportionate stratified sampling approach to collect a proportional sample from each smart city. The details of this distribution based on location are shown below (Figure 5.2 and Table 5.1). It can be observed that the majority of respondents are from Bangalore, with about 59.3 percent (856 respondents). Even though the number is less than the desired target (913 responses), the shortfall is minimal, with an acceptable response rate of around 98 percent. All of the other cities, on the other hand, had responses that were far more than the required sample size.

Table 5.1: Distribution of respondents based on place

Smart city	Desired sample size	Obtained sample size	In percentage
Belagavi	65	97	6.7
Bengaluru	913	856	59.3
Davangere	47	79	5.5
Hubballi-Dharwad	101	151	10.5
Mangaluru	67	152	10.5
Shivamogga	35	64	4.4
Tumakuru	32	45	3.1
Total	1260	1444	100

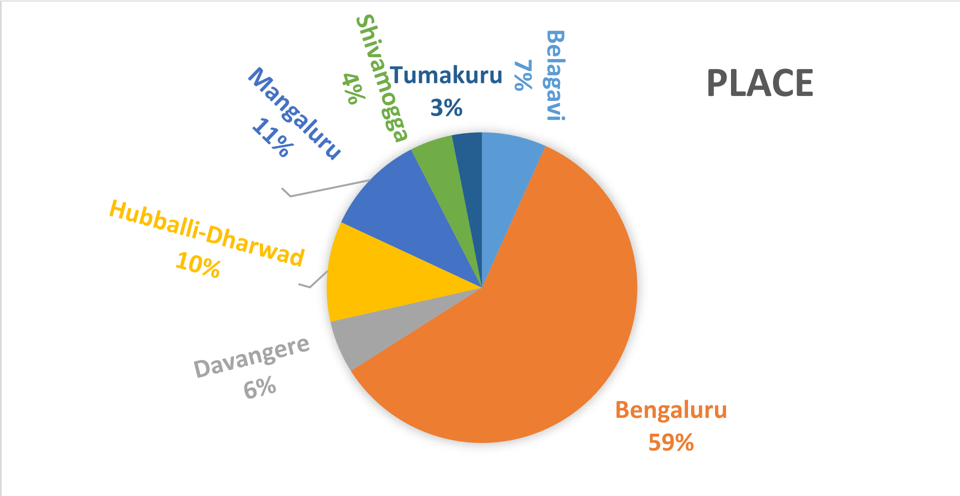

Figure 5.2: Chart for respondent's distribution across smart cities

Table 5.2: Details of smartphone usage and internet mode of the respondents

Smartphone Use			Internet Mode		
	Frequency	Percent		Frequency	Percent
Smart Phone-YES	1431	99.1	Mobile Data	1100	76.2
Smart Phone-NO	9	.6	Wi-Fi Office	46	3.2
Not Answered	4	.3	Wi-Fi Home	293	20.3
			Not Using	5	.3
Total	1444	100.0	Total	1444	100.0

From Table 5.2, it can be observed that the majority of the respondents are using smartphones (around 99.1 percent). The majority of the respondents assess the internet on their mobile phones through mobile data or Wi-Fi connections. Here, about 76.2 percent of the respondent are using mobile data services for the internet. These aspects are very much favourable for the adoption of m-government services. Furthermore, it is worth noting that approximately 98 percent of respondents have prior m-government experience in any one of the current services (Table 5.3).

However, it should be noted that only about 40% of the respondents are frequent users (referring to a few times per month), while the rest do not use these services frequently (Table 5.3). Again, only about 62 percent of respondents have prior EG experience, which is relatively low and is most likely due to the affordability of required resources for availing these services (Table 5.3). This aspect shows the potential of m-government services and the need for the government to make additional efforts to increase the frequency with which these services are used. The study is on the right path as it will provide the government with valuable insights into citizen adoption of m-government, which will aid in developing effective strategies to increase usage among citizens.

Table 5.3: Details on EG and m-government experiences of the respondents

<table>
<tr><td colspan="3">M-government Experience</td><td colspan="3">EG Experience</td></tr>
<tr><td></td><td>Frequency</td><td>Percent</td><td></td><td>Frequency</td><td>Percent</td></tr>
<tr><td>Once in a Month</td><td>291</td><td>20.2</td><td rowspan="2">YES</td><td rowspan="2">896</td><td rowspan="2">62.0</td></tr>
<tr><td>Few Times in a Month</td><td>579</td><td>40.1</td></tr>
<tr><td>Few Times in a Year</td><td>556</td><td>38.5</td><td rowspan="2">NO</td><td rowspan="2">548</td><td rowspan="2">38.0</td></tr>
<tr><td>Not Using</td><td>18</td><td>1.2</td></tr>
<tr><td>Total</td><td>1444</td><td>100.0</td><td></td><td></td><td></td></tr>
</table>

In terms of demographics, approximately 61 percent of respondents are male, and 41 percent are female (Table 5.4, Figure 5.3)). Furthermore, 48.3 percent of participants are young adults between the age of 18 to 30 years. About 39.6 percent of respondents are between 31 and 45 years, representing middle-aged adults (Table 5.4). Together, these two categories account for 88 percent of all responses. The remaining 9.1 percent of respondents are between 45 and 60 years and are classified as senior adults. Finally, approximately 2.5 percent of respondents are over 60 years (Table 5.4, Figure 5.4).

Though the last two categories are less proportionate to the total number of responses, the dominance of individuals aged 18 to 45 years (young and middle-aged adults) is very useful. The findings can help future m-government implementations and developments, as this group of people will most likely be the future majority and primary users of these services.

In terms of education, most respondents have completed at least their graduation degree (about 90 percent). In this, approximately 38% of them have an education level of post-graduation and above (Pg+), while the remaining 52 percent have a graduation degree (Table 5.4). Only one percent of them are uneducated, while 8.2 percent have primary or secondary education (Table 5.4, Figure 5.5). Because these are not proportionate, care must be exercised when comparing groups and drawing conclusions based on these categories. However, from a positive point of view, since the respondents are well educated, the chances of getting reliable and proper responses from these groups are higher, which is an advantage.

Table 5.4: Details on gender, age, and education level of the respondents

	Frequency	Percent
GENDER		
Male	852	59.0
Female	592	41.0
Total	*1444*	*100.0*
AGE		
18-30 Years	698	48.3
31-45 Years	572	39.6
45-60 Years	131	9.1
Above 60 Years	36	2.5
Not Answered	7	0.5
Total	*1444*	*100.0*
EDUCATION		
Not Professionally Educated	14	1.0
Primary/Secondary	119	8.2
Graduate	760	52.6
Post-Graduate and above	546	37.8
Not Answered	5	0.3
Total	*1444*	*100.0*

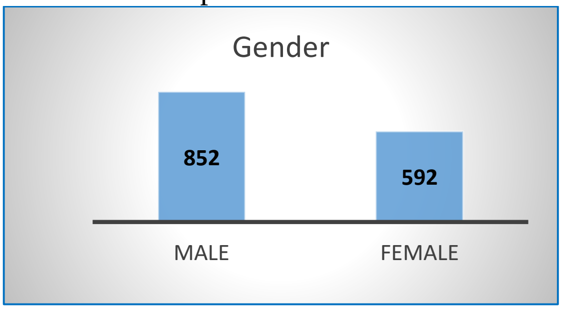

Figure 5.3: Chart for descriptive statistics of gender

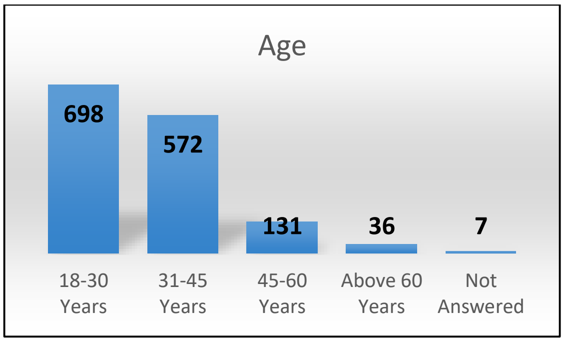

Figure 5.4: Chart for descriptive statistics of age

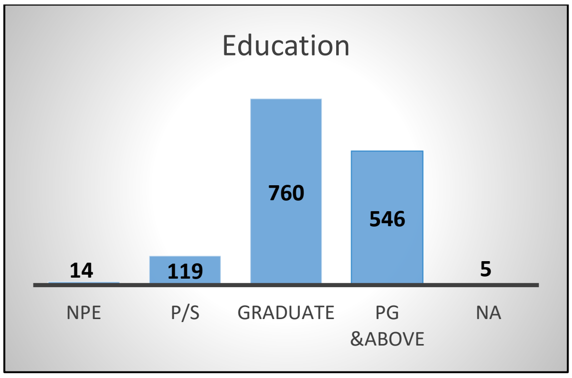

Figure 5.5: Chart for descriptive statistics of education

Table 5.5: Descriptive statistics of occupation of the respondents

OCCUPATION	Frequency	Percent
Student	296	20.5
Self-Employed	121	8.4
Private Employee	753	52.1
Government Employee	98	6.8
Not Currently Employed	136	9.4
Retired	34	2.4
Not Answered	6	.4
Total	*1444*	*100.0*

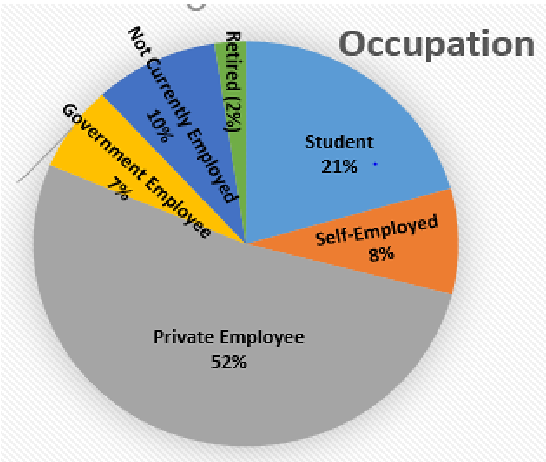

Figure 5.6: Chart for descriptive statistics of occupation

The occupation and income of the respondents are the other two critical demographics characteristics that influence an individual's behaviour. However, the study analyses monthly household income and will be referred to as income from now on. Further, most respondents in the survey are employed and have their source of income (Table 5.5). Most respondents (52 percent) are private employees, about 7 percent are government employees, and 8.4 percent are self-employed (Table 5.5, Figure 5.6). Furthermore, 20.5 percent of participants are students, 9.4 percent are unemployed, and 2.4 percent are retired (Table 5.5). The data obtained is a good mix, though private employees predominate. Except for retired people, these figures across groups are adequate because most m-government services are primarily valuable for employees who work and are responsible for their households.

Table 5.6 shows the profile of monthly household income levels of the respondents. Here, the income distribution of the respondents is proportionate, with about 24.5 percent of them having a monthly income below 20,000 Indian Rupees (INR). About 25.6 percent earn between 20,000 and 40,000 INR, and about 15 percent earn between 40,000 and 60,000 INR. Furthermore, approximately 9% earn between 60,000 and 80,000 INR, while 20% earn more than 80,000 INR. However, it is essential to note that about 6% of respondents did not respond, indicating an individual's reluctance to reveal their income level.

Table 5.6: Descriptive statistics of income of the respondents

Monthly Household Income			
Group	Categories	Frequency	Percent
Group 1	Below 20,000 INR	354	24.5
Group 2	20,000 - 40,000 INR	369	25.6
Group 3	40,000 - 60,000 INR	219	15.2
Group 4	60,000 - 80,000 INR	129	8.9
Group 5	Above 80,000 INR	289	20.0
	Not Answered	84	5.8
	Total	1444	100.0

The respondents' social media usage behaviour is another essential characteristic available from the data (Table 5.7). According to the data, most respondents are regular social media users, using social media at least twice a day (75.9 percent). Again, approximately 26.1 percent of this group is highly frequent users, with a usage rate of more than ten times per day. However, only about 14.1 percent use social media once a day, and 7.7 percent do not use it (Table 5.7). These characteristics reflect social media's dominance over an individual's lifestyle.

Table 5.7: SM related characteristics of the respondents

<table>
<tr><th colspan="3">SM Experience</th><th colspan="3">SM Ads Experience</th><th colspan="3">Use of SM for MG</th></tr>
<tr><th></th><th>Frequency</th><th>Percent</th><th></th><th>Frequency</th><th>Percent</th><th></th><th>Frequency</th><th>Percent</th></tr>
<tr><td>Not Everyday</td><td>111</td><td>7.7</td><td rowspan="2">Following</td><td rowspan="2">412</td><td rowspan="2">28.5</td><td rowspan="3">Used</td><td rowspan="3">717</td><td rowspan="3">49.7</td></tr>
<tr><td>Once in a Day</td><td>203</td><td>14.1</td></tr>
<tr><td>2-5 Times a Day</td><td>419</td><td>29.0</td><td rowspan="2">Not Following</td><td rowspan="2">609</td><td rowspan="2">42.2</td></tr>
<tr><td>5-10 Times a Day</td><td>300</td><td>20.8</td><td rowspan="3">Not Used</td><td rowspan="3">727</td><td rowspan="3">50.3</td></tr>
<tr><td>10+ Times a Day</td><td>377</td><td>26.1</td><td rowspan="2">Maybe Following</td><td rowspan="2">423</td><td rowspan="2">29.3</td></tr>
<tr><td>Not Using</td><td>34</td><td>2.4</td></tr>
<tr><td>Total</td><td>1444</td><td>100.0</td><td>Total</td><td>1444</td><td>100.0</td><td>Total</td><td>1444</td><td>100.0</td></tr>
<tr><td colspan="9">Note: MG refers to Mobile Government, and SM is Social Media</td></tr>
</table>

As a result, using this medium for communication and service delivery can be considered an effective channel, even true for m-government services. Furthermore, 28.5 percent of respondents are currently following social media advertisements (SM Ads). About 29.3 percent are interested in pursuing social media advertisements in the future. Furthermore, roughly 49 percent of respondents have used social media to obtain information about m-government services. These characteristics suggest that social media can be a very effective channel in m-government services to communicate information and provide advertisements about m-government services to increase adoption.

5.6 DISTRIBUTION OF LATENT VARIABLES

This section provides a summary of the respondent's perceptions of the various factors used in the model. The distribution values of each construct in terms of mean and standard deviations are provided and discussed. It aids in gaining a thorough understanding of the sample's characteristics regarding m-government.

Table 5.8: Descriptive statistics of latent variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Behavioural Intention	1444	1.00	5.00	4.0499	0.86689
Awareness	1444	1.00	5.00	3.5665	0.97032
Relative Advantage	1444	1.00	5.00	4.0660	0.86072
Ease of Use	1444	1.00	5.00	4.0083	0.89035
Compatibility	1444	1.00	5.00	3.9481	0.89116
Image	1444	1.00	5.00	2.8474	1.03925
Trust	1444	1.00	5.00	3.4486	0.81343
Transparency	1444	1.00	5.00	3.9082	0.76838
Social Influence	1444	1.00	5.00	3.6782	0.88789
Facilitating Condition	1444	1.00	5.00	4.1098	0.81792
Information Quality	1444	1.00	5.00	3.9967	0.79048
System Quality	1444	1.00	5.00	3.9649	0.82311
Social Media	1444	1.00	5.00	3.6381	0.78592

Table 5.8 shows that the minimum and maximum values for the variables one and five as the measurement are based on a five-point Likert scale. The fact that the mean value of the factor BI is greater than 4 indicates that respondents have a favourable attitude toward m-government services. Furthermore, except for image, almost all constructs had a mean value greater than three, indicating that respondents' perceptions of these

factors were favourable. However, the factor image had a mean value below the average (i.e., three) and a standard deviation higher than one, indicating that individuals negatively perceived this factor.

Here, relative advantage, ease of use, compatibility under attitudinal factors, quality factors such as information quality and system quality, facilitating condition, and transparency have a higher mean value above 3.9. However, factors like awareness, trust, social influence, and social media are very close to the mean value of 3, indicating the presence of significant samples below the average value. This aspect provides an insightful detail that would help while interpreting the results and drawing conclusions.

Table 5.9: Descriptive statistics of latent variables of respondents from each smart city

	Belagavi (97)		Bengaluru (856)		Davangere (79)		Hubbali-Dharwad (151)		Mangaluru (152)		Shivamogga (64)		Tumakuru (45)	
Place	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
BI	3.38	1.549	4.09	0.784	4.11	0.696	4.09	0.713	4.18	0.773	4.10	0.883	3.94	0.778
AW	3.57	1.249	3.57	0.945	3.53	0.866	3.55	0.989	3.67	0.944	3.21	1.042	3.77	0.758
RA	3.76	1.318	4.09	0.818	4.10	0.756	4.10	0.753	4.19	0.750	3.86	1.055	3.93	0.824
EU	3.66	1.355	4.05	0.828	4.04	0.816	3.95	0.777	4.11	0.884	3.88	1.101	3.97	0.801
CMP	3.69	1.367	4.00	0.830	3.96	0.746	3.88	0.791	4.00	0.925	3.77	1.032	3.84	0.846
IM	3.04	1.248	2.83	1.027	2.64	1.109	2.82	1.016	2.79	0.974	3.07	0.980	3.16	0.928
T	3.33	1.323	3.46	0.789	3.58	0.693	3.45	0.715	3.50	0.739	3.30	0.734	3.35	0.661
TRN	4.20	1.042	3.87	0.746	3.83	0.701	3.95	0.731	4.01	0.706	3.76	0.796	3.77	0.744
SI	4.12	1.076	3.63	0.880	3.64	0.813	3.71	0.889	3.66	0.843	3.69	0.829	3.72	0.696
FC	4.34	1.010	4.13	0.794	3.95	0.834	4.09	0.731	4.10	0.852	3.97	0.872	3.90	0.766
IQ	4.33	0.989	3.98	0.783	3.94	0.696	3.99	0.738	4.03	0.724	3.88	0.860	3.83	0.740
SQ	4.27	1.021	3.95	0.817	3.86	0.745	4.03	0.823	3.93	0.778	3.85	0.780	3.92	0.670
SM	3.18	1.391	3.68	0.723	3.67	0.707	3.68	0.612	3.66	0.706	3.59	0.805	3.74	0.741

Further, a comparison of these statistics by location (Table 5.9) revealed no significant deviations in the mean score on these variables except for a few cases. People in Belagavi, for example, had lower mean scores for behavioural intention and trust than people in other cities. Similarly, they placed a higher value on social influence than other cities. They had a lower level of perception of the use of social media in m-government services than others. Similarly, citizens in the Shivamogga city had much lower awareness of m-government when compared to others, even though awareness was just above average in all cities. In the following sections, a detailed statistical analysis will be conducted to have a clear understanding on the relationships of these variables.

5.7 STATISTICAL ANALYSIS

5.7.1 Overview

One of the critical aspects of research that significantly impacts the research outcomes is selecting an appropriate statistical technique. This section discusses these points and explains why the study chose the methods used in the analysis.

The final data from the screening (1444 responses) is used to evaluate and validate the theoretical model defined in the study. The goal here is to establish the causal relationships between m-government predictors and the intention to use these services. For this purpose, as the theoretical model contains many variables with complex connections, a structural equation modelling (SEM) technique in the multivariate analysis will be used. It is a widespread technique because it allows you to examine multiple interconnected relationships in a single study. In this analysis, there are two types of variables: endogenous variables, which are dependent, and exogenous independent variables. Furthermore, there are two primary methods in SEM: covariance-based SEM (CB-SEM) and variance-based partial least squares analysis (PLS-SEM). Here, the CB-SEM is primarily used for confirming established theories, while the PLS-SEM is primarily used for predicting relationships, but it can also be used for confirmatory research (Hair, Matthews, et al., 2017).

Furthermore, as previously mentioned, CB-SEM is ideally suited for studies with a large sample size and the aim of confirming a proven existing theory. CB-SEM is also an effective technique that works very well when all variables are reflective (Sarstedt et al., 2016). However, CB-SEM becomes unwieldy and ineffective when the model is complex, and there are some interrelationships among the predicating variables, resulting in identification and model fit issues (Lowry & Gaskin, 2014; Sarstedt et al., 2016). The current study employs a complex model with numerous constructs, indicators, and mediation paths. Furthermore, the predictors under attitudinal aspects have a weak correlation with one another. Although it is within the acceptable limits of multi-collinearity, it is not an ideal condition for CB-SEM (Hair et al., 2017; Sarstedt et al., 2016).

Moreover, even though the model is based on a well-established theory, integrating two theories and social media as a factor can still be regarded as an exploratory aspect. Thus, PLS-SEM can be considered the most effective technique in these circumstances (Hair et al., 2017; Lowry & Gaskin, 2014; Sarstedt et al., 2016). In addition, the implementation of a consistent PLS algorithm, particularly for reflective type factor-based models, addressed the suitability of PLS-SEM for the current reflective factor-based model (Dijkstra & Henseler, 2015). As a result, this study employs the PLS-SEM technique with SmartPLS-3 software to analyze the measurement and structural model to achieve the objectives defined in the study (Ringle et al., 2015).

In PLS-SEM, the standard procedure of performing an SEM analysis can be described under the following steps (Lowry & Gaskin, 2014):

1. The model specification refers to clearly defining the model in terms of the reflective or formative indicators, endogenous and exogenous variables, and their relationships. These are critical in modelling, directly impacting the model's predictive power, such as the R^2 value.
2. The next step is to examine the construct validity and reliability of the measurement model (i.e., items or indicators of measuring variables). Here, the convergent validity and discriminant validity measures are crucial aspects discussed below. The validity of formative indicators is not present because there are no formative indicators in the proposed model of the study.
3. The next aspect is to test for multi-collinearity issues and common method bias in the data.
4. We can then perform the analysis of a structural model for direct relationships between the variables. Later on, test for moderation and mediation effects in any in the proposed model.

5. Lastly, it is vital to check for the model's predictive power and after which the final statistics of the analysis can be interpreted and reported.

5.7.2 Assessment of Measurement Model

In SEM, the first phase of the process after data screening is assessing the measurement model. A measurement model derives the indicators for each construct, thereby reflecting on the underlying structure of each construct or latent variable (Dwivedi et al., 2009). Moreover, the quality of the measurement model has a critical influence on the model's power to predict the relationships between the variables defined in the study. Hence, in SEM, it is necessary to attain the convergent and discriminant validity of the measurement model before analysing the hypotheses. It mainly helps assess the data's fit to the predefined specific theory-driven measurement model (Mueller & Hancock, 2015). Here, variance-based SEM analysis using the partial least square approach with SmartPLS-3 software has been adopted to assess the validity of the measurement model (Ringle et al., 2015).

An iterative approach has been adopted to assess the validity along with the elimination of multivariate outliers. Initially, the 1499 responses obtained after data screening is tested for validity. The results indicated lower loadings and few concerns on the validity aspects. Hence the multivariate outliers based on MD, which deviated significantly from the rest, were eliminated (as explained in previous section 5.4). Further, the items SM1 and SM7 under the construct social media and TRN1 and IQ5 under the constructs transparency and information quality, respectively, were eliminated. It was decided so, as these represented latent reflective factors with large items and are somewhat redundant.

In the process, the results of the convergent validity are described below. Here, a convergent validity reflects on the internal consistency or reliability of the items in measuring a particular variable. It is assessed using two measures viz. individual item reliability and internal consistency. The factor loadings are mainly used in measuring individual item reliability whose value should be greater than 0.6 (ideally above 0.7) (Hair et al., 2017; Kline, 2015). The internal consistency is assessed using Cronbach's

Alpha value and Composite Reliability (CR), whose value should be above 0.7 (Hair et al., 2017; Kline, 2015). Further, AVE, whose value must be greater than 0.5, is also a crucial measure indicating the convergent validity (Hair et al., 2017; Kline, 2015). The analysis results showed the attainment of convergent validity of the instrument (Figure 5.7, Table 5.10).

Discriminant validity also referred to as divergent validity, refers to the degree to which items differentiate between variables. Here, the Fornell and Larcker criterion (1981) and Heterotrait - Monotrait ratio of correlations (HTMT) are used as the measures to evaluate discriminant validity. In the Fornell and Larcker criterion, the Square root of AVE of an item (represented diagonally in Table 5.11) should be higher than its correlation value with other items (subsequent below column values) (Fornell and Larcker, 1981; Hair et al., 2017; Kline, 2015).

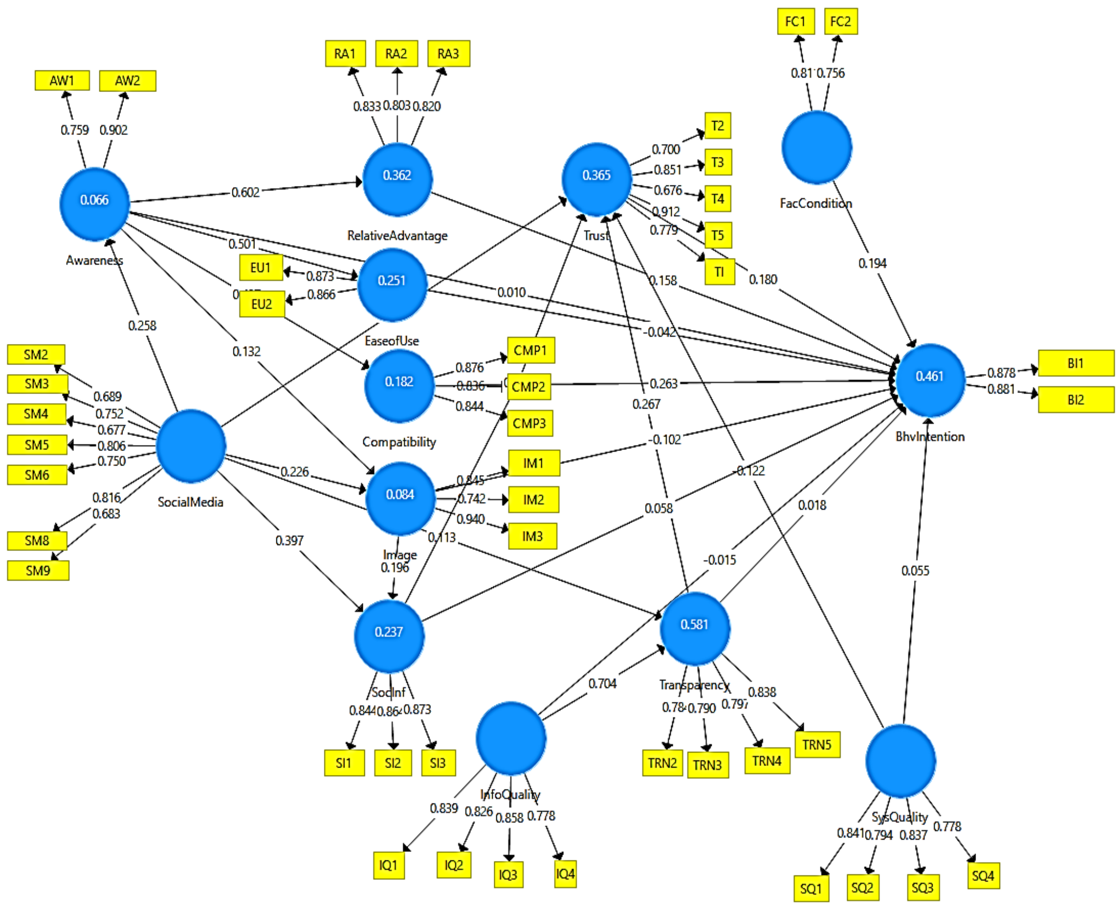

Figure 5.7: The SEM model with outer loadings for the main study

Table 5.10: Measures of convergent validity of the instrument of the main study

Constructs	Items	Loadings	Cronbach's Alpha	CR	AVE
Social Media (SM)	SM2	0.67	0.90	0.89	0.55
	SM3	0.74			
	SM4	0.67			
	SM5	0.81			
	SM6	0.76			
	SM8	0.83			
	SM9	0.70			
Awareness (AW)	AW1	0.76	0.81	0.82	0.70
	AW2	0.90			
Relative Advantage (RA)	RA1	0.83	0.86	0.86	0.67
	RA2	0.80			
	RA3	0.82			
Ease of Use (EU)	EU1	0.87	0.86	0.86	0.76
	EU2	0.87			
Compatibility (CMP)	CMP1	0.88	0.89	0.89	0.73
	CMP2	0.84			
	CMP3	0.84			
Image (IM)	IM1	0.84	0.88	0.88	0.72
	IM2	0.74			
	IM3	0.94			
Social Influence (SI)	SI1	0.85	0.90	0.90	0.74
	SI2	0.85			
	SI3	0.88			
Facilitating Condition (FC)	FC1	0.81	0.76	0.76	0.61
	FC2	0.76			
Trust (T)	T1	0.70	0.89	0.89	0.62
	T2	0.85			
	T3	0.68			
	T4	0.91			
	T5	0.78			
Transparency (TRN)	TRN2	0.78	0.88	0.88	0.64
	TRN3	0.79			
	TRN4	0.80			
	TRN5	0.84			
Information Quality (IQ)	IQ1	0.84	0.90	0.90	0.68
	IQ2	0.83			
	IQ3	0.86			
	IQ4	0.78			
System Quality (SQ)	SQ1	0.84	0.89	0.89	0.66
	SQ2	0.79			
	SQ3	0.84			
	SQ4	0.79			
Behavioural Intention to use m-government (BI)	BI1	0.88	0.87	0.87	0.77
	BI2	0.88			
Note: Items SM1, SM7, TRN1, IQ5 were removed					

Table 5.11: Discriminant validity using Fornell and Larcker criteria

	AW	BI	CMP	EU	FC	IM	IQ	RA	SI	SM	SQ	TRN	T
AW	**0.83**												
BI	0.38	**0.88**											
CMP	0.43	0.61	**0.85**										
EU	0.50	0.55	0.84	**0.87**									
FC	0.42	0.56	0.64	0.58	**0.78**								
IM	0.19	0.09	0.22	0.20	0.06	**0.85**							
IQ	0.29	0.48	0.53	0.48	0.74	0.09	**0.83**						
RA	0.60	0.57	0.79	0.80	0.58	0.16	0.503	**0.82**					
SI	0.34	0.43	0.45	0.41	0.56	0.30	0.56	0.43	**0.86**				
SM	0.26	0.73	0.50	0.48	0.43	0.26	0.46	0.42	0.45	**0.74**			
SQ	0.23	0.45	0.51	0.44	0.65	0.09	0.82	0.45	0.49	0.46	**0.81**		
TRN	0.32	0.47	0.52	0.47	0.60	0.15	0.76	0.47	0.62	0.43	0.69	**0.80**	
T	0.48	0.45	0.52	0.53	0.38	0.464	0.40	0.47	0.50	0.49	0.33	0.47	**0.79**

Table 5.12: Discriminant validity using HTMT ratio

	AW	BI	CMP	EU	FC	IM	IQ	RA	SI	SM	SQ	TRN	T
AW	-												
BI	0.38												
CMP	0.43	0.61											
EU	0.50	0.55	0.84										
FC	0.42	0.56	0.64	0.59									
IM	0.19	0.09	0.22	0.20	0.06								
IQ	0.30	0.48	0.53	0.48	0.74	0.09							
RA	0.60	0.57	0.79	0.80	0.58	0.15	0.50						
SI	0.34	0.43	0.45	0.41	0.56	0.30	0.56	0.43					
SM	0.26	0.74	0.51	0.48	0.44	0.25	0.46	0.42	0.45				
SQ	0.24	0.45	0.51	0.44	0.66	0.09	0.82	0.45	0.49	0.46			
TRN	0.33	0.47	0.52	0.47	0.64	0.15	0.76	0.47	0.62	0.44	0.69		
T	0.48	0.44	0.52	0.53	0.38	0.47	0.39	0.47	0.49	0.49	0.33	0.47	-

On the other hand, HTMT is a novel and better method that has been established to measure the discriminant validity (Henseler et al., 2015). HTMT ratio is the average of correlations of indicators measuring different phenomena (heterotrait-heteromethod correlations) to the average of correlations of indicators within the same construct (monotrait-heteromethod correlations) (Henseler et al., 2015). The value of this ratio should be below 0.85 to have an adequate discriminant validity between the constructs (Henseler et al., 2015; Kline, 2015). The results of the HTMT ratio were all within the threshold value of 0.85 (Table 5.12). As a result, the measurement model has achieved discriminant validity.

Further, the two key models fit criteria (i.e., how well data fits the model) such as standardized root mean square residual (SRMR) and normed fit index (NFI) were also considered. However, it is not so significant in variance-based analysis like PLS-SEM (Hair et al., 2017). Here, the SRMR evaluates the absolute fit indices reflecting on the model's fit based on the data and does not use a baseline model for comparison (Hooper et al., 2008). It is the most fundamental indicator of how well the proposed theory fits the data. The other index used is NFI, a relative measure estimating the discrepancies in chi-square value between the hypothesized and null models (Kline, 2015). The result indicated a good fit index of the model under the study with SRMR of 0.033 (threshold below 0.08) and NFI of 0.915 (threshold above 0.9), indicating the adequacy of the model for further analysis (L. Hu & Bentler, 1999).

5.7.3 Multi-collinearity

Table 5.13: Correlation matrix of the variables considered in the study

	AW	RA	EU	CMP	IM	Tr	TRN	SI	FC	IQ	SQ	SM	BI
AW	1												
RA	0.50	1											
EU	0.42	0.69	1										
CMP	0.36	0.69	0.73	1									
IM	0.16	0.13	0.171	0.191	1								
Tr	0.41	0.41	0.46	0.46	0.42	1	.						
TRN	0.28	0.41	0.41	0.46	0.13	0.41	1						
SI	0.29	0.38	0.36	0.40	0.27	0.44	0.55	1					
FC	0.33	0.47	0.48	0.52	0.05	0.31	0.52	0.46	1				
IQ	0.25	0.44	0.42	0.47	0.08	0.35	0.67	0.50	0.61	1			
SQ	0.20	0.39	0.39	0.45	0.08	0.29	0.61	0.44	0.54	0.73	1		
SM	0.22	0.37	0.42	0.45	0.23	0.44	0.39	0.40	0.36	0.41	0.41	1	
BI	0.32	0.49	0.48	0.53	0.08	0.39	0.41	0.38	0.46	0.43	0.39	0.65	1

Before performing the analysis, it is also essential to check for the presence of any multi-collinearity issues. Multi-collinearity refers to correlation among the predictors (independent variables), thereby affecting the regression results. The primary criteria for assessing multi-collinearity is through observing the correlation matrix of the variables. Here, if the correlation value between the two variables is higher than 0.8, indicates severe multi-collinearity between the variables (Hair et al., 2017). The results showed the absence of any severe multi-collinearity issues that may impact the results of the SEM analysis, with all the correlation values between the factors being below the threshold value of 0.8 (Table 5.13).

Table 5.14: Assessment of multi-collinearity (VIF values)

	AW	BI	CMP	EU	FC	IM	IQ	RA	SI	SM	SQ	TRN	T
AW		1.855	1.000	1.000		1.071		1.000					
BI													
CMP		4.629											
EU		4.280											
FC		3.063											
IM		1.367							1.000				
IQ		4.517										1.263	
RA		4.070											
SI		1.979											1.727
SM	1.000					1.071						1.263	1.386
SQ		3.238											2.059
TRN		2.900											2.395
T		2.116											

The other prominent index used to detect multi-collinearity issues is Variance Inflated Factor (VIF). It measures the degree to which the variance of regression coefficient is inflated due to multi-collinearity. Here, generally, if the VIF value exceeds 4, it reflects the multi-collinearity issue (Hair et al., 2017). However, VIF values between 1 and 5 are considered moderately correlated and are acceptable, which is not a cause of concern (Dodge, 2008).

The VIF values of the predictors considering different dependent variables are estimated and presented in Table 5.14 below. The results indicated a moderate correlation among the predictors of BI, such as compatibility, ease of use, information quality, and relative advantage. Here, the VIF values were above 4 for these predictors, which is though acceptable reflects a moderate correlation. The VIF's for all the other scenarios VIF were below the ideal threshold value of 4.

5.7.4 Common Method Bias

Common method bias (CMB) is the commonly observed phenomenon in survey-based studies using a questionnaire. It refers to the variations caused in responses due to the instrument and not due to the aspects it tries to uncover. Thus, it indicates the presence of bias in responses, thereby reducing the instrument's efficiency and impacting the study results. Hence it is vital to identify any significant biases in the data obtained from the survey and control its impact on the results during the analysis (MacKenzie & Podsakoff, 2012).

Here, Harman's single factor test is performed to check whether the instrument introduces any CMB (using SPSS 21). It assumes that covariance is reflected if a single factor or a general factor extracted in EFA accounts for most of the covariance (MacKenzie and Podsakoff, 2012). If the total variance is below 50%, CMB doesn't affect the data (Fuller et al., 2016). The study indicated the absence of CMB with a total variance of only 37 percent for a single factor. Further, Fuller et al. (2016) also pointed out the adequacy of only Harman's test to check CMB, as it doesn't significantly impact the validity of research findings.

Moreover, the VIF values are also considered an indicator of CMB. Here, Kock and Lynn (2012) suggested the threshold of 5 for VIF in SEM, which incorporates measurement errors. Hence, the results indicate the absence of bias that may significantly impact the study results (i.e., hypotheses testing) (Table 5.14).

5.8 ASSESSMENT OF STRUCTURAL MODEL

The outcomes of the previous sections in the chapter indicated the adequacy of the measurement model for performing the hypotheses testing. The testing of hypotheses can also be referred to as the assessment of the structural model. A structural model expresses the underlying structure of the phenomenon or theory under investigation. It explains the causal and correlations linkages among the latent variables proposed in the theoretical model. The structural model explains the relationships between the two variables (i.e., individual paths), the overall model, the mediating influence of the variables, and the moderating impact of variables. The results of the proposed model of the study are described in detail below.

The structural model is first assessed based on the R^2, Q^2, and significance of paths. The goodness of the model is first examined with the strength of each structural path using the R^2 value for dependent variables (Hair et al., 2017). Here, the value of R^2 above 0.1 is the minimum required reflecting on the predictive capability of the model (Falk & Miller, 1992). Moreover, Freguson (2009) highlighted the minimum requirement of R^2 value to be around 0.04 and the minimum path coefficient value of 0.2 for the structural model in social sciences. Also, the R^2 value above 0.25 reflects a moderate effect and above 0.64 is a strong effect. Further, studies have highlighted the importance of a model even with a lower R-squared value, and it depends on the context and phenomenon being studied (Grace-Martin, 2012). Here, the R^2 value, also known as a coefficient of determination, is an indicator that tells how close the data are to the regression line and refers to the percentage of variation in the dependent variable explained by the independent variable (Miles, 2014).

The results of the R^2 value shown that the theorized model is acceptable at a moderate level in explaining the desired concepts (Table 5.15). Though at a moderate level, the critical outcome is an R^2 value of 46.1% for the study's key outcome variable, behavioural intention. It depicts that the predicting variables in the study could explain about 46% percent of the total variance of the citizen's m-government adoption intention in the smart cities of Karnataka. Moreover, the other endogenous variables such as trust, transparency, relative advantage, and ease of use also had moderate effects (Table 5.15). The factors compatibility and social influence are at a lower acceptable level based on Falk & Miller (1992). However, the other two variables, such as image and awareness are much weaker, though lower than 10%, it is an acceptable level according to Freguson (2009). The lower value of R^2 is probably because the study tries to explore only the impact of social media on these aspects. Theoretically, there might be many other factors impacting the same that are extraneous to the study context. But it implies social media has some effect which is vital in the current context. Hence, it is not so important to look into this value in this context and is more critical to understand the relationship between these variables. However, we need to interpret and conclude the results very carefully.

Table 5.15: Results of R-square and Q-square values of endogenous variables

	R^2	Q^2
Awareness	0.066	0.040
Behavioural Intention	0.461	0.330
Compatibility	0.182	0.109
Ease of Use	0.251	0.156
Image	0.084	0.052
Relative Advantage	0.362	0.199
Social Influence	0.237	0.157
Transparency	0.581	0.338
Trust	0.365	0.207
		SRMR= 0.033

Further, the other criteria here is the Q^2 value reflecting the predictive relevance of the endogenous constructs, which should be above zero (Hair et al., 2017). It reflects on the model's capability to accurately predict the data from the current sample. As both Q^2 and R^2 are acceptable at a moderate level above the threshold values, the structural model is good (Table 5.15). Furthermore, the model's goodness of fit is also assessed with the SRMR index, 0.034 for the developed model. It is below the threshold of 0.08 and thus acceptable (L. Hu & Bentler, 1999).

5.8.1 Direct or Individual Paths

The direct relationship between the predictors or the independent variables (IV) with its dependent variables (DV) is assessed in this section. The results of the direct paths with the path coefficient values (β), standard deviation (SD), T statistics, and the detail of statistical significance (p-value) are presented below (Table 5.16). Further, Figure 5.8 depicts a theoretical model with significant paths represented by a solid double line and non-significant paths with a dotted line and each path's coefficient value (beta value with statistical significance).

The first aspect of the study hypotheses is regarding awareness and its effect on behavioural intention. The results of the SEM reflected in the insignificant direct relationship between awareness and intention to use m-government (β= +0.010, p > 5%), and thus hypothesis H1 is rejected. However, the indirect effects of awareness on relative advantage (β= +0.602, p < 0.1%), ease of use (β= +0.501, p < 0.1%), compatibility (β= +0.427, p < 0.1%), and image (β= +0.132, p < 0.1%) was proved to have significant positive influence. Further, these indirect relationships through the attitudinal factors will be tested for their mediating role between awareness and behavioural intention in the coming section.

Table 5.16: Results of the individual paths of the model

	β-value	SD	T Statistics	Inference
Awareness → Behavioural Intention	0.010	0.039	0.251	NS
Awareness → Compatibility	0.427***	0.031	13.597	S
Awareness → Ease of Use	0.501***	0.031	15.998	S
Awareness → Image	0.132***	0.033	4.043	S
Awareness → Relative Advantage	0.602***	0.027	21.926	S
Compatibility → Behavioural Intention	0.263***	0.077	3.394	S
Ease of Use → Behavioural Intention	-0.042	0.067	0.636	NS
Facilitating Condition → Behavioural Intention	0.194**	0.062	3.137	S
Image → Behavioural Intention	-0.102***	0.032	3.178	Suppressor
Image → Social Influence	0.196***	0.032	6.087	S
Information Quality → Behavioural Intention	-0.015	0.064	0.235	NS
Information Quality → Transparency	0.704***	0.027	25.695	S
Relative Advantage → Behavioural Intention	0.158*	0.068	2.335	S
Social Influence → Behavioural Intention	0.058	0.038	1.532	NS
Social Influence → Trust	0.248***	0.040	6.237	S
Social Media → Awareness	0.258***	0.035	7.280	S
Social Media → Image	0.226***	0.033	6.767	S
Social Media → Social Influence	0.397***	0.038	10.575	S
Social Media → Transparency	0.113***	0.029	3.917	S
Social Media → Trust	0.319***	0.045	7.156	S
System Quality → Behavioural Intention	0.055	0.050	1.088	NS
System Quality → Trust	-0.122**	0.047	2.609	Suppressor
Transparency → Behavioural Intention	0.018	0.059	0.300	NS
Transparency → Trust	0.267***	0.051	5.211	S
Trust → Behavioural Intention	0.180***	0.046	3.912	S

*S- Significant, NS- Non Significant; Significance level: *** is p<0.1%, ** is p<1% and * is p<5% confidence level*

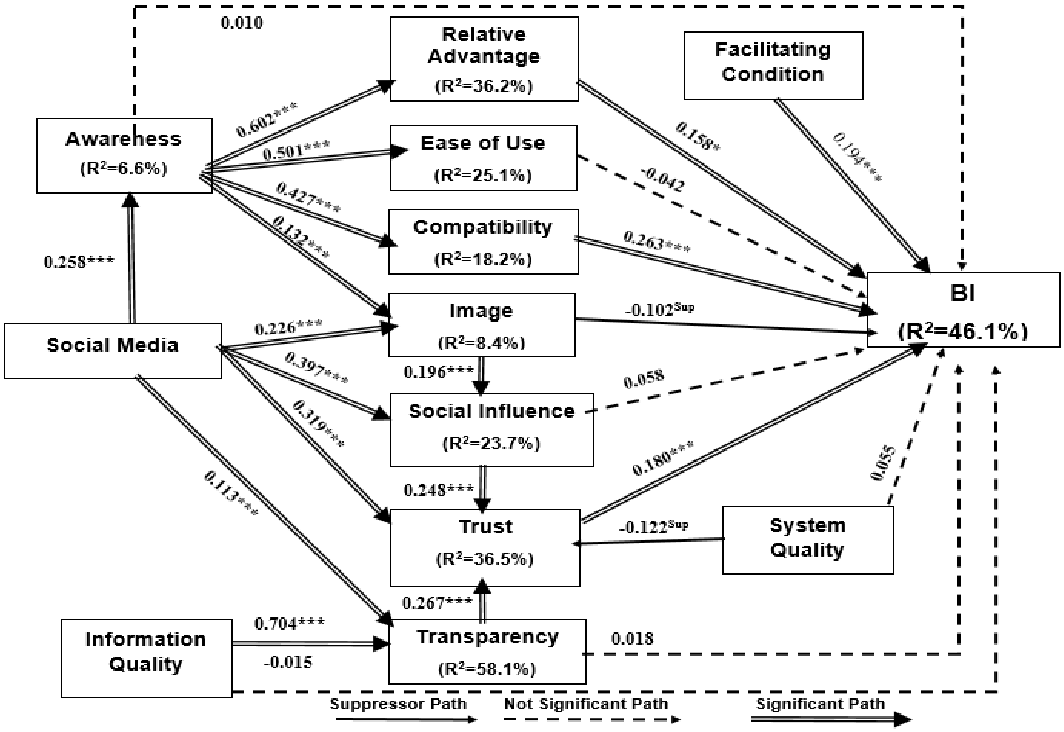

Figure 5.8: Model showing the results of SEM for direct paths

The result of the SEM indicated the presence of significant positive relationship of the predictors compatibility (β= +0.263, p < 0.1%), facilitating condition (β= +0.194, p < 1%) and trust (β= +0.180, p < 0.1%) to BI at 0.1 percent significance level. Thus the hypotheses H4, H10, and H9 respectively were accepted. The factor relative advantage (β= +0.158, p < 5%) had a significant positive influence on BI at five percent statistical significance (accepting hypothesis H2). Furthermore, the analysis of social media influence on awareness (β= +0.258, p < 0.1%), social influence (β= +0.397, p < 0.1%), image (β= +0.226, p < 0.1%), trust (β= +0.319, p < 0.1%) and transparency (β= +0.113, p < 0.1%) were proved to have a positive impact at 0.1 percent significance level. Hence, the hypotheses under H12 (a, b, c, d, and e) were accepted. But it is to be noted that with the R^2 value of awareness and image being below 10%, the role of social media on these two aspects may not be significant compared to other relationships.

Further, the factors social influence (β= +0.058, p > 5%), system quality (β= +0.055, p > 5%) and transparency (β= +0.018, p > 5%) were found to have an insignificant association with BI. Hence the study rejected the hypotheses H11, H7, and H8.

Moreover, the results showed an insignificant negative influence for the factors ease of use (β= -0.042, $p > 5\%$) and information quality (β= -0.015, $p > 5\%$) on BI (rejecting hypothesis H3 and H6). Here, since the path is not significant, the sign of the relationship is irrelevant. However, the negative path coefficient occurred due to the random fluctuation around zero in the regression analysis as these relationships were very weak.

Furthermore, the role of information quality in enhancing transparency (β= +0.704, $p < 0.1\%$) and transparency's impact on trust (β= +0.267, $p < 0.1\%$) were found to have a significant positive association at 0.1 percent significance level. Besides, results showed a significant association of image in enhancing social influence (β= +0.196, $p < 0.1\%$) and the role of social influence in the development of trust (β= +0.248, $p < 0.1\%$). Though these indirect paths were not hypothesized specifically, it plays a vital role in the mediation analysis.

The other key observation in the outcome is the negative relationships of factor image on BI (β= -0.102, $p < 0.1\%$) and system quality on trust (β= -0.102, $p < 0.1\%$) with statistical significance, which is contrary to the actual correlation between the factors (Table 5.13). This sign change in SEM analysis is referred to as a phenomenon known as the negative suppression effect. Here, the sign of the suppressors reverses from its actual relation with the dependent variable, and it increases the path coefficients of other associated predictors of dependent variable. Thus, the results cannot prove the true relationship between the suppressor and the independent variable. Therefore, with no significant empirical evidence to prove the substantial influence of image on BI and system quality on trust, its associated hypotheses were rejected (H5 and H9a). The detailed description and justification of these aspects are discussed in the below section.

5.8.1.1 Image and System Quality as Suppressors

In a multiple regression analysis, predictors attempt to explain the criterion or concept under investigation (i.e., dependent variable). Here, sometimes one of the predictors (referred to as the suppressor) may have a lower correlation with the outcome variable (i.e., little to explain the criterion) but shares more common irrelevant elements with one or more other predictors. When this suppressor is combined with other predictors in multi-variate analysis, these irrelevant aspects are nullified, resulting in a stronger correlation between one or more related predictors and the outcome variable (Maassen & Bakker, 2001). In the process, the suppressor reverses its sign and becomes negative and is referred to negative suppression effect (Falk & Miller, 1992; Maassen & Bakker, 2001). In general, according to Conger (1974), a suppressor is a variable that, when included in a regression equation, increases the predictive validity of another variable (or group of variables). The variable is a suppressor only for those variables whose regression weights are increased.

Here, when the suppressor has reversed its sign instead of the hypothesized one, it should not be assumed that the suppressor has a contrary finding. This relationship exists only with other predictors subject to the suppression effect, and thus meaningful interpretation should be performed in conjunction with all other related predictors (Maassen & Bakker, 2001). As a result, studies have revealed that hypotheses concerning the variable that plays the suppressor role lack empirical evidence on its direct relationship with the dependent variable and thus cannot be accepted (Falk & Miller, 1992; Maassen & Bakker, 2001).

A similar phenomenon is observed in the study for the factor image and its relationship with BI and other predictors, trust, and transparency. Also, system quality played a suppressor role along with transparency and social media with its relationship to factor trust. First, to assess the role of the image as a suppressor, the path coefficients of the image and other influencing predictors were observed in a simple model connecting the outcome variable BI (Figure 5.9a). The change in path coefficients of these variables with and without the factor image is observed.

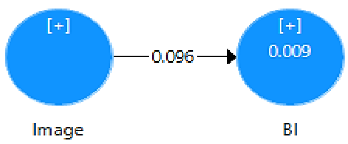

Figure 5.9a: Effect of the image as a single predictor on BI

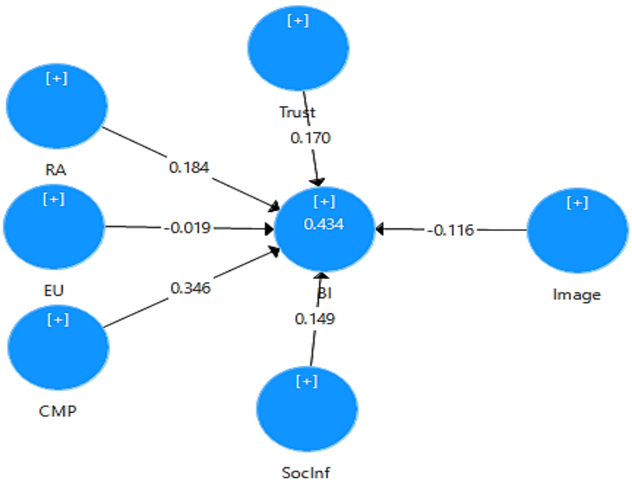

Figure 5.9b: Simple path model for BI and its predictors with image

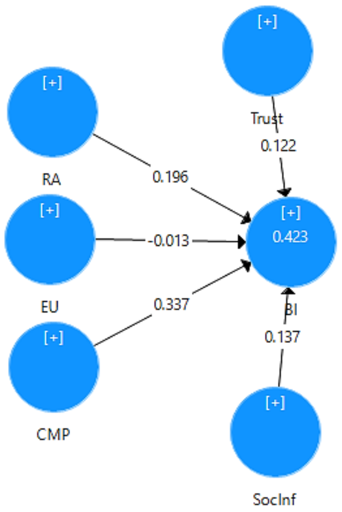

Figure 5.9c: Simple path model for BI and its predictors without image

According to the results, in the simple two-factor model, the path coefficient between image and BI is positive (= +0.096) and is according to the theory (Figure 5.9a). However, when the other BI predictors are added to the model, the path coefficient of the image reverses to negative 0.112, which is a significant change (Figure 5.9b). Following that, the path coefficients of predictors were observed in the same model after the factor image was removed. The path coefficients for the factors trust (from +0.170 to +0.122) and social influence (+0.149 to +0.137) both decreased significantly (Figure 5.9c). In other words, the inclusion of an image in the model suppresses the image to a negative value. It substantially improves the path coefficients of other predictors (trust and social influence). It thus demonstrates the role of image as a suppressor concerning BI. As a result, no conclusions should be drawn with no empirical evidence on the direct impact of image on BI. However, it is recommended that the results be inferred by combining the suppressor with other predictors. Image is discovered here to strengthen the relationship of trust and social influence with BI. Thus, hypothesis H5 is rejected due to a lack of empirical evidence of an image's direct relationship with BI.

A similar suppressor effect was observed for the factor system quality and its relationship with trust and predictors transparency and social media. Initially, the bivariate correlation of system quality with trust was positive (β= +0.333), which supports the theoretical concept (Figure 5.10a). In the next stage, the path coefficient of transparency and social media on trust without system quality is observed (Figure 5.10b). When the model included system quality later, it showed a suppression with a significant negative path coefficient (β= -0.122), and the path coefficients of the predictors' transparency (β from 0.195 to 0.266) and social media (β from 0.298 to 0.320) boosted (Figure 5.10c). It thus demonstrates the role of system quality as a suppressor, enhancing the relationship of transparency and social media with trust. Hence, the study rejected the hypotheses associated with the direct influence of system quality on trust, due to a lack of empirical evidence (H9a).

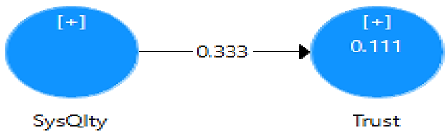

Figure 5.10a: Effect of system quality as a single predictor on trust

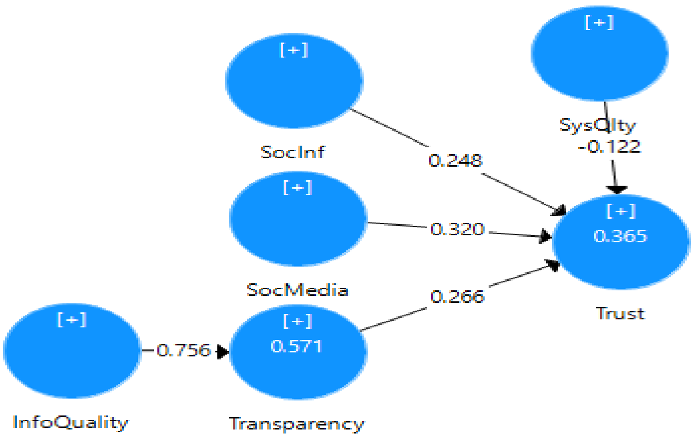

Figure 5.10b: Simple path model for trust and its predictors with system quality

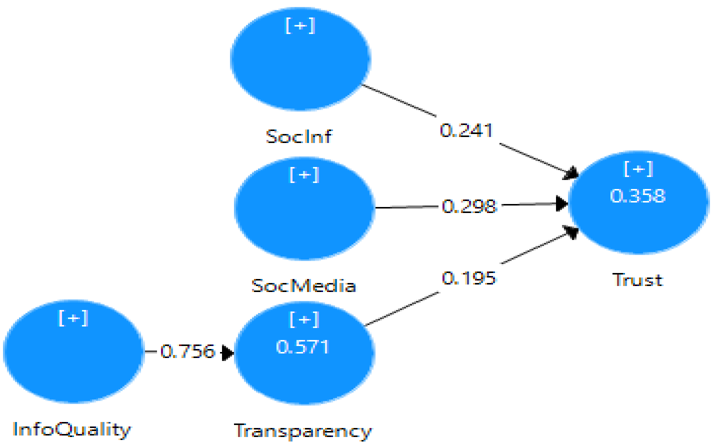

Figure 5.10c: Simple path model for trust and its predictors without system quality

5.8.1.2 Summary on Hypotheses Results for Direct Paths

The summary of hypotheses with the results is presented in Table 5.17 below.

Table 5.17: Summary of the results of hypotheses related to direct paths

Details of Hypotheses		Inference
H1	There is a significant influence of awareness on the intention to use m-government	Not Supported
H2	There is a significant influence of relative advantage on the intention to use m-government	Supported
H3	There is a significant influence of ease of use on the intention to use m-government	Not Supported
H4	There is a significant influence of compatibility on the intention to use m-government	Supported
H5	There is a significant influence of image on the intention to use m-government	Not Supported
H6	There is a significant influence of information quality on the intention to use m-government	Not Supported
H7	There is a significant influence of system quality on the intention to use m-government	Not Supported
H8	There is a significant influence of transparency on the intention to use m-government	Not Supported
H9	There is a significant influence of trust on the intention to use m-government	Supported
H10	There is a significant influence of facilitating conditions on the intention to use m-government	Supported
H11	There is a significant impact of social influence on the intention to use m-government	Not Supported
H12a	Social media has a significant influence on awareness	Supported
H12b	Social media has a significant influence on trust	Supported
H12c	Social media has a significant influence on transparency	Supported
H12d	Social media has a significant influence on social influence	Supported
H12e	Social media has a significant influence on the image.	Supported

5.8.2 Mediation Analysis

Mediation analysis is a process that tries to explain the relationship between the IV and DV with the inclusion of an intervening variable (i.e., mediator). The mediation model specifies that the relationship between IV to the mediator and the mediator to DV is stronger than the direct causal relationship between IV and DV (Figure 5.11). Hence, this analysis helps understand the mechanism and attain detailed insights on the relationships between the variables. It also explores the possible connection between the IV and DV when these do not have an apparent direct relationship. In Figure 5.11, the relationship between the IV and DV can be explained directly through path a. However, the mediation is said to present the relationship between IV to Mediator (path b), and then mediator to DV (path c) is significant. If only the mediation path (b x c) is substantial and not the direct path (a), then it is said to have a full mediation effect. Further, if both the mediation and direct paths are significant, partial mediation is a case. If there is more than one mediator between IV and DV, it is a serial mediation. The examination of all these possible relationships is critical to have a detailed understanding of the variables and their interrelationships.

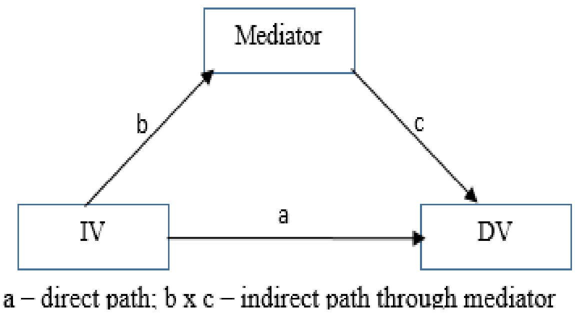

Figure 5.11: A simple representation of a mediation model

The proposed model in the study has several mediating variables, and it is critical to examine the role of all these mediators and their influence on the outcome variable. Hence, critical mediation paths are identified and analyzed for their relationships with other variables in different cases. The details of all the cases with the mediation paths and their results are provided below (Table 5.18).

- Case 1 reflects on the indirect effect of awareness towards behavioural intention through the mediators' relative advantage, ease of use, compatibility, and image.
- Case 2 explains the indirect effect of image and social influence on BI through the mediator trust.
- Case 3 is on the indirect effect of system quality and information quality to BI through the mediator trust.
- Case 4 is the indirect effect of transparency to BI through trust.
- Case 5 is on indirect effects of social media on trust and social influence

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The bootstrap approach using the SmartPLS3 has been adopted to examine mediation effects, which is a well-accepted approach (Ramayah et al., 2017). The details of direct and indirect effects of the paths (path coefficient) along with standard deviation, T-statistics, bias-corrected lower and upper limits of the 95% confidence interval are examined to assess the indirect impact. Here, the relationship is insignificant if the zero is between the lower limit confidence interval (LLCI) and the upper limit confidence interval (ULCI). The T value above 1.96 and p-value below 0.05 (significant at 5% confidence level) are the leading indicators reflecting the strength and significance of the relationships between the variables (Ramayah et al., 2017).

The study examines whether the indirect effect of awareness through the attitudinal factors significantly impacts BI. The results revealed the significance of relative advantage and compatibility as a moderating variable between awareness and behavioural intention, thus accepting the hypotheses H1a and H1c (Table 5.18, Figure 5.12a and 5.12b). However, ease of use did not moderate the relationship between awareness and BI (H1b rejected) (Table 5.18, Figure 5.12d).

Further, the mediation path (awareness → image → BI) was rejected as the path image to BI exhibited a suppression effect, thereby rejecting hypothesis H1d (Table 5.18, Figure 5.12c). Hence, with the direct path between awareness and BI being insignificant, a full mediation effect was observed for relative advantage and compatibility factors. These insights are very crucial to understand the role of awareness in m-government adoption.

Further, the indirect path of awareness through image, social influence, trust, and BI was proved to be significant, indicating a full mediation effect (accepting H1f) (Table 5.18, Figure 5.12c). However, hypothesis H1e is rejected due to the insignificance of the path (AW→ IM→ SI→ BI) (Table 5.18, Figure 5.12c). Hence, it can be concluded that image as a mediator is crucial in driving social influence, thereby developing trust resulting in a positive effect on BI.

Table 5.18: Results of bootstrap for the indirect effect (Mediation)

Effects	Paths	Indirect Effect	Biased Corrected Confidence Interval		T-value	Result
		Beta (SD)	LLCI	ULCI		
CASE 1: Indirect Effect of Awareness						
Direct without Mediator	*AW → BI*	*0.010 (0.038)*	*-0.064*	*0.081*	*0.260*	*NS*
Indirect with Mediator	AW → RA → BI	0.095 (0.041)*	0.018	0.178	2.333	S
	AW → EU → BI	-0.021 (0.034)	-0.084	0.048	0.631	NS
	AW → CMP → BI	0.112 (0.034)***	0.048	0.184	3.298	S
	AW → IM → BI *(suppressor)*	-0.013 (0.006)*	-0.027	-0.004	2.311	NS
	AW → IM → SI → BI	0.002(0.002)	0.000	0.007	1.321	NS
	AW → IM → SI → T → BI	0.002 (0.001)*	0.001	0.004	2.353	S
CASE 2: Indirect Effect of Image and Social Influence						
Direct without Mediator	*IM → BI (suppressor)*	*-0.102 (0.032)*	*-0.164*	*-0.038*	*3.169*	*NS*
Indirect with Mediator	IM → SI → BI	0.017 (0.012)	-0.005	0.041	1.482	NS
	IM → SI → T → BI	0.013 (0.004)***	0.007	0.024	3.241	S
Direct without Mediator	*SI → BI*	*0.058 (0.038)*	*-0.017*	*0.133*	*1.517*	*NS*
Indirect with Mediator	SI → T → BI	0.045 (0.012) ***	0.024	0.073	3.662	S
CASE 3: Indirect Effect of System Quality and Information Quality						
Direct without Mediator	*SQ → BI*	*0.055 (0.049)*	*-0.042*	*0.150*	*1.108*	*NS*
Indirect with Mediator	SQ → T → BI *(suppressor)*	-0.022 (0.011)*	-0.048	-0.006	2.086	NS
Direct without Mediator	*IQ → BI*	*-0.015 (0.063)*	*-0.136*	*0.111*	*0.240*	*NS*
Indirect with Mediator	IQ → TRN → BI	0.012 (0.041)	-0.068	0.096	0.303	NS
	IQ → TRN → T → BI	0.034 (0.011)**	0.016	0.059	3.119	S
CASE 4: Indirect Effect of Transparency						
Direct without Mediator	*TRN → BI*	*0.018 (0.059)*	*-0.093*	*0.138*	*0.302*	*NS*
Indirect with Mediator	TRN → T → BI	0.048 (0.015)***	0.023	0.083	3.196	S

CASE 5: Indirect Effect of Social Media						
Direct without Mediator	*SM → IM*	*0.226 (0.033)****	*0.159*	*0.289*	*6.767*	S
Indirect with Mediator	SM → AW → IM	0.034 (0.009)***	*0.018*	*0.055*	3.661	S
Direct without Mediator	*SM → T*	*0.319 (0.045)****	*0.227*	*0.402*	*7.156*	*S*
Indirect with Mediator	SM → IM → SI → T	0.011 (0.003)***	0.006	0.018	3.519	S
Indirect with Mediator	SM → AW → IM → SI →T	0.002 (0.001)*	0.001	0.004	2.385	S
Indirect with Mediator	SM → TRN → T	0.030 (0.009)***	0.016	0.050	3.525	S
Indirect with Mediator	SM → SI → T	0.099 (0.018)***	0.067	0.135	5.511	S
Direct without Mediator	*SM → SI*	*0.397 (0.038)****	*0.320*	*0.469*	*10.56*	*S*
Indirect with Mediator	SM → AW → IM → SI	0.007 (0.002)**	0.003	0.013	2.867	S
Indirect with Mediator	SM → IM → SI	0.044 (0.009)***	0.028	0.064	4.801	S
*Significance level: *** is p<0.1%, ** is p<1% and * is p<5% confidence level*						

Case 1: The indirect effect of Awareness

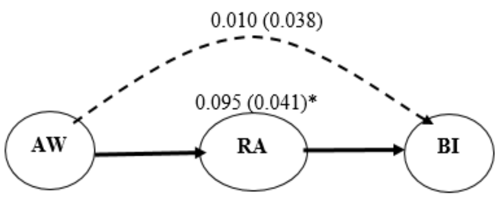

Figure 5.12a: Mediation with relative advantage

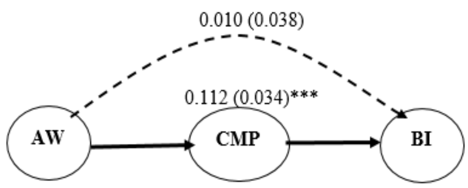

Figure 5.12b: Mediation with compatibility

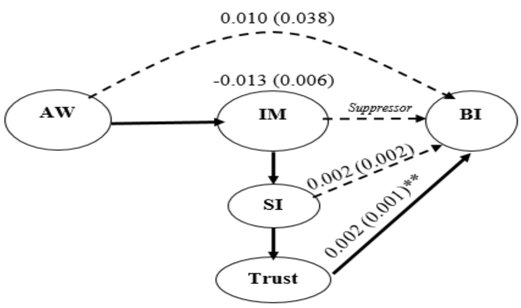

Figure 5.12c: Mediation with image

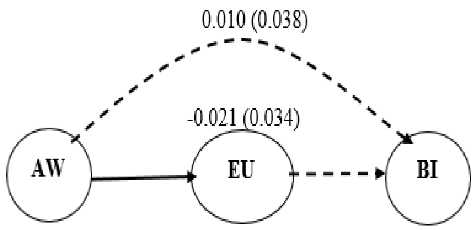

Figure 5.12d: Mediation with ease of use

Figure 5.12: Indirect effect of awareness to BI

Case 2: Indirect effect of Image and Social Influence

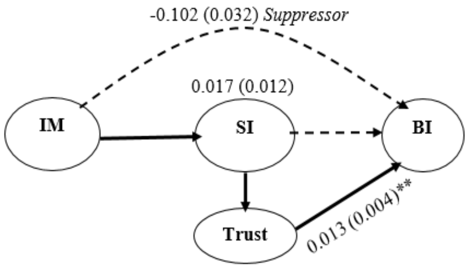

Figure 5.13: Indirect effect of image through social influence and trust to BI

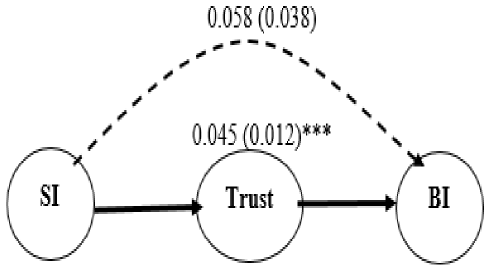

Figure 5.14: Indirect effect of social influence through a trust to BI

The result also revealed trust, and social influence as a serial mediator between image and BI (accepting H5b). Here, social influence alone doesn't mediate between image and BI (rejecting H5a) (Table 5.18, Figure 5.13). The path image to social influence to trust and then to BI is significant, but the direct path to BI is non-conclusive due to the suppression effect (thus rejected). Hence, it can be inferred that there is a mediation of image to BI through the serial mediators' social influence and trust (H5c) (Figure 5.13). Further, the relationship between social influence and behavioural intention was found to be significant through the mediator trust, thereby accepting the hypothesis H11a (Table 5.18, Figure 5.14).

Case 3: Indirect effect of System Quality and Information Quality

The indirect effect of system quality through the trust to BI is also rejected due to the suppression effect of the path (SQ → BI) (Table 5.18, Figure 5.15). Hence, system quality could not be proved to have an indirect influence on BI through mediator trust. Thus hypothesis H9a is rejected. Further, the indirect effect of information quality on BI through the mediator transparency is also examined in the study (Table 5.18, Figure 5.16). The result revealed the absence of mediation effect of transparency between information quality and BI (rejecting H8a). However, the results showed the significant role of trust between these paths. The indirect effect of information quality through transparency will enhance the trust, which significantly impacts the intention to use m-government. Hence, transparency and trust serially mediate between information quality and BI, which is one of the critical outcomes of this study (accepting hypothesis H8b).

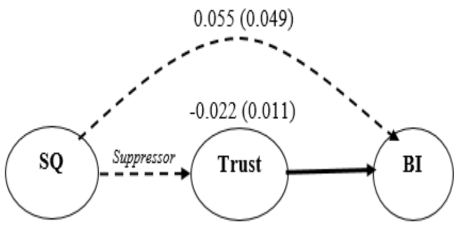

Figure 5.15: Indirect effect of system quality to BI through trust

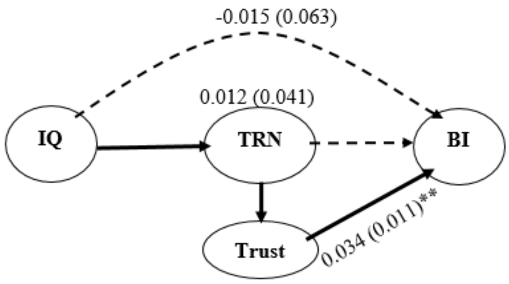

Figure 5.16: Indirect effect of information quality to BI through transparency and trust

Case 4: Indirect effect of Transparency

As mentioned in the previous case trust plays a vital role as a mediator. In this case, the effect of transparency to BI is significant through the mediator trust and not its direct impact (Table 5.18, Figure 5.17). Hence, a full mediation has been achieved with trust as the mediator between trust and transparency (accepting H8c).

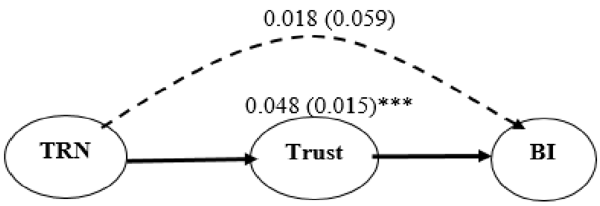

Figure 5.17: Indirect effect of transparency to BI through trust

Case 5: Indirect effect of Social media

The study also tried to examine the indirect effect of social media on the development of image and trust. The results revealed the partial mediation with both direct and indirect paths being significant between social media and all connected outcome variables such as image, social influence, transparency, and trust (Table 5.18). The indirect paths such as Figure 5.18a through awareness, Figure 5.18b through image, Figure 5.18c through social influence, and Figure 5.18d through transparency are considered between social media and outcome variables. The figure also presents these indirect paths with their path coefficient, standard deviation, and statistical significance.

From the results (Table 5.18), first, awareness was found to mediate the relationship between social media and image, indicating awareness's key role (accepting H12f). The image also mediates the relationship between social media and social influence, thereby accepting the hypothesis H12g. Further, awareness and image act serially as a mediator in enhancing the social influence (H12h is accepted). Moreover, awareness, image, and social influence act serially in developing trust towards m-government (H12k). Here, image and social influence were also found to serially mediate the relationship between social media and trust (accepting H12j). Besides, social influence acts as the mediator between social media and trust (accepting H12i) and transparency as a mediator between social media and trust (accepting H12l).

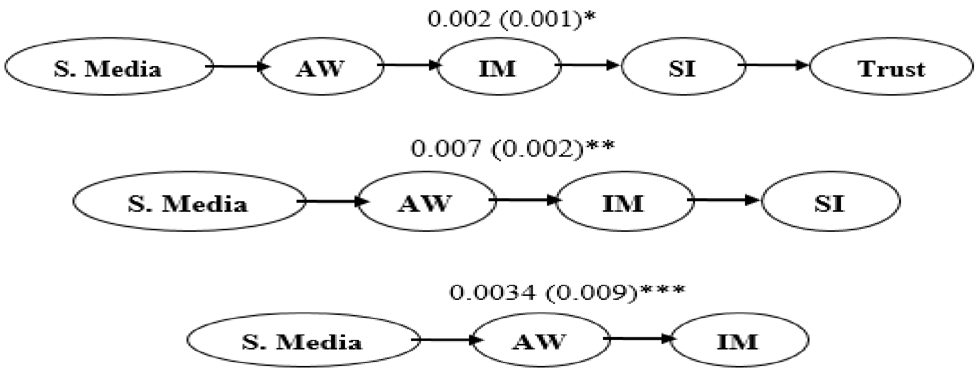

Figure 5.18a: Indirect role of social media through awareness

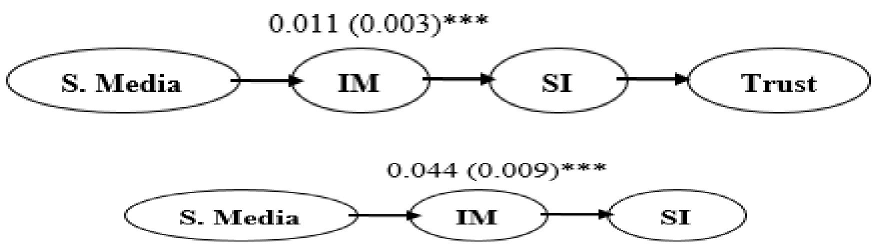

Figure 5.18b: Indirect role of social media through image

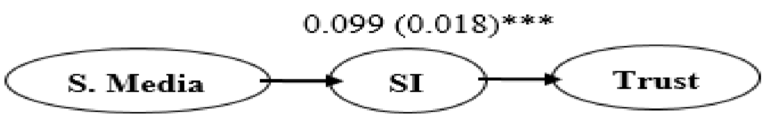

Figure 5.18c: Indirect role of social media through social influence

Figure 5.18d: Indirect role of social media through transparency

The summary of the results with hypotheses is presented below in Table 5.19.

Table 5.19: Summary on hypotheses with mediating effect

Details of Hypotheses		Inference
H1a	Relative advantage mediates the relationship between awareness and intention to use m-government.	Supported
H1b	Ease of use mediates the relationship between awareness and intention to use m-government.	Not Supported
H1c	Compatibility mediates the relationship between awareness and intention to use m-government.	Supported
H1d	Image mediates the relationship between awareness and intention to use m-government.	Not Supported
H1e	Image and social influence serially mediates the relationship between awareness and intention to use m-government.	Not Supported
H1f	The relationship between awareness and intention to use m-government services serially mediates through image, social influence, and trust.	Supported
H5a	Social influence mediates the relationship between image and intention to use m-government.	Not Supported
H5b	The relationship between image and intention to use m-government serially mediates through social influence and trust.	Supported
H8a	Transparency mediates the relationship between information quality and intention to use m-government.	Not Supported
H8b	The relationship between information quality and intention to use m-government serially mediates through transparency and trust.	Supported
H8c	Trust mediates the relationships between transparency and intention to use m-government.	Supported
H9a	Trust mediates the relationship between system quality and intention to use m-government.	Not Supported
H11a	Trust mediates the relationship between social influence and intention to use m-government.	Supported
H12f	Awareness mediates the relationship between social media and image	Supported
H12g	Image mediates the relationship between social media and social influence	Supported
H12h	The relationship between social media and social influence is serially mediated through awareness and image.	Supported
H12i	Social influence mediates the relationship between social media and trust.	Supported
H12j	The relationship between social media and trust is serially mediated through image and social influence.	Supported
H12k	The relationship between social media and trust is serially mediated through awareness, image, and social influence.	Supported
H12l	Transparency mediates the relationship between social media and trust.	Supported

5.8.3 Moderation Analysis

5.8.3.1 Overview

The next aspect of the analysis is performing a moderation analysis. The analysis here tries to assess whether a moderating variable modifies the existing relationship between the IV and DV. However, it is vital to note that the moderating variable doesn't influence IV, but it affects the strength and direction of the relationship between IV and DV (Hair et al., 2017). If a moderating influence exists, it indicates that the relationship between two variables is not constant and varies based on the value of the moderating variable. Understanding these variations in moderating variables and their impact on IV and DV are crucial aspects of obtaining a detailed insight on the behavioural characteristics of m-government adoption in this study. The study mainly has moderating variable, which is categorical, and the analysis tries to explore the differences in the relationships between variables across different groups of moderating variables.

Here, the study examines the moderating effect of demographic factors such as age, gender, education, income, and occupation. Further, differences among the locality (place) and comparison in the behaviour among the people of metropolitan city Bangalore against the people from other smart cities are examined. Furthermore, the study explores differences in m-government adoption behaviour based on SM experience, m-government experience, and EG experience of an individual. Hence, all these variables are considered as moderating variables and hypothesized for the moderation between the paths of any two variables in the m-government adoption model developed in the study. Smart-PLS 3 is used for this purpose. Since the moderating variables are categorical, a multi-group analysis (MGA) has been performed. The model being a factor-based model with reflective indicators, consistent MGA with 2000 resamples cases is set for the analysis. These setup criteria are the preferred and most suitable to obtain better results for the categorical variables (Hair et al., 2017). The details of the results of all the moderating variables are described in sections below.

5.8.3.2 Multi-Group Analysis (MGA)

The MGA has been performed for demographic factors which have distinct categories. It is first essential to establish the invariance criteria of the data across the groups and then perform the MGA. This section describes these stages of MGA viz. Invariance test and MGA in detail below for every demographic variable.

5.8.3.2.1 Invariance Test

The invariance test is a method for comparing the measurement properties of variables across groups. It reflects factor structure equivalence, indicating the quality of items across groups. It represents whether or not the same factor is being assessed by its measures across different groups, indicating the presence of any bias in the measures across groups. Though this aspect is being neglected in some of the previous studies, it is one of the critical aspects in MGA (Henseler et al., 2015; Klesel et al., 2018; Sarstedt et al., 2011). Establishing measurement invariance ensures that the relationships and differences across the groups are not caused due to the differences in understanding the content and meaning of the measures. It is a necessary condition, and the failure of which may reduce the power of the statistical tests and may also result in misleading conclusions. Here, for the purpose, we need to establish the configural invariance (same structure across groups), metric invariance (loadings are invariant across groups) and scalar invariance (equal intercept across the groups).

❖ ***Configural Invariance***

In PLS-SEM, the configural invariance is generally attained automatically if the necessary group size requirement is met. For this, Cohen's power primer, which estimates size based on R^2 value and the number of arrows pointing towards the dependent variable (BI, which is 11), is used (Cohen, 1992; Hair et al., 2017). The minimum required size required for each group is around 95 at a 5% confidence level with an R^2 value of 0.46. This condition has been met for all the moderating variables except place with seven groups, of which three had smaller sizes. Since these three cities were smaller based on population (below three lakhs), it has been decided to exclude them from MGA. Only the other cities such as Belagavi, Bengaluru, Hubballi-Dharwad, and Mangaluru are considered in the analysis for comparison.

❖ ***Metric & Scalar Invariance***

The next aspect of the invariance test is establishing metric and scalar invariances. To attain this in PLS, the differences in outer loadings of the indicators are assessed (Cheah et al., 2020; Henseler et al., 2015; Sarstedt et al., 2011). If the differences are not significant across the groups, it is a sign of equality and the invariance is established (full invariance) (Henseler et al., 2015; Sarstedt et al. 2011). If this is not met, it is necessary to attain at least a partial invariance for doing an MGA. Here, the indicators with significant differences can be eliminated or neglected for attaining the invariance (Cheah et a., 2020; Henseler et al., 2015). In the process, it is necessary to have at least two indicators that are equal across the group for establishing partial invariance for a particular factor (Henseler et al., 2015). Here, in the study, it is assumed that if the number of significant differences between items is minimum, then it's considered as partial invariance. If these conditions are met, then only it is viable to perform MGA else, the results may lead to misleading conclusions.

A consistent MGA is perfumed with 2000 resamples and based on factor-based bootstrapping to assess the metric and scalar invariances in PLS-SEM. It is the recommended condition for MGA to obtain reliable outcomes (Hair et al., 2017). The results of the significance test for the differences in the outer loadings (c) between the two groups are presented below. In the results tables, items with issues in the data and a significant difference in outer loadings are highlighted in a yellow shade.

- **Gender**

The results of the differences in the outer loadings for male and female groups indicated the presence of partial invariance. Here, the two items viz. RA2 and SM6 had a significant difference in the loadings across the groups (Table A1 in Appendix V). Since the items under this construct had at least two other indicators equal between the groups, a partial invariance is established.

- **Age**

The age is categorized under three groups viz. Young adults (18-30 years), Middle age adults (31-45 years), and Older adults (45-60 years). Each group is compared against the other group, and the differences in the loadings and its statistical significance results are presented (Table A1 in Appendix V). The results indicated some concern in data for the construct facilitating condition, which should be carefully considered while concluding MGA. However, the results can be assumed as partial invariant, excluding the construct facilitating condition. Here, the items such as IQ1 and T2 had significant differences between older, younger, and middle-aged adults.

Further, differences were seen between young and middle-aged adults for the items RA3 and SM3. Also, a difference was seen for the item IM2 between young and senior adults. However, since all the items excluding these items have at least two indicators per variable and the occurrence of significant differences is very minimal compared to the total number of indicators, it can be accepted for partial invariance. However, the final MGA results should be carefully interpreted considering these differences.

- **Education**

This demographic factor is categorized into three groups: below primary/secondary education (PS) level, graduate (G), and post-graduation and above (Pg). The results indicated the partial invariance with significant differences in the loadings for the items FC2, IQ2, IQ4, and SM4 between the groups' graduates and post-graduation and above. Further, the difference was significant for IQ4 between Pg and PS and SI2 between G and PS (Table A1 in Appendix V). Additionally, the results indicated few concerns on the data for the construct social media, and thus overall, it can be inferred that the data is partially invariant. However, comparison on social media aspects should be made carefully. Since the groups graduate and post-graduation and above had shown maximum differences, though the number of cases is minimal, it should be considered appropriately while concluding.

- **Occupation**

The occupation has been categorized under five groups, namely students (St), Self-employed (SE), Private employee (PE), Government employee (GE), and Not currently employed (NCE). The results indicated few significant concerns on the suitability of the data for the self-employed category and thus should be excluded from the MGA

(Table A2 in Appendix V). Further, the construct facilitating condition also had some major concerns, and therefore no conclusions should be drawn on this factor. Excluding these, the results indicated minimum differences in outer loadings for items and thus assumed to be partial invariant. Here, the item SM2 had significant differences across GE, NCE, and St groups. Further, SI2 and TRN5 between PE and St groups, CMP3 between GE and St, and T4 between PE and NCE did not meet the invariance assumption (Table A2 in Appendix V).

- **Income**

Income is one of the major socio-economic factors which the previous studies have considered as a moderating variable. In the study the income has been categorized under five groups viz. below 20,000 INR (gb2), 20,000 to 40,000 INR (g24), 40,000 to 60,000 INR (g46), 60,000 to 80,000 INR (g68), and above 80,000 INR (g8+). Each group has been compared against the other groups and the differences in the value of the outer loading are analyzed. The results indicated the concern in the data for the factor image and thus should not be considered for comparison purposes.

Other than this, it was observed that the items such as IQ1 for groups that involve 8+ under two instances and RA3 for the group that involves gb2 under two instances are the two key observations. Further, few differences were also observed for the items CMP1, CMP3, IQ3, SI1, SM8, and TRN2 only under one instance across different group comparisons (Table A3 in Appendix V). Hence, it can be concluded that a partial invariance has been established.

- **Place**

First it is important to note that, since the sample size for Davangere, Shivamogga, and Tumakuru is very low invariance condition will not be met. Thus, the comparison could not be performed for these cities. In the study only other four cities such as Belagavi, Bengaluru, Hubballi-Dharwad, and Mangaluru, are used for multi-group comparison. The invariance test results in Table A4 in Appendix V for these cities indicated a significant concern with the data for the Belagavi city.

However, excluding this, it was observed to have a very minimal significant differences for items. The other issue was with the data for construct image, which should thus be carefully used while comparing and drawing conclusions. A few differences were also observed for the items CMP3, SM6, and T4. Hence, in conclusion, excluding the cities, Belagavi, Davangere, Shivamogga, and Tumukrur multi-group comparison can be performed with the assumption of partial invariance condition. Further, a comparison based on metropolitan city Bangalore against other cities has also been carried out. Here, the results indicated a partial invariance with only a couple of items such as CMP2 and RA2 showed significant differences between the groups (Table A4 in Appendix V).

- **EG experience**

Since EG experience is a nominal factor with only two groups viz. with experience and without experience, it has been considered for MGA. The results indicated a partial invariance for this comparison, with few items such as SM4, SM6, SM9, IM3, and CMP2 having significant differences across the group (Table A5 in Appendix V). Thus it can be inferred that a partial invariance has been established and can proceed with MGA.

- **M-government Experience**

Experience tends to influence the adoption behaviour of an individual, and hence many previous studies has considered this as one of the key moderating variables. Accordingly, this study categorizes m-government experience under three groups viz. Less frequent users (few times in a year), Average users (once in a month), and Frequent users (few times in a month). Before examining the differences across these groups, it is first necessary to establish the invariance in the obtained data across these groups.

The differences in the values of the outer loading between these groups were found to be significant across few items. For instance, RA1 and RA3 substantially differed between the three groups (Table A5 in Appendix V). FC1 and IQ2 showed substantial differences between less frequent and frequent users of m-government. Moreover, the outcome variable item BI1, which is critical, showed significant differences across the groups (Table A5 in Appendix V). Thus m-government experience has not met the necessary invariance conditions, particularly for the outcome variable. M-government experience thus cannot be use to perform MGA in this study with the existing data.

- **SM Experience**

SM experience has been categorized under their groups such as Low (with a minimum social media usage of once in a day), Medium (social media usage of about 2-10 times a day), and High (with social media usage of more than ten times in a day). The invariance test results (Table A5 in Appendix V) revealed an issue with item EU1 and violated the required condition of two items per construct to be invariant. Thus, this factor should not be considered for drawing any conclusions. Other than this only few items had differences such as CMP1, T3, T5, and TRN2, between High and Low frequent users. Also, differences were observed for the items SI3, T3, and T4 between High and Medium frequent users. The differences were also observed between Low and Medium frequent users for the items CMP1, IM1, RA2, T5. Overall, it can be concluded that the data is partially invariant, and MGA can be performed.

5.8.3.2.2 Results of Multi-Group Analysis

The next aspect is examining the MGA results for the demographic factors considered in the study. In MGA, the structural model of each group is estimated and observed for any significant differences in their structural relationships. The pairwise comparison results between groups with path coefficient (c) and p-value of statistical significance at 5% level (p) for the demographic variables are presented below. Here, the significant cases are highlighted in a yellow shade in the result tables. Henseler's Bootstrap-based MGA using consistent PLS-MGA has been adopted as it is effective under larger variations in sizes of each group (Cheah et a., 2020; Henseler et al., 2015). It is also acceptable because the results from these methods do not vary significantly (Cheah et al., 2020).

- **Gender (Female versus Male)**

The results of the comparison between male and female respondents using MGA in PLS-SEM are presented below and analyzed in detail (Table 5.20).

Table 5.20: Results of MGA pairwise comparison of gender

c1, c2… path coefficients of each group →	Female		Male		M-F	
	c1	p	c2	p	c2-c1	p
Awareness → BI	0.109	0.060	-0.045	0.416	-0.155	0.051
Awareness → Compatibility	0.417	0.000	0.431	0.000	0.013	0.841
Awareness → Ease of Use	0.496	0.000	0.504	0.000	0.008	0.905
Awareness → Image	0.086	0.082	0.156	0.000	0.070	0.286
Awareness → Relative Advantage	0.589	0.000	0.610	0.000	0.021	0.721
Compatibility → BI	0.259	0.036	0.278	0.011	0.020	0.902
Ease of Use → BI	-0.027	0.799	-0.044	0.647	-0.018	0.902
Facilitating Condition → BI	0.051	0.613	0.318	0.000	0.267	0.045
Image → BI	-0.048	0.318	-0.127	0.003	-0.079	0.214
Image → Social Influence	0.118	0.014	0.237	0.000	0.119	0.058
Information Quality → BI	0.069	0.442	-0.126	0.199	-0.195	0.137
Information Quality → Transparency	0.694	0.000	0.711	0.000	0.017	0.769
Relative Advantage → BI	0.115	0.326	0.162	0.070	0.047	0.757
Social Influence→ BI	0.135	0.015	0.021	0.681	-0.114	0.133
Social Influence→ Trust	0.211	0.001	0.273	0.000	0.063	0.445
Social Media → Awareness	0.281	0.000	0.248	0.000	-0.033	0.635
Social Media → Image	0.261	0.000	0.207	0.000	-0.055	0.403
Social Media → Social Influence	0.454	0.000	0.370	0.000	-0.084	0.255
Social Media → Transparency	0.104	0.046	0.119	0.001	0.015	0.804
Social Media → Trust	0.310	0.000	0.325	0.000	0.015	0.869
System Quality → BI	0.104	0.239	0.046	0.482	-0.057	0.611
System Quality → Trust	-0.144	0.085	-0.112	0.053	0.031	0.760
Transparency → BI	0.082	0.366	-0.009	0.908	-0.092	0.451
Transparency → Trust	0.303	0.000	0.244	0.000	-0.059	0.584
Trust → BI	0.130	0.054	0.208	0.001	0.078	0.392

The findings revealed only one notable difference between males and females, with the results revealing a significant difference between males and females for the predictor facilitating condition. It is important to note that the facilitating condition was critical in males but not in females (Table 5.20). With all other paths having no significant differences, hypothesis H13a is partially accepted. The other observations which though had no significant differences but are important to note are,

- The predictors of BI, such as transparency, system quality, information quality, relative advantage, ease of use, and awareness were not significant among both the groups. All other paths had a significant influence.

- It is also vital to note that social influence was significant for females and non-significant for males though the difference is not significant. Further, impact of trust on BI was significant among males and not among females though the difference in the path values of these two groups was insignificant.

- **Age (Young adults versus Middle-aged adults versus Senior adults)**

A pairwise comparison has been carried out between the three groups young, middle-aged, and senior adults. The results of the sample are presented and described in detail below (Table 5.21). The key differences observed among the three groups were, firstly, the impact of awareness on compatibility, ease of use, and image was much more substantial among senior adults than the other two groups. Further, the role of transparency in the development of trust was very critical among young and middle-aged adults, and this deviated significantly with the senior adults (Table 5.21). There was also a significant impact among young adults over middle-aged adults on the role of social media in the development of image and social influence's impact on BI. Hence, hypothesis H13b is partially accepted.

Further, some of the other differences, which were not significant but needed attention, are listed below.

- The facilitating condition was a significant aspect among young adults and not for middle-aged adults. Social influence played an important role among young and middle-aged adults in developing trust and not for senior adults.
- Social media was critical among young adults in the development of trust and transparency. However, it was critical only in the development of trust for middle-aged adults, and both these aspects were not critical for senior adults.

- **Education**

The factor education has been categorized under three MGA groups: below primary/secondary, graduate, and post-graduation, and above as mentioned previously. These groups were then subjected to pairwise comparison, and the results indicated some of the critical insights explained below (Table 5.22).

From the results, it was observed that awareness in the development of image was significant among graduates and not for Post-graduation and above. Further, the impact of Trust on BI was more substantial among graduates than the other two groups. Similarly, transparency played a significant role in the development of BI among the post-graduation and above group than the other two groups (Table 5.22). The other non-critical observations are that the factors compatibility, relative advantage, and trust were critical among the graduates and not with the other two groups. Hence, hypothesis H13c is partially accepted.

- **Occupation**

The occupation was categorized under five groups: student, self-employed, private employee, government employee, and not currently employed. Here, it is essential to note that the self-employed group had maximum deviations compared to other groups in the invariance test and thus not considered for inferences. However, the results indicated few significant differences across the groups, 'not currently employed,' students, and private employees.

For instance, the results implied a more substantial influence of awareness on compatibility and ease of use among the not currently employed category than the private employees (moderate influence) and students (weaker influence). Further, the influence of awareness on relative advantage was more substantial for government employees than private employees. Also, the impact of awareness on the image was more significant for private employees than students. Social media was found to have a more decisive influence on image enhancement among the not currently employed category than the students (moderate) and private employees (weaker) (Table 5.23 and Table 5.24). It was also observed that students have a stronger belief in social media's role in developing transparency on the m-government system than the other groups. On the other hand, information quality had a more substantial influence on transparency among not currently employed groups than the students. Thus the hypothesis H13d is partially accepted.

Table 5.21: Results of MGA pairwise comparison of age

c1, c2… path coefficients of each group →	Middle-aged (M)		Senior (S)		Young (Y)		M-S		Y-M		Y-S	
	c1	**p**	**c2**	**p**	**c3**	**p**	**c1-c2**	**p**	**c3-c1**	**p**	**c3-c2**	**p**
Awareness → BI	0.015	0.778	-0.106	1.000	0.034	0.607	0.121	1.000	0.018	0.823	0.140	1.000
Awareness → Compatibility	0.397	0.000	0.648	0.000	0.391	0.000	-0.251	0.008	-0.005	0.935	-0.257	0.006
Awareness → Ease of Use	0.471	0.000	0.670	0.000	0.481	0.000	-0.199	0.035	0.010	0.886	-0.189	0.038
Awareness → Image	0.189	0.000	0.349	0.000	0.015	0.746	-0.160	0.118	-0.173	0.017	-0.334	0.002
Awareness → Relative Advantage	0.562	0.000	0.713	0.000	0.598	0.000	-0.151	0.057	0.036	0.557	-0.115	0.129
Compatibility → BI	0.374	0.003	0.358	1.000	0.256	0.018	0.015	1.000	-0.118	0.471	-0.103	1.000
Ease of Use → BI	-0.010	0.932	-0.406	1.000	-0.042	0.648	0.395	1.000	-0.032	0.831	0.363	1.000
Facilitating Condition → BI	0.105	0.427	0.312	1.000	0.223	0.008	-0.207	1.000	0.118	0.447	-0.089	1.000
Image → BI	-0.115	0.024	-0.153	1.000	-0.090	0.044	0.038	1.000	0.025	0.704	0.063	1.000
Image → Social Influence	0.174	0.000	0.277	0.005	0.176	0.000	-0.103	0.342	0.002	0.970	-0.101	0.350
Information Quality → BI	-0.108	0.291	-0.043	1.000	0.077	0.463	-0.065	1.000	0.185	0.207	0.120	1.000
Information Quality → Transparency	0.737	0.000	0.786	0.000	0.630	0.000	-0.049	0.503	-0.107	0.073	-0.156	0.058
Relative Advantage → BI	0.197	0.078	0.258	1.000	0.029	0.792	-0.061	1.000	-0.168	0.281	-0.229	1.000
Social Influence→ BI	-0.055	0.272	-0.031	1.000	0.209	0.001	-0.024	1.000	0.264	0.001	0.240	1.000
Social Influence→ Trust	0.207	0.001	0.093	0.401	0.331	0.000	0.114	0.363	0.124	0.137	0.238	0.060
Social Media → Awareness	0.239	0.000	0.328	0.003	0.262	0.000	-0.089	0.460	0.023	0.756	-0.066	0.576
Social Media → Image	0.119	0.031	0.153	0.125	0.333	0.000	-0.033	0.777	0.214	0.004	0.181	0.105
Social Media → Social Influence	0.313	0.000	0.322	0.008	0.508	0.000	-0.009	0.954	0.195	0.009	0.186	0.154
Social Media → Transparency	0.073	0.079	0.035	0.617	0.192	0.000	0.038	0.615	0.120	0.059	0.157	0.068
Social Media → Trust	0.348	0.000	0.334	0.032	0.282	0.000	0.014	0.958	-0.067	0.448	-0.053	0.731
System Quality → BI	-0.035	0.651	0.136	1.000	0.075	0.377	-0.170	1.000	0.110	0.336	-0.061	1.000
System Quality → Trust	-0.089	0.269	-0.311	0.012	-0.114	0.082	0.223	0.119	-0.025	0.803	0.197	0.147
Transparency → BI	0.192	0.066	-0.201	1.000	-0.030	0.683	0.393	1.000	-0.221	0.081	0.172	1.000
Transparency → Trust	0.249	0.004	0.631	0.000	0.205	0.003	-0.382	0.018	-0.043	0.689	-0.426	0.005
Trust → BI	0.142	0.030	0.482	1.000	0.131	0.035	-0.340	1.000	-0.011	0.904	-0.351	1.000

Table 5.22: Results of MGA pairwise comparison of education

c1, c2… path coefficients of each group →	G		Pg		PS		G-PS		Pg-G		Pg-PS	
	c1	**p**	**c2**	**p**	**c3**	**p**	**c1-c3**	**p**	**c2-c1**	**p**	**c2-c3**	**p**
Awareness → BI	0.003	0.945	0.100	0.139	-0.929	1.000	0.932	0.003	0.097	0.244	1.029	0.003
Awareness → Compatibility	0.420	0.000	0.443	0.000	0.407	0.000	0.013	0.922	0.023	0.734	0.037	0.764
Awareness → Ease of Use	0.501	0.000	0.494	0.000	0.525	0.000	-0.023	0.831	-0.007	0.918	-0.031	0.791
Awareness → Image	0.193	0.000	0.044	0.432	0.088	1.000	0.104	1.000	-0.149	0.035	-0.044	1.000
Awareness → Relative Advantage	0.602	0.000	0.580	0.000	0.721	0.000	-0.119	0.163	-0.022	0.713	-0.141	0.115
Compatibility → BI	0.337	0.003	0.205	0.120	0.001	1.000	0.336	0.025	-0.133	0.434	0.203	0.025
Ease of Use → BI	-0.105	0.280	0.130	0.259	-0.738	1.000	0.633	0.005	0.235	0.109	0.868	0.005
Facilitating Condition → BI	0.198	0.022	0.279	0.013	0.909	1.000	-0.711	0.003	0.081	0.561	-0.630	0.003
Image → BI	-0.100	0.030	-0.042	0.404	-0.739	0.999	0.639	0.008	0.058	0.405	0.697	0.008
Image → Social Influence	0.193	0.000	0.113	0.021	0.453	1.000	-0.261	1.000	-0.079	0.222	-0.340	1.000
Information Quality → BI	0.104	0.221	-0.156	0.172	-0.483	1.000	0.588	0.003	-0.260	0.059	0.328	0.003
Information Quality → Transparency	0.709	0.000	0.670	0.000	0.778	1.000	-0.069	1.000	-0.039	0.530	-0.108	1.000
Relative Advantage → BI	0.188	0.035	-0.116	0.405	1.323	1.000	-1.135	0.011	-0.304	0.061	-1.440	0.011
Social Influence→ BI	-0.005	0.923	-0.007	0.911	0.197	1.000	-0.203	0.017	-0.001	0.988	-0.204	0.017
Social Influence→ Trust	0.256	0.000	0.208	0.002	0.287	1.000	-0.031	1.000	-0.048	0.585	-0.079	1.000
Social Media → Awareness	0.226	0.000	0.302	0.000	0.296	1.000	-0.070	1.000	0.075	0.305	0.006	1.000
Social Media → Image	0.215	0.000	0.253	0.000	0.199	1.000	0.016	1.000	0.038	0.592	0.054	1.000
Social Media → Social Influence	0.402	0.000	0.416	0.000	0.341	1.000	0.061	1.000	0.014	0.850	0.076	1.000
Social Media → Transparency	0.090	0.035	0.141	0.004	0.141	1.000	-0.051	1.000	0.051	0.429	0.000	1.000
Social Media → Trust	0.354	0.000	0.289	0.000	0.235	1.000	0.119	1.000	-0.065	0.458	0.054	1.000
System Quality → BI	0.037	0.602	0.118	0.183	-0.787	1.000	0.823	0.003	0.082	0.472	0.905	0.003
System Quality → Trust	-0.133	0.064	-0.114	0.079	-0.097	1.000	-0.036	1.000	0.018	0.853	-0.017	1.000
Transparency → BI	-0.086	0.307	0.273	0.007	0.273	1.000	-0.359	0.006	0.359	0.005	0.000	0.006
Transparency → Trust	0.174	0.019	0.353	0.000	0.540	1.000	-0.366	1.000	0.179	0.093	-0.186	1.000
Trust → BI	0.191	0.001	0.058	0.466	1.066	0.999	-0.875	0.041	-0.133	0.175	-1.008	0.039

Table 5.23: Results of path coefficients with its statistical significance for each group of occupation

c1, c2… path coefficients of each group →	GE		NCE		PE		SE		St	
	c1	**p**	**c2**	**p**	**c3**	**p**	**c4**	**p**	**c5**	**p**
Awareness → BI	0.227	1.000	0.047	0.972	0.000	0.996	-0.084	1.000	-0.096	0.881
Awareness → Compatibility	0.502	0.000	0.605	0.000	0.386	0.000	0.571	0.000	0.317	0.000
Awareness → Ease of Use	0.542	0.000	0.671	0.000	0.450	0.000	0.667	0.000	0.447	0.000
Awareness → Image	0.290	0.049	0.092	0.304	0.145	0.001	0.305	0.013	-0.036	0.605
Awareness → Relative Advantage	0.735	0.000	0.688	0.000	0.527	0.000	0.708	0.000	0.621	0.000
Compatibility → BI	0.370	1.000	0.667	0.936	0.153	0.169	0.530	1.000	0.149	0.883
Ease of Use → BI	0.280	1.000	-0.498	0.946	0.022	0.821	-0.330	1.000	-0.205	0.684
Facilitating Condition → BI	-0.071	1.000	-0.074	0.990	0.246	0.004	0.507	1.000	0.369	0.682
Image → BI	-0.073	1.000	-0.051	0.937	-0.105	0.026	-0.364	1.000	-0.014	0.944
Image → Social Influence	0.244	0.023	0.089	0.311	0.176	0.000	0.190	1.000	0.236	0.000
Information Quality → BI	-0.017	1.000	0.165	0.954	0.009	0.921	-0.507	1.000	-0.215	0.829
Information Quality → Transparency	0.647	0.000	0.810	0.000	0.687	0.000	0.830	0.000	0.591	0.000
Relative Advantage → BI	-0.034	1.000	0.175	0.905	0.199	0.038	0.145	1.000	0.308	0.806
Social Influence→ BI	-0.309	1.000	0.301	0.861	-0.004	0.938	0.089	1.000	0.165	0.616
Social Influence→ Trust	0.244	0.303	0.108	0.371	0.281	0.000	0.138	1.000	0.247	0.008
Social Media → Awareness	0.469	0.001	0.369	0.000	0.176	0.000	0.416	0.000	0.267	0.001
Social Media → Image	0.108	0.412	0.396	0.000	0.181	0.000	0.098	0.372	0.370	0.000
Social Media → Social Influence	0.503	0.000	0.480	0.000	0.397	0.000	0.165	1.000	0.505	0.000
Social Media → Transparency	0.147	0.210	0.052	0.497	0.105	0.013	-0.019	0.762	0.296	0.000
Social Media → Trust	0.378	0.014	0.284	0.005	0.240	0.000	0.478	1.000	0.451	0.000
System Quality → BI	0.000	1.000	0.199	0.949	0.028	0.716	-0.169	1.000	0.243	0.613
System Quality → Trust	-0.120	0.622	-0.184	0.249	-0.127	0.065	-0.053	1.000	-0.030	0.752
Transparency → BI	0.298	1.000	-0.073	0.982	0.040	0.634	0.077	1.000	0.061	0.859
Transparency → Trust	0.368	0.224	0.476	0.010	0.298	0.000	0.071	1.000	0.088	0.410
Trust → BI	0.286	1.000	0.226	0.842	0.112	0.099	0.541	1.000	0.208	0.264

Table 5.24: Results of MGA pairwise comparison of occupation

c1, c2…path coefficients →	GE-NCE		GE-PE		GE-St		PE-NCE		PE-St		SE-GE		SE-NCE		SE-PE		SE-St		St-NCE	
	c1-c2	**p**	**c1-c3**	**p**	**c1-c5**	**p**	**c3-c2**	**p**	**c3-c5**	**p**	**c4-c1**	**p**	**c4-c2**	**p**	**c4-c3**	**p**	**c4-c5**	**p**	**c5-c2**	**p**
AW → BI	0.18	1.00	0.23	1.00	0.32	1.00	-0.05	0.92	0.10	0.67	-0.31	1.00	-0.13	1.00	-0.08	1.00	0.01	1.00	-0.14	0.79
AW → CMP	-0.10	0.53	0.12	0.43	0.19	0.25	-0.22	0.03	0.07	0.43	0.07	0.69	-0.03	0.79	0.18	0.09	0.25	0.04	-0.29	0.01
AW → EU	-0.13	0.44	0.09	0.51	0.10	0.54	-0.22	0.02	0.00	1.00	0.12	0.46	0.00	0.99	0.22	0.04	0.22	0.07	-0.22	0.05
AW → IM	0.20	0.25	0.15	0.33	0.33	0.06	0.05	0.61	0.18	0.03	0.02	0.94	0.21	0.16	0.16	0.22	0.34	0.02	-0.13	0.26
AW → RA	0.05	0.65	0.21	0.05	0.11	0.30	-0.16	0.05	-0.09	0.21	-0.03	0.82	0.02	0.82	0.18	0.06	0.09	0.39	-0.07	0.46
CMP → BI	-0.30	1.00	0.22	1.00	0.22	1.00	-0.51	0.65	0.00	1.00	0.16	1.00	-0.14	1.00	0.38	1.00	0.38	1.00	-0.52	0.71
EU → BI	0.78	1.00	0.26	1.00	0.48	1.00	0.52	0.60	0.23	0.35	-0.61	1.00	0.17	1.00	-0.35	1.00	-0.13	1.00	0.29	0.95
FC → BI	0.00	1.00	-0.32	1.00	-0.44	1.00	0.32	0.53	-0.12	0.77	0.58	1.00	0.58	1.00	0.26	1.00	0.14	1.00	0.44	0.51
IM → BI	-0.02	1.00	0.03	1.00	-0.06	1.00	-0.05	0.62	-0.09	0.43	-0.29	1.00	-0.31	1.00	-0.26	1.00	-0.35	1.00	0.04	0.92
IM → SI	0.15	0.27	0.07	0.55	0.01	0.94	0.09	0.37	-0.06	0.44	-0.05	1.00	0.10	1.00	0.01	1.00	-0.05	1.00	0.15	0.18
IQ → BI	-0.18	1.00	-0.03	1.00	0.20	1.00	-0.16	0.83	0.22	0.59	-0.49	1.00	-0.67	1.00	-0.52	1.00	-0.29	1.00	-0.38	0.58
IQ → TRN	-0.16	0.19	-0.04	0.78	0.06	0.63	-0.12	0.11	0.10	0.22	0.18	0.11	0.02	0.80	0.14	0.03	0.24	0.00	-0.22	0.02
RA → BI	-0.21	1.00	-0.23	1.00	-0.34	1.00	0.02	1.00	-0.11	0.84	0.18	1.00	-0.03	1.00	-0.05	1.00	-0.16	1.00	0.13	0.87
SI → BI	-0.61	1.00	-0.31	1.00	-0.47	1.00	-0.30	0.10	-0.17	0.28	0.40	1.00	-0.21	1.00	0.09	1.00	-0.08	1.00	-0.14	0.65
SI → T	0.14	0.60	-0.04	0.90	0.00	0.99	0.17	0.19	0.03	0.75	-0.11	1.00	0.03	1.00	-0.14	1.00	-0.11	1.00	0.14	0.36
SM → AW	0.10	0.55	0.29	0.06	0.20	0.22	-0.19	0.08	-0.09	0.32	-0.05	0.75	0.05	0.74	0.24	0.04	0.15	0.26	-0.10	0.41
SM → IM	-0.29	0.07	-0.07	0.57	-0.26	0.08	-0.22	0.03	-0.19	0.01	-0.01	0.96	-0.30	0.04	-0.08	0.47	-0.27	0.04	-0.03	0.79
SM → SI	0.02	0.88	0.11	0.47	0.00	0.99	-0.08	0.43	-0.11	0.18	-0.34	1.00	-0.31	1.00	-0.23	1.00	-0.34	1.00	0.03	0.84
SM → TRN	0.10	0.50	0.04	0.78	-0.15	0.27	0.05	0.55	-0.19	0.02	-0.17	0.19	-0.07	0.46	-0.12	0.10	-0.31	0.00	0.24	0.02
SM → T	0.09	0.55	0.14	0.36	-0.07	0.70	-0.04	0.71	-0.21	0.10	0.10	1.00	0.19	1.00	0.24	1.00	0.03	1.00	0.17	0.25
SQ → BI	-0.20	1.00	-0.03	1.00	-0.24	1.00	-0.17	0.75	-0.22	0.33	-0.17	1.00	-0.37	1.00	-0.20	1.00	-0.41	1.00	0.04	0.72
SQ → T	0.06	0.79	0.01	0.99	-0.09	0.65	0.06	0.73	-0.10	0.41	0.07	1.00	0.13	1.00	0.07	1.00	-0.02	1.00	0.15	0.40
TRN → BI	0.37	1.00	0.26	1.00	0.24	1.00	0.11	0.98	-0.02	0.93	-0.22	1.00	0.15	1.00	0.04	1.00	0.02	1.00	0.13	0.92
TRN → T	-0.11	0.73	0.07	0.76	0.28	0.29	-0.18	0.37	0.21	0.10	-0.30	1.00	-0.40	1.00	-0.23	1.00	-0.02	1.00	-0.39	0.08
T → BI	0.06	1.00	0.17	1.00	0.08	1.00	-0.11	0.59	-0.10	0.45	0.25	1.00	0.31	1.00	0.43	1.00	0.33	1.00	-0.02	0.96

Table 5.25: Results of path coefficients with its statistical significance for each group of income

c1, c2… path coefficients of each group →	i24		i46		i68		i8+		ib2	
	c1	**p**	**c2**	**p**	**c3**	**p**	**c4**	**p**	**c5**	**p**
Awareness → BI	0.147	0.089	-0.120	0.953	0.128	1.000	-0.062	0.441	-0.002	0.986
Awareness → Compatibility	0.460	0.000	0.420	0.000	0.439	0.000	0.259	0.000	0.505	0.000
Awareness → Ease of Use	0.540	0.000	0.569	0.000	0.612	0.000	0.277	0.000	0.554	0.000
Awareness → Image	0.089	0.155	0.132	0.120	0.134	1.000	0.135	0.074	0.115	0.073
Awareness → Relative Advantage	0.660	0.000	0.586	0.000	0.532	0.000	0.438	0.000	0.683	0.000
Compatibility → BI	0.317	0.067	0.307	0.923	0.266	1.000	0.305	0.114	0.125	0.440
Ease of Use → BI	-0.050	0.778	0.083	0.959	0.011	1.000	-0.148	0.249	-0.086	0.644
Facilitating Condition → BI	0.324	0.096	0.213	0.952	0.426	1.000	0.168	0.329	0.245	0.199
Image → BI	-0.103	0.072	-0.080	0.919	-0.106	1.000	-0.186	0.035	-0.105	0.198
Image → Social Influence	0.214	0.000	0.093	0.242	0.217	1.000	0.184	0.007	0.139	0.029
Information Quality → BI	-0.185	0.255	-0.129	0.943	-0.403	1.000	0.205	0.205	0.187	0.345
Information Quality → Transparency	0.703	0.000	0.706	0.000	0.753	0.000	0.587	0.000	0.776	0.000
Relative Advantage → BI	-0.028	0.862	0.141	0.906	0.026	1.000	0.026	0.841	0.412	0.055
Social Influence→ BI	0.072	0.460	-0.074	0.966	-0.071	1.000	0.072	0.383	-0.021	0.849
Social Influence→ Trust	0.288	0.006	0.188	0.064	0.381	0.001	0.268	0.001	0.116	0.155
Social Media → Awareness	0.259	0.000	0.276	0.003	0.177	0.138	0.080	0.303	0.400	0.000
Social Media → Image	0.220	0.001	0.315	0.000	-0.070	1.000	0.088	0.279	0.350	0.000
Social Media → Social Influence	0.382	0.000	0.371	0.000	0.360	1.000	0.419	0.000	0.458	0.000
Social Media → Transparency	0.144	0.021	0.116	0.072	0.073	0.455	0.173	0.017	0.036	0.529
Social Media → Trust	0.336	0.000	0.494	0.000	0.084	0.433	0.099	0.329	0.452	0.000
System Quality → BI	0.117	0.309	0.086	0.950	0.272	1.000	-0.014	0.903	-0.021	0.890
System Quality → Trust	-0.109	0.298	0.012	0.911	-0.013	0.954	-0.097	0.281	-0.215	0.017
Transparency → BI	-0.011	0.943	0.158	0.866	-0.028	1.000	0.072	0.540	-0.104	0.518
Transparency → Trust	0.196	0.143	0.018	0.865	0.334	0.084	0.353	0.000	0.391	0.000
Trust → BI	0.188	0.071	0.294	0.780	0.113	1.000	0.040	0.669	0.184	0.186

Table 5.26: Results of MGA pairwise comparison of income

c1, c2… path coefficients →	i24 - i46		i24 - i68		i24 - i8+		i24 - ib2		i46 - i68		i46 - i8+		i46 - ib2		i68 - i8+		i68 - ib2		ib2 - i8+	
	c1-c2	**p**	**c1-c3**	**p**	**c1-c4**	**p**	**c1-c5**	**p**	**c2-c3**	**p**	**c2-c4**	**p**	**c2-c5**	**p**	**c3-c4**	**p**	**c3-c5**	**p**	**c5-c4**	**p**
AW → BI	0.27	0.15	0.02	1.00	0.21	0.08	0.15	0.29	-0.25	1.00	-0.06	0.74	-0.12	0.54	0.19	1.00	0.13	1.00	0.06	0.64
AW → CMP	0.04	0.70	0.02	0.89	0.20	0.03	-0.04	0.59	-0.02	0.88	0.16	0.16	-0.08	0.43	0.18	0.19	-0.07	0.62	0.25	0.01
AW → EU	-0.03	0.76	-0.07	0.51	0.26	0.01	-0.01	0.88	-0.04	0.72	0.29	0.01	0.02	0.86	0.33	0.01	0.06	0.59	0.28	0.00
AW → IM	-0.04	0.69	-0.04	1.00	-0.05	0.65	-0.03	0.77	0.00	1.00	0.00	0.98	0.02	0.88	0.00	1.00	0.02	1.00	-0.02	0.85
AW → RA	0.07	0.42	0.13	0.25	0.22	0.01	-0.02	0.74	0.05	0.68	0.15	0.15	-0.10	0.28	0.09	0.44	-0.15	0.17	0.24	0.00
CMP → BI	0.01	0.91	0.05	1.00	0.01	0.96	0.19	0.41	0.04	1.00	0.00	0.90	0.18	0.59	-0.04	1.00	0.14	1.00	-0.18	0.46
EU → BI	-0.13	0.69	-0.06	1.00	0.10	0.64	0.04	0.88	0.07	1.00	0.23	0.44	0.17	0.61	0.16	1.00	0.10	1.00	0.06	0.77
FC → BI	0.11	0.84	-0.10	1.00	0.16	0.49	0.08	0.74	-0.21	1.00	0.05	0.75	-0.03	0.96	0.26	1.00	0.18	1.00	0.08	0.71
IM → BI	-0.02	0.68	0.00	1.00	0.08	0.43	0.00	0.99	0.03	1.00	0.11	0.31	0.02	0.72	0.08	1.00	0.00	1.00	0.08	0.49
IM → SI	0.12	0.23	0.00	1.00	0.03	0.74	0.08	0.39	-0.12	1.00	-0.09	0.38	-0.05	0.65	0.03	1.00	0.08	1.00	-0.05	0.63
IQ → BI	-0.06	0.88	0.22	1.00	-0.39	0.08	-0.37	0.13	0.27	1.00	-0.33	0.20	-0.32	0.26	-0.61	1.00	-0.59	1.00	-0.02	0.95
IQ → TRN	0.00	0.97	-0.05	0.58	0.12	0.21	-0.07	0.32	-0.05	0.63	0.12	0.24	-0.07	0.41	0.17	0.13	-0.02	0.83	0.19	0.05
RA → BI	-0.17	0.73	-0.05	1.00	-0.05	0.78	-0.44	0.08	0.12	1.00	0.12	0.84	-0.27	0.46	0.00	1.00	-0.39	1.00	0.39	0.09
SI → BI	0.15	0.27	0.14	1.00	0.00	1.00	0.09	0.52	0.00	1.00	-0.15	0.24	-0.05	0.61	-0.14	1.00	-0.05	1.00	-0.09	0.49
SI → T	0.10	0.49	-0.09	0.54	0.02	0.87	0.17	0.20	-0.19	0.20	-0.08	0.54	0.07	0.59	0.11	0.41	0.26	0.06	-0.15	0.19
SM → AW	-0.02	0.88	0.08	0.56	0.18	0.09	-0.14	0.12	0.10	0.51	0.20	0.11	-0.12	0.25	0.10	0.48	-0.22	0.08	0.32	0.00
SM → IM	-0.10	0.32	0.29	1.00	0.13	0.20	-0.13	0.15	0.39	1.00	0.23	0.04	-0.03	0.72	-0.16	1.00	-0.42	1.00	0.26	0.01
SM → SI	0.01	0.95	0.02	1.00	-0.04	0.73	-0.08	0.48	0.01	1.00	-0.05	0.72	-0.09	0.51	-0.06	1.00	-0.10	1.00	0.04	0.70
SM → TRN	0.03	0.75	0.07	0.52	-0.03	0.76	0.11	0.19	0.04	0.70	-0.06	0.55	0.08	0.35	-0.10	0.40	0.04	0.75	-0.14	0.13
SM → T	-0.16	0.21	0.25	0.09	0.24	0.09	-0.12	0.36	0.41	0.01	0.40	0.00	0.04	0.73	-0.01	0.90	-0.37	0.02	0.35	0.01
SQ → BI	0.03	0.88	-0.15	1.00	0.13	0.41	0.14	0.46	-0.19	1.00	0.10	0.63	0.11	0.64	0.29	1.00	0.29	1.00	-0.01	0.97
SQ → T	-0.12	0.41	-0.10	0.72	-0.01	0.92	0.11	0.44	0.02	0.89	0.11	0.43	0.23	0.10	0.08	0.75	0.20	0.41	-0.12	0.35
TRN → BI	-0.17	0.47	0.02	1.00	-0.08	0.67	0.09	0.67	0.19	1.00	0.09	0.66	0.26	0.28	-0.10	1.00	0.08	1.00	-0.18	0.36
TRN → T	0.18	0.30	-0.14	0.53	-0.16	0.32	-0.19	0.26	-0.32	0.16	-0.33	0.02	-0.37	0.02	-0.02	0.95	-0.06	0.82	0.04	0.79
T → BI	-0.11	0.60	0.07	1.00	0.15	0.29	0.00	0.97	0.18	1.00	0.25	0.18	0.11	0.62	0.07	1.00	-0.07	1.00	0.14	0.38

- **Income**

As mentioned earlier income has been categorized under 5 groups viz. below 20,000 INR (gb2), 20,000-40,000 INR (g24), 40,000-60,000 INR (g46), 60,000-80,000 INR (g68) and above 80,000 INR (g8+). The pairwise comparison results of the groups are reported, and key observations have been listed below. There were no significant differences among the groups for the major predictors of BI, which were hypothesized in the study.

However, few other observations that had critical differences among the groups are listed below. First, the differences were observed among the groups on social media's role in developing trust. Here, the groups with income above 60,000 INR did not strongly perceive the role of social media towards the development of trust, which is significantly contrary to the other groups (Table 5.25 and Table 5.26). The results also indicated few significant differences between the groups, especially with income levels above 80,000 INR and groups with income below 20,000 on the dimensions such as information quality to transparency, social media on awareness, image, and trust. Here, the lower-income group perceived social media to play a more vital role in developing awareness and trust towards m-government. Further, they perceived information quality as critical in the development of transparency. Moreover, the higher income group (g8+) had a very low influence of awareness on relative advantage, ease of use, and compatibility than the other groups.

The differences were also observed for the relationship between transparency to trust for the group with income level 40,000 to 60,000 INR (significantly lower effect) with groups of income level below 20,000 INR and Above 80,000 INR, which had a more substantial impact. With these mixed results for the various paths in the m-government adoption model, it can be said that hypothesis H13e is partially accepted.

- **Place - Bengaluru versus Other Cities**

Bengaluru is one of the metropolitan cities of the country with a lot of growth and developments thereby having an impact on an individual's lifestyle. However, all the other smart cities are not of this kind and are mainly semi-urban cities, and thus comparison between the two might show some differences among the individual towards m-government adoption. With this aim, a comparison of these two groups is carried, and the results indicated few differences in the m-government adoption behaviour (Table 5.27).

Table 5.27: Results of MGA pairwise comparison of Bengaluru versus Others

c1, c2… path coefficients of each group →	Bengaluru (Bn)		Others		Bn-Others	
	c1	p	c2	p	c1-c2	p
Awareness → BI	0.052	0.300	-0.049	0.521	0.101	0.268
Awareness → Compatibility	0.302	0.000	0.570	0.000	-0.267	0.000
Awareness → Ease of Use	0.423	0.000	0.589	0.000	-0.166	0.008
Awareness → Image	0.098	0.020	0.177	0.001	-0.079	0.236
Awareness → Relative Advantage	0.509	0.000	0.709	0.000	-0.200	0.000
Compatibility → BI	0.345	0.000	0.106	0.425	0.240	0.149
Ease of Use → BI	-0.100	0.202	-0.047	0.776	-0.053	0.775
Facilitating Condition → BI	0.259	0.004	0.187	0.080	0.072	0.593
Image → BI	-0.072	0.049	-0.098	0.113	0.026	0.707
Image → Social Influence	0.150	0.000	0.254	0.000	-0.104	0.094
Information Quality → BI	0.032	0.752	-0.050	0.649	0.081	0.581
Information Quality → Transparency	0.605	0.000	0.780	0.000	-0.175	0.002
Relative Advantage → BI	0.052	0.508	0.336	0.042	-0.283	0.117
Social Influence→ BI	0.143	0.004	-0.008	0.882	0.151	0.048
Social Influence→ Trust	0.274	0.000	0.203	0.000	0.070	0.360
Social Media → Awareness	0.214	0.000	0.307	0.000	-0.093	0.183
Social Media → Image	0.217	0.000	0.235	0.000	-0.019	0.795
Social Media → Social Influence	0.550	0.000	0.234	0.000	0.316	0.000
Social Media → Transparency	0.193	0.000	0.074	0.036	0.118	0.042
Social Media → Trust	0.319	0.000	0.322	0.000	-0.003	0.962
System Quality → BI	0.099	0.224	-0.034	0.647	0.132	0.221
System Quality → Trust	-0.184	0.002	-0.039	0.610	-0.145	0.127
Transparency → BI	0.001	0.986	0.076	0.499	-0.075	0.575
Transparency → Trust	0.282	0.000	0.242	0.005	0.040	0.709
Trust → BI	0.140	0.006	0.205	0.021	-0.065	0.528

The results indicated that the information quality had a much more substantial impact on transparency for other cities than Bengaluru. On the contrary, social media had a significant impact on transparency and social influence among individuals from Bangalore. Also, social influence was found to have a considerable effect on BI for the citizens from Bengaluru and was not significant for the citizens from other cities (Table 5.27). Moreover, awareness was found to have a more substantial influence among the citizens of other cities towards developing relative advantage, ease of use, and compatibility. Hence, the hypothesis H13g is partially accepted.

Table 5.28: Results of path coefficients with its statistical significance for each group of place

c1, c2… path coefficients of each group →	Belagavi (Bel)		Bengaluru (Bn)		Hubballi-Dharwad (HD)		Mangaluru (M)	
	c1	**p**	**c2**	**p**	**c3**	**p**	**c4**	**p**
Awareness → BI	-0.519	1.000	0.052	0.310	0.655	1.000	0.090	0.986
Awareness → Compatibility	0.831	0.000	0.302	0.000	0.472	0.000	0.320	0.001
Awareness → Ease of Use	0.896	0.000	0.423	0.000	0.414	0.001	0.320	0.003
Awareness → Image	0.756	0.000	0.098	0.024	0.141	1.000	-0.076	0.392
Awareness → Relative Advantage	0.879	0.000	0.509	0.000	0.587	0.000	0.598	0.000
Compatibility → BI	-1.995	1.000	0.345	0.001	-0.601	1.000	0.191	0.914
Ease of use → BI	6.598	1.000	-0.100	0.187	1.742	1.000	-0.073	0.987
Facilitating Condition → BI	0.185	1.000	0.259	0.004	-0.869	1.000	0.182	0.955
Image → BI	0.278	1.000	-0.072	0.049	-0.048	1.000	-0.006	0.997
Image → Social Influence	0.391	1.000	0.150	0.000	0.156	1.000	0.099	0.246
Information Quality → BI	2.619	1.000	0.032	0.749	0.525	1.000	-0.108	0.970
Information Quality → Transparency	0.914	0.000	0.605	0.000	0.763	0.000	0.574	0.000
Relative Advantage → BI	-3.149	1.000	0.052	0.501	-0.745	1.000	0.183	0.986
Social Influence→ BI	-0.809	1.000	0.143	0.003	0.533	1.000	0.191	0.841
Social Influence→ Trust	0.341	1.000	0.274	0.000	0.203	0.056	0.334	0.001
Social Media → Awareness	0.430	0.000	0.214	0.000	0.161	0.222	0.188	0.081
Social Media → Image	-0.044	0.615	0.217	0.000	0.212	1.000	0.368	0.000
Social Media → Social Influence	0.075	1.000	0.550	0.000	0.350	1.000	0.382	0.000
Social Media → Transparency	0.020	0.713	0.193	0.000	-0.019	0.834	0.266	0.003
Social Media → Trust	0.377	1.000	0.319	0.000	0.241	0.062	0.228	0.052
System Quality → BI	-1.643	1.000	0.099	0.221	-0.076	1.000	0.116	0.869
System Quality → Trust	0.043	1.000	-0.184	0.002	-0.011	0.938	-0.216	0.139
Transparency → BI	-0.705	1.000	0.001	0.986	0.308	1.000	0.296	0.875
Transparency → Trust	-0.046	1.000	0.282	0.000	0.403	0.003	0.397	0.036
Trust → BI	-1.023	1.000	0.140	0.008	-0.231	1.000	-0.028	0.994

Table 5.29: Results of MGA pairwise comparison of place

c1, c2…path coefficients of each group →	Bel-Bn		Bel-HD		Bel-M		Bn-HD		Bn-M		HD-M	
	c1-c2	**p**	**c1-c3**	**p**	**c1-c4**	**p**	**c2-c3**	**p**	**c2-c4**	**p**	**c3-c4**	**p**
Awareness → BI	-0.571	1.000	-1.174	1.000	-0.609	1.000	-0.603	1.000	-0.038	0.685	0.565	1.000
Awareness → Compatibility	0.529	1.000	0.359	0.000	0.512	0.000	-0.170	0.100	-0.017	0.859	0.153	0.245
Awareness → Ease of Use	0.474	1.000	0.482	0.000	0.577	1.000	0.008	0.978	0.103	0.385	0.095	0.568
Awareness → Image	0.658	1.000	0.615	1.000	0.832	1.000	-0.043	1.000	0.174	0.076	0.217	1.000
Awareness → Relative Advantage	0.370	1.000	0.292	0.001	0.281	0.001	-0.078	0.418	-0.089	0.316	-0.010	0.942
Compatibility → BI	-2.340	1.000	-1.394	1.000	-2.186	1.000	0.947	1.000	0.154	0.506	-0.792	1.000
EU → BI	6.698	1.000	4.856	1.000	6.671	1.000	-1.842	1.000	-0.027	0.722	1.815	1.000
FC → BI	-0.074	1.000	1.054	1.000	0.003	1.000	1.128	1.000	0.077	0.472	-1.051	1.000
Image → BI	0.350	1.000	0.326	1.000	0.284	1.000	-0.024	1.000	-0.065	0.807	-0.042	1.000
Image → Social Influence	0.241	1.000	0.235	1.000	0.292	1.000	-0.006	1.000	0.051	0.586	0.057	1.000
Information Quality → BI	2.587	1.000	2.094	1.000	2.727	1.000	-0.493	1.000	0.140	0.357	0.633	1.000
Information Quality → Transparency	0.309	0.000	0.151	0.104	0.340	0.000	-0.158	0.083	0.032	0.756	0.189	0.091
Relative Advantage → BI	-3.201	1.000	-2.405	1.000	-3.332	1.000	0.797	1.000	-0.130	0.240	-0.927	1.000
Social Influence→ BI	-0.951	1.000	-1.342	1.000	-0.999	1.000	-0.391	1.000	-0.048	0.798	0.342	1.000
Social Influence→ Trust	0.067	1.000	0.138	1.000	0.007	1.000	0.071	0.559	-0.060	0.584	-0.130	0.363
Social Media → Awareness	0.217	0.062	0.270	0.072	0.243	0.102	0.053	0.696	0.026	0.823	-0.027	0.897
Social Media → Image	-0.261	0.012	-0.256	1.000	-0.412	0.004	0.005	1.000	-0.152	0.145	-0.156	1.000
Social Media → Social Influence	-0.475	1.000	-0.275	1.000	-0.307	1.000	0.200	1.000	0.168	0.118	-0.032	1.000
Social Media → Transparency	-0.173	0.018	0.039	0.717	-0.246	0.015	0.212	0.036	-0.073	0.471	-0.285	0.022
Social Media → Trust	0.058	1.000	0.136	1.000	0.149	1.000	0.078	0.541	0.091	0.475	0.013	0.938
System Quality → BI	-1.742	1.000	-1.567	1.000	-1.759	1.000	0.174	1.000	-0.018	0.910	-0.192	1.000
System Quality → Trust	0.227	1.000	0.054	1.000	0.259	1.000	-0.173	0.265	0.032	0.834	0.205	0.312
Transparency → BI	-0.706	1.000	-1.013	1.000	-1.000	1.000	-0.307	1.000	-0.294	0.217	0.013	1.000
Transparency → Trust	-0.328	1.000	-0.448	1.000	-0.442	1.000	-0.120	0.402	-0.114	0.538	0.006	0.982
Trust → BI	-1.162	1.000	-0.791	1.000	-0.995	1.000	0.371	1.000	0.168	0.656	-0.203	1.000

Table 5.30: Results of MGA pairwise comparison of SM experience

c1, c2… path coefficients of each group →	High		Low		Medium		H-L		H-M		M-L	
	c1	**p**	**c2**	**p**	**c3**	**p**	**c1-c2**	**p**	**c1-c3**	**p**	**c3-c2**	**p**
Awareness → BI	0.042	0.619	0.043	0.731	-0.012	0.836	-0.001	0.999	0.054	0.588	-0.055	0.645
Awareness → Compatibility	0.437	0.000	0.485	0.000	0.340	0.000	-0.048	0.559	0.097	0.199	-0.145	0.067
Awareness → Ease of Use	0.463	0.000	0.612	0.000	0.418	0.000	-0.149	0.077	0.045	0.553	-0.194	0.014
Awareness → Image	0.013	0.844	0.125	0.089	0.161	0.000	-0.112	0.249	-0.149	0.058	0.036	0.675
Awareness → Relative Advantage	0.587	0.000	0.683	0.000	0.530	0.000	-0.096	0.182	0.057	0.408	-0.153	0.030
Compatibility → BI	0.211	0.159	0.408	0.019	0.162	0.156	-0.197	0.358	0.049	0.792	-0.246	0.209
Ease of Use → BI	-0.106	0.399	-0.088	0.771	-0.121	0.215	-0.018	0.938	0.015	0.917	-0.033	0.877
Facilitating Condition → BI	0.160	0.225	0.245	0.437	0.324	0.001	-0.085	0.748	-0.164	0.308	0.079	0.699
Image → BI	0.058	0.305	-0.105	0.203	-0.128	0.004	0.163	0.106	0.186	0.011	-0.023	0.817
Image → Social Influence	0.140	0.026	0.328	0.000	0.119	0.002	-0.188	0.036	0.021	0.785	-0.209	0.006
Information Quality → BI	0.088	0.546	-0.028	0.927	-0.082	0.457	0.116	0.617	0.170	0.340	-0.054	0.773
Information Quality → Transparency	0.708	0.000	0.706	0.000	0.626	0.000	0.002	0.975	0.083	0.264	-0.081	0.224
Relative Advantage → BI	0.204	0.246	0.148	0.604	0.081	0.378	0.056	0.827	0.123	0.524	-0.067	0.769
Social Influence→ BI	0.184	0.005	-0.095	0.277	0.186	0.003	0.280	0.010	-0.001	0.985	0.281	0.010
Social Influence→ Trust	0.349	0.000	0.243	0.008	0.183	0.004	0.106	0.347	0.166	0.071	-0.060	0.592
Social Media → Awareness	0.253	0.000	0.280	0.000	0.228	0.000	-0.027	0.780	0.024	0.767	-0.051	0.565
Social Media → Image	0.354	0.000	0.213	0.004	0.204	0.000	0.140	0.142	0.150	0.050	-0.010	0.918
Social Media → Social Influence	0.452	0.000	0.170	0.043	0.613	0.000	0.282	0.008	-0.161	0.027	0.443	1.000
Social Media → Transparency	0.105	0.078	0.067	0.225	0.229	0.000	0.038	0.643	-0.125	0.107	0.163	0.029
Social Media → Trust	0.296	0.000	0.274	0.001	0.320	0.000	0.022	0.869	-0.024	0.810	0.046	0.671
System Quality → BI	0.018	0.861	-0.045	0.762	0.158	0.061	0.063	0.681	-0.139	0.293	0.203	0.177
System Quality → Trust	-0.132	0.117	0.026	0.796	-0.200	0.008	-0.158	0.223	0.068	0.539	-0.226	0.068
Transparency → BI	0.108	0.326	0.001	0.996	0.070	0.404	0.107	0.573	0.038	0.785	0.069	0.695
Transparency → Trust	0.256	0.003	0.136	0.227	0.371	0.000	0.120	0.400	-0.115	0.309	0.235	0.082
Trust → BI	-0.021	0.769	0.124	0.231	0.227	0.001	-0.145	0.236	-0.248	0.011	0.102	0.399

Table 5.31: Results of MGA pairwise comparison of EG experience

c1, c2… path coefficients of each group →	EG_No		EG_Yes		EG_Yes-EG_No	
	c1	**p**	**c2**	**p**	**c1-c2**	**p**
Awareness → BI	-0.022	0.743	0.031	0.516	0.053	0.522
Awareness → Compatibility	0.412	0.000	0.371	0.000	-0.041	0.540
Awareness → Ease of Use	0.469	0.000	0.467	0.000	-0.003	0.965
Awareness → Image	0.168	0.001	0.117	0.005	-0.051	0.445
Awareness → Relative Advantage	0.589	0.000	0.565	0.000	-0.025	0.672
Compatibility → BI	0.306	0.018	0.231	0.013	-0.075	0.642
Ease of Use → BI	0.014	0.918	-0.087	0.242	-0.100	0.507
Facilitating Condition → BI	0.025	0.832	0.272	0.000	0.248	0.074
Image → BI	-0.184	0.000	-0.064	0.145	0.120	0.073
Image → Social Influence	0.165	0.002	0.215	0.000	0.050	0.448
Information Quality → BI	-0.074	0.602	0.004	0.952	0.078	0.617
Information Quality → Transparency	0.732	0.000	0.679	0.000	-0.053	0.331
Relative Advantage → BI	0.096	0.478	0.181	0.028	0.084	0.591
Social Influence→ BI	0.119	0.106	0.063	0.164	-0.056	0.517
Social Influence→ Trust	0.169	0.018	0.285	0.000	0.116	0.178
Social Media → Awareness	0.233	0.000	0.224	0.000	-0.009	0.894
Social Media → Image	0.239	0.000	0.224	0.000	-0.015	0.825
Social Media → Social Influence	0.346	0.000	0.415	0.000	0.069	0.392
Social Media → Transparency	0.052	0.251	0.153	0.000	0.102	0.089
Social Media → Trust	0.383	0.000	0.273	0.000	-0.109	0.240
System Quality → BI	0.222	0.063	-0.013	0.823	-0.235	0.070
System Quality → Trust	-0.085	0.345	-0.120	0.033	-0.035	0.740
Transparency → BI	-0.093	0.331	0.075	0.341	0.168	0.176
Transparency → Trust	0.217	0.016	0.294	0.000	0.078	0.483
Trust → BI	0.299	0.000	0.113	0.057	-0.186	0.059

- **Place - Bengaluru versus Hubballi-Dharwad versus Mangaluru**

The subsequent comparison was among the cities Bengaluru, Hubballi-Dharwad, and Mangaluru. It is important to note that the smaller cities such as Davangere, Shivamogga, and Tumakuru are not considered in MGA due to smaller sample sizes. Further, the Belagavi city has been excluded due to the failure to meet the invariance condition (Table 5.28, Table 5.29). With these assumptions, results indicated no significant differences among the cities.

However, the only comparable difference was between the relationship of social media to transparency among the cities Bengaluru, Hubballi-Dharwad, and Mangaluru. The results indicated that the citizens had a more substantial positive impact of Social media on transparency among the citizens of Mangaluru and then among Bengaluru. However, the people from Hubballi-Dharwad city perceived the role of social media on transparency negatively. Hence, hypothesis H13f is partially accepted.

- **EG Experience**

The study here tries to assess whether the citizens with prior EG experience exhibit a different adoption behaviour than citizens with no EG experience. The results on the comparison of the two groups indicated no significant differences between the two indicating the absence of moderation effect of EG experience on m-government adoption (Table 5.31). Thus the hypothesis H13h is rejected.

However, few insights observed between the groups, though these differences were not significant, are pointed out below. The factors facilitating condition, relative advantage on BI, social media on transparency on trust had substantial influence among individuals with prior EG experience. On the contrary, the factors trust and system quality significantly influenced BI for groups without EG experience (Table 5.31).

- **SM Experience**

The results of MGA for SM experience reflected on few critical insights on the relationships between variables. For instance, the impact of awareness on relative advantage and ease of use was more decisive for low frequent users. Similarly, the image on social influence was stronger for low frequent users of social media. The influence of social influence on BI was significant among high and medium frequent users and not for low frequent users of social media. Even the social media impact on social influence was stronger for medium and high frequent users than low frequent users of social media. The effect of trust on BI was significant only for the medium frequent users (Table 5.30). Hence with these mixed results, the hypothesis H13k is partially accepted.

- **M-government Experience**

The MGA on m-government experience could not be performed due to the failure to attain measurement invariance of the data across the groups. Hence, no further analysis could be conducted, and thus no conclusions were made on hypothesis H13j.

The summary of results and its hypotheses for moderation analysis of demographic factors are presented in Table 5.32 and Table 5.33 below.

Table 5.32: Summary of moderation analysis results for demographic factors

Moderator	Summary of Results from Moderation Analysis
Gender	• The facilitating condition was significant among males than females.
Age	• Three groups, young, middle-aged, older adults, are considered for comparison, and the elderly (above 60) were not considered. • The indirect influence of awareness through attitudinal factors was more substantial for senior adults and much lower for younger adults. • Impact of transparency to trust was more substantial among senior and middle-aged adults and lesser for young adults. • SM on image and social influence on BI was stronger for young adults.
Education	• The impact of trust on BI was more substantial among the graduates. • Impact of transparency to BI was significant for the group with postgraduate and above level of education.
Occupation	• Self-employed is excluded in comparison. • The indirect effect of awareness and SM influence on the image was significant for not currently employed groups than private employees. • Government employees had a more substantial influence of awareness on relative advantage than private employees.

	• Impact of image on social influence and social media on transparency was significantly higher among students than other groups.
Income	• The indirect effect of awareness decreased with the increase in income. • The influence of social media on awareness, image, and trust and also information quality to transparency was stronger with lower income groups (below 20,000INR) than others • The impact of transparency to trust was significantly lower among middle-income groups (g46 and g24) than the others.
Place (B vs O)	• The indirect effect of awareness was more substantial among citizens from other cities than from Bengaluru. • Information quality has a stronger impact on transparency in others cities, and SM strongly influences transparency in Bengaluru.
Place (Each City)	• Belagavi and Smaller Cities were excluded (non invariant). • Social media to transparency had a stronger influence among the citizens from Bengaluru and Mangaluru. • Impact of information quality on transparency was more substantial for citizens from Hubballi/Dharwad.
SM Exp	• Awareness had a critical indirect role for low frequent users of SM. Also, for low frequent users impact of image on social influence was stronger. • Social media impact on social influence and social influence on BI was more substantial among high and medium frequent users.

Table 5.33: Summary of hypotheses results for moderation analysis

	Hypotheses	**Inference**
H13a:	The relationships between variables of m-government adoption show statistically significant differences between males and females.	Accepted
H13b:	The relationships between variables of m-government adoption show statistically significant differences across age groups.	Accepted
H13c:	The relationships between variables of m-government adoption show statistically significant differences across education categories.	Accepted
H13d:	The relationships between variables of m-government adoption show statistically significant differences across occupation categories.	Accepted
H13e:	The relationships between variables of m-government adoption show statistically significant differences across groups with different income levels.	Accepted
H13f:	The relationships between variables of m-government adoption show statistically significant differences between people from various smart cities of Karnataka.	Accepted
H13g:	The relationships between variables of m-government adoption show statistically significant differences between people of Bengaluru and other cities.	Accepted
H13h:	The relationships between variables of m-government adoption show statistically significant differences between people with and without EG experience.	Rejected
H13i:	The relationships between variables of m-government adoption show statistically significant differences across citizens with varying m-government experiences.	Non Conclusive
H13j:	The relationships between variables of m-government adoption show statistically significant differences across citizens with varying SM experiences.	Accepted

Chapter 6
DISCUSSIONS AND IMPLICATIONS

6.1 OVERVIEW

The chapter presents a detailed discussion on the study's key findings. The first section focuses on understanding the impact of predictors of m-government adoption towards the intention to use these services. Here, the relationship between the variables both as direct effect and the mediation effect are explored and presented. The section then discusses the moderating influence of the demographic variables using MGA for all the relationships in the conceptual model on m-government adoption. Further, the chapter provides significant implications for academic researchers and policymakers in m-government services, primarily for Karnataka's smart cities.

6.2 DISCUSSIONS

6.2.1 Role of Awareness in M-government Adoption

The study examines the impact of citizen awareness on Behavioural Intention (BI) to use m-government services. Here, the results found the direct relationship between the two variables to be insignificant. The results, however, revealed the significance of awareness's indirect effect on attitudinal factors such as relative advantage, ease of use, compatibility, and image. These findings align with the works of Mandari et al. (2017) and Ohme (2014). In these studies, awareness had a negligible direct impact on the intention to use m-government but had a significant indirect effect on attitudinal aspects. It implies that individuals should be aware of the benefits of m-government, its role in current trends and lifestyle, and its image in society. It then leads to the development of a favourable attitude toward m-government. Examining these specific indirect aspects, rather than the direct relationship, is critical, and the study has provided detailed insights into this.

The study also attempted to determine whether these indirect effects significantly affect behavioural intention, where these attitudinal aspects play a mediating role. The findings revealed that relative advantage and compatibility factors play an important role as mediators, whereas ease of use and image failed to prove mediation effect. Even though the previous studies did not extensively investigate these aspects, the work by Mandari (2017) found similar relationships except for ease of use, which yielded opposite results. As a result, it can be concluded that awareness of specific aspects such as relative advantage and compatibility are critical factors that will play a significant role in increasing the intention to use m-government services. It will also be true for the proposed Smart cities of Karnataka.

Furthermore, previous research has demonstrated the relationship between image and social influence, and social influence and trust (Liu et al., 2014). As a result, in the study, these relationships form a few indirect paths in which image, social influence, and trust mediate between awareness and BI. These connections are investigated further and the findings demonstrated the importance of image as a mediator between awareness and social influence. However, the mediation path (awareness→ image→ social influence→ behavioural intention) was proven insignificant in this case, with the role of social influence to BI being insignificant. On the other hand, the results showed that image and social influence mediate the relationship between awareness and trust. In a similar vein, Liu et al. (2014) found the importance of image on social influence and social influence on trust in their study. It also found the importance of trust in the long-term usefulness of m-government services.

It is consistent with current findings that image, social influence, and trust play a role in mediating the relationship between awareness and behavioural intention. The results of previous studies Liu et al. (2014), Mandari (2017), Mandari et al. (2017) would adequately support the findings of this study. The key takeaway from these findings is that knowing about various aspects of m-government, such as relative advantage and compatibility, is more important than merely being aware of its presence. People who believe that image is an important criterion are more likely to wield social power because they may attempt to present themselves to others or listen to others in light of image formation. Others' influence would then strongly support an increase in trust in these services. These aspects then lead to an enhanced favourable intention to use m-government services.

6.2.2 Impact of Attitudinal Factors on Behavioral Intention

The modified DOI theory (Moore & Benbasat, 1991) discusses four main persuading factors influencing m-government services, and the study's attitudinal factors are derived from that theory. The results revealed the significance of relative advantage in affecting the intention to use m-government services. It implies that the citizens will adopt m-government services if they strongly perceive m-government services as beneficial on various dimensions. Further, the result shows that people think m-government facilities are the best alternative to EG and conventional physical offices (mean value of 4.1). The benefits of these services, such as convenience, time savings, and overall efficiency, are critical. The government should effectively manage these services so that the people can reap the maximum benefits. Previous research has also demonstrated the importance of relative advantage in the successful adoption of m-government among citizens (Kapoor et al., 2015; Mandari et al., 2017; Mandari & Chong, 2018; Shareef et al., 2012; C. Wang et al., 2020).

Furthermore, the results showed that ease of use had no significant influence on m-government adoption. Even though these findings contradict some previous studies, there are a few studies that support this relationship. For example, Ahmad and Khalid (2017) and Aloudat et al. (2014) discovered that the EU had no significant influence on m-government attitude. Similarly, C. Wang (2014) found that the EU made no substantial contribution to the perceived value of m-government services. The probable reason could be that the respondents are well-educated and have adequate experience with these digital technologies. Moreover, with the dominance of digital services, such as online shopping, people are now well versed in these similar technologies. Hence, ease of use has not been a critical factor in the adoption of m-government services.

The other attitudinal aspect is compatibility, and this had a significant influence on m-government adoption. It is a vital factor because it is a conative aspect of attitude that directly affects an individual's behaviour (Shareef, Kumar, et al., 2016). The findings of this study are backed up by previous research by Abu-Shanab and Haider (2015), Kapoor et al. (2015), Mandari et al. (2017), Mandari and Chong (2018). However, the findings contradict the observations of Saxena (2017), Shareef, Kumar et al. (2016).

The results are apparent because anything mobile-based, such as shopping, gaming, and so on, is a current trend. M-government thus fits very well with the lifestyle of the majority of citizens, as almost everyone uses this technology. Consequently, it is critical for m-government services and related applications to keep up with changing trends and technologies to achieve widespread adoption among citizens. For example, the current trend in financial transactions is based on a unique payment interface (UPI), and the government should incorporate this system into its m-government services to ensure their success.

Another similar component is determining whether using m-government services is viewed as an image enhancer in people's social lives. The findings indicated that image had a negative influence due to suppression effect (detailed in the section 5.8.1.1) and not because of its actual relationship with BI. Hence due to inadequate empirical evidence, the study rejected the hypothesis. However, image has a vital role in strengthening social influence and trust in the system. Moreover, the findings revealed that people do not consider the image as an essential factor in m-government services as its mean value (i.e., 2.85) is below the average value. Previous research, for example, by Kapoor et al. (2015), Liu et al. (2014), Mandari et al. (2017), Mandari & Chong (2018), Shareef, Kumar et al. (2016) demonstrated the insignificance of the image on m-government services. It reflects that people do not regard the image as a critical factor in m-government adoption and this is consistent with the current study's findings (lower mean value of the image to BI).

The image, as previously mentioned, was also found to have a significant impact on social influence, which is consistent with previous findings by Liu et al. (2014). As a result, the significance of indirect paths (image → social influence → trust) and (image → social influence → trust → BI) was demonstrated. However, the path (image → social influence → BI) was not significant and thus rejected. This probably is due to the insignificance of social influence on BI. As a result, social influence and trust serve as active mediating variables in the relationship between image and behavioural intention. Liu et al. (2014) also emphasized the importance of the trust factors benevolence and integrity in the long-term use of m-government services.

These findings imply that citizens in these proposed smart cities of Karnataka do not consider the image as an essential factor in m-government adoption. However, it plays a critical indirect role in enhancing the social influence and trust and thus strengthens the intention to use m-government services. Understanding these relationships is beneficial for future effective decision-making concerning new m-government services that, if any, require image orientation.

6.2.3 Means of Reducing Uncertainty

Transparency and trust are two major factors in the URT that play a critical role in reducing service uncertainty. As a result, the study attempted to investigate the impact of these two factors on behavioural intention to use m-government services, both directly and indirectly.

Transparency is a crucial feature of a system that reflects how open and clear it is with its users. The study's findings indicated that transparency had no direct impact on the intention to use m-government, but it significantly impacted trust. Similarly, Ekaabi et al. (2020) and Reddick et al. (2020) discovered that transparency has a negligible direct influence on satisfaction when these variables are estimated freely without any control variables. Furthermore, the outcome contradicted some previous research findings (Shahzad et al., 2019; Venkatesh et al., 2016; G. Wang et al., 2020). Even though the findings contradict a few previous studies, this study demonstrates the importance and role of the indirect effect of transparency.

The study's findings revealed that transparency has a significant positive impact on the development of trust. Furthermore, it was discovered that trust positively mediated the relationship between transparency and intention to use m-government. Previous research by Z. Chen et al. (2016), Shahzad et al. (2019), Venkatesh et al. (2016), and G. Wang et al. (2020) found similar results. These findings highlight the importance of transparency's indirect effect on the development of trust which influences behavioural intention. It is because a highly transparent system reflects on the open communication by the government on all the aspects of m-government services. It then promptly would enhance the citizen's understanding of these services, which in turn, reduces the physical interaction of citizens with government services providers. Therefore, it minimizes the uncertainty about these m-government services and contributes significantly to the development of trust and subsequently impacts its adoption.

One of the significant findings of this study is an investigation into the role of trust in m-government adoption. Trust was also found to be a crucial factor, positively impacting m-government adoption. The results also revealed that trust played a significant positive role in mediating behavioral intention with the other variables. Furthermore, the results showed an average level of trust among citizens (mean score of 3.4), indicating that a certain number of citizens still have a lower level of trust in these services, which is a cause of concern. These findings are also validated in most of the previous studies in the field of m-government (Ahmad & Khalid, 2017; Alharbi et al., 2020; Aloudat & Michael, 2011; Hung et al., 2013; Lopes et al., 2019; Sharma et al., 2018; Shahzad et al., 2019). Here, trust in the government (i.e., service provider) and trust in technology are two critical factors that have been shown to have a significant impact on these services (Beza et al., 2018; Liu et al., 2014). Hence, citizens' confidence that the service provider will resolve any issues that arise while using these services and their belief in privacy and security should be prioritized to foster trust. Further, trust is thought to play an essential role in increasing citizen compliance and developing favourable long-term usefulness for m-government services (G. Wang et al., 2020). As a result, it is critical to build trust among citizens in these services to gain success in m-government services.

6.2.4 Role of Quality Factors in M-Government Adoption

The study considered and analysed two important quality determinants in IS research: information quality and system quality. The findings revealed that there is no direct relationship between information quality and behavioural intention. Even though this contradicted most previous research, it has emphasized the indirect effect of information quality via transparency. The findings indicated that information quality significantly impacts transparency and it is consistent with earlier findings by Shahzad et al. (2019) and Venkatesh et al. (2016). Later, it was demonstrated that the indirect effect of information quality via transparency significantly impacts trust rather than directly on BI. Thus, hypothesis H8a, which attempted to investigate the presence of a mediating effect of transparency between information quality and BI, was rejected, contradicting the findings of Shahzad et al. (2019) and Venkatesh et al. (2016). However, the discovery has demonstrated the serial mediation path between information quality and BI through the mediators' transparency and trust (H8b), that is supported by the previous findings (Venkatesh et al., 2016).

The study's findings indicated that system quality has no bearing on behavioural intention. Previous results supported this conclusion, such as the works of Glood et al. (2016b), C. Wang and Teo (2020), and T. Zhou et al. (2013). Furthermore, the study disproved the indirect effect of system quality on trust. It is caused by the suppression effect, which occurs when the sign of the relationship between the factors reverses. Thus, it rejects the hypothesis of the mediating role between system quality and BI (H9a). These findings were contrary to previous research by Shahzad et al. (2019) and Venkatesh et al. (2016). Previous literature rarely pointed on this suppression effect and thus requires further investigation.

As a result, it can be inferred that information quality is critical in developing transparency in the system, which leads to trust in the system. Thus, the relationship of quality factors on trust is more important than the behavioural intention to use m-government directly. These findings are supported by previous research (A. Kumar et al. (2018), Shahzad et al. (2019), Venkatesh et al. 2016), who demonstrated that transparency and trust act as a mediator between quality parameters and intention to use. Hence, the quality of m-government services should be considered as a key dimension to enhance trust. The service provider's negligence on this aspect leads to mistrust and lower satisfaction, negatively impacting its adoption.

6.2.5 Role of External Factors Social Influence and Facilitating Condition

The theoretical model also included two other external factors: social influence and facilitating condition. In this context, social influence refers to the influence of others on an individual's decision to use or not use m-government services. The findings demonstrated the insignificance of social influence, indicating that most people nowadays are self-sufficient and do not entirely rely on others; instead, they make their own decisions. These findings are very similar to those of Beza et al. (2018), Sharma et al. (2018), Saxena (2018). However, the results suggested that the role of others may be necessary for developing trust and influencing attitudes, but not explicitly the behavioural intention. The previous study by Liu et al. (2014) also illustrated the indirect function of social influence.

However, the study found facilitating conditions to have a significant impact on the acceptance of m-government services. Adequate infrastructure, such as the availability of mobile networks in all areas, proper m-government software, and so on, are critical aspects. If they are not appropriately met, it will result in the avoidance of m-government services. However, the mean value for the factor was higher than four, which means that people are well-equipped with these tools and can use them. These results are similar to the previous findings of Ohme (2014), Sharma et al. (2018), where facilitating condition was proved to have a significant association with m-government intention use.

6.2.6 Role of Social Media

With the advent of social media, there is a renewed emphasis on its role in service delivery. This study looks at whether people think of social media as a good platform for m-government services. The findings attempted to determine whether social media is crucial to creating transparency and trust in m-government services. Furthermore, the study tried to determine whether social media is vital for raising awareness and influencing social influence and image factors of m-government adoption.

The awareness and social influence primarily reflect social media's position as a medium of communication, where contact with others and experts regarding these services leads to their adoption. In a similar vein, Erkan and Evans (2016), C. Wang and Medaglia (2017) discovered social media as a medium for initially raising awareness in m-government services. E-WOM is another phenomenon in social media that aids in rapidly disseminating knowledge among people and is a significant factor in raising awareness (C. Wang & Medaglia, 2017; G. Wang et al., 2019; Wirtz et al., 2018). Social media is also an effective and simple medium for advertising, which marketers make extensive use of. It has also been shown to be helpful in m-government services (Campbell et al., 2014; Chatterjee, 2020; Zolait et al., 2014; Nomani et al., 2016). These dimensions help update citizens' knowledge and lead to a positive attitude toward services (Fullerton et al., 2017; Nisar & Shafiq, 2019). The current study's findings also demonstrated a crucial function for social media in increasing understanding of these government programs, validating and reinforcing previous research findings.

Besides this, the results reveal that social media is an essential tool in reinforcing the impact of others on an individual's intention to use m-government (i.e., social influence). The study also discovered that social media could serve as an image enhancer in an individual's social environment. Similarly, in their research, Usman and Okafor (2019) focused on the importance of social media in developing an individual's image and social factors from a marketing perspective. However, this was not specific to m-government services.

The results also emphasized the significance of social media in increasing transparency and trust in m-government services (Warren et al., 2014). Previous research has shown that offering all relevant information on m-government services increases knowledge, making it easier for customers to use (Al-Aufi et al., 2017; Fullerton et al., 2017; Nisar & Shafiq, 2019). It then fosters a positive attitude toward services and providers, resulting in trust creation (Al-Aufi et al., 2017; Gibreel et al., 2018; Kim et al., 2015; C. Wang et al., 2020; G. Wang et al., 2020). Here, social media can be a very effective channel for information dissemination on m-government services and should be utilized effectively. It thus plays a critical role in delivering these services efficiently, thereby positively impacting the growth of trust in m-government services.

Further, these individual relationships among variables such as social media, awareness, image, social influence, transparency, and trust resulted in indirect mediation effects, which were investigated further. The findings suggested that social media affects awareness, which mediates the relation in forming an image-oriented attitude. Additionally, the results demonstrated that awareness and image serially mediate between social media and social influence, and then three factors (awareness, image, social influence) serially mediate with trust. Hence, the findings imply the significant indirect role of social media in developing image, social influence, and trust. Though there is no specific literature supporting these mediation relationships, the results of the previous studies of Liu et al. (2014), Usman and Okafor (2019) do add credibility to the findings of this study.

Similarly, the significant relationship between social media and transparency, and transparency's favourable position in creating trust culminated in establishing a substantial mediation role of transparency between social media and trust. The findings of previous research adequately support the current study results (Al-Aufi et al., 2017; Gibreel et al., 2018; S. Kim et al., 2015; G. Wang et al., 2020). These aspects reflect the criticality of social media in developing trust towards m-government services through various dimensions.

6.2.7 Moderating Role of Demographic Variables

Demographic variables such as gender, age, education, occupation, income, m-government experience, EG experience, SM experience, and place are considered for moderation analysis. It investigates the existence of any significant differences across groups under each factor. The findings revealed a mixed bag of outcomes, with most cases showing no substantial variations across demographic groups. Similar results were also found in previous studies by Al-Busaidi (2012), Mandari and Chong (2018), and Saxena (2017). The details of the same are discussed below:

6.2.7.1 Gender

The findings revealed no substantial differences between male and female on relationships among variables of m-government adoption. However, in one instance, the difference was significant: the predictor facilitating condition and its effect on BI. The findings revealed that males (β=0.318, $p < 0.1\%$) have a much more substantial impact of facilitating condition on BI than females (β=0.051, $p>5\%$). Hence, we can infer that males have a higher propensity to avoid using these services when resources are limited. Service providers thus should carefully consider this aspect since males are usually family leaders and more often uses these services. In a similar vein, previous findings of Mandari & Chong (2018), Saxena (2018) found differences among gender groups, with males having a more significant impact on m-government adoption factors.

6.2.7.2 Age

The comparative findings among the three categories, young adults, middle-aged adults, and senior adults (except individuals over 60 years old, elderly), revealed minor differences. The first finding concerned the impact of social influence on the decision to use m-government. The results show that youth value social influence and thus positively impact m-government adoption, whereas middle-aged adults have no profound impact. It implies that younger generations are more likely to adopt m-government if they discuss and share relevant information.

Similarly, differences in the impact of awareness on compatibility and ease of use, and the relationship between transparency and trust were observed between senior adults and others. Seniors have a more significant positive impact on these factors than the other two groups. It emphasizes the criticality of awareness and transparency among senior adults. The study of Beza et al. (2018), Mandari and Chong (2018), Mwalukasa et al. (2018), Saxena (2018) also indicated some similar differences among young and senior adults towards m-government adoption behaviour.

6.2.7.3 Education

A few differences were also observed among the individuals from different categories of education. The findings revealed that, for the individuals with education level of graduation and below focus should be on raising awareness mainly on social aspects such as image, and towards the development of trust. It would impact significantly enhancing the adoption of m-government services. However, post-graduates particularly look for the service characteristics like transparency in the system. It might be because individuals with PG and above, with their educational background, may probably be more focused on the value of the services rather than social aspects such as the image. Previous research by Albusaidi (2012), Mandari (2017), Mwalukasa et al. (2018), Saxena (2018) highlighted similar aspects, proving the findings of this study.

6.2.7.4 Occupation

The MGA results revealed few discrepancies in the study's findings, owing to the disproportionate sample distribution across the groups. As a result, a few comparisons could be made, and the study thus pointed a few observations across the groups. For example, students perceive social media to play a vital role in enhancing transparency in the system than the other two groups. On the other hand, the social media role on social influence was more decisive among the not currently employed category than others. It reflects the importance of social communication in these channels among the not currently employed group, and the younger generations trust these Web 2 technologies in performing the core service activities.

Furthermore, the study found the significance of awareness relation with compatibility and ease of use to be greater among not currently employed individuals than among private employees, most likely due to their relatively less exposure to the outside corporate world. On the other hand, private employees may believe that because they interact with the outside world more frequently, they become aware of these services with less effort. It reflects a greater need for awareness among those who are not currently employed. Even though previous works did not explore the differences in behaviour based on occupation significantly, the findings of Saxena (2018) are somewhat consistent with the results of this study.

6.2.7.5 Income

The comparison result among people with different income levels revealed only minor differences among groups of people with incomes of less than 20,000 INR and more than 80,000 INR (low versus high). Some of the key findings are that the influence of awareness on compatibility, image, and relative advantage is much stronger among low-income people than among high-income people. This was true for lower-income categories (under 20,000 and 20,000 to 40,000 INR) and high income categories (above 80,000 INR).

Similarly, the impact of social media on awareness, image, and trust was more significant among low-income individuals (under 20,000 INR) than among high-income individuals (above 80,000 INR). Previous studies by Ahmad and Khalid (2017), Albusaidi (2012), Mandari (2017), Mwalukasa et al. (2017) found some similarities in the differences among high and low-income level individuals.

6.2.7.6 Experience

The study used MGA to investigate experience aspects such as EG experience and SM experience. The results indicated the absence of moderation effect between the people with and without prior EG experience. The result supports the finding of Ohme (2014) that EG Attitude did not have a significant impact on BI to use m-government, although it did contribute to shaping the attitude.

The comparison of individuals with varying levels of SM experience (low, medium, and high) also revealed a few differences. Significant differences were obtained between groups with usage rates 'Low' and 'Medium'. According to the findings, the impact of awareness on ease of use and relative advantage was much more substantial among social media users with usage rate 'Low' than among 'Medium'. It implies that increasing awareness via various channels is crucial for people who use social media infrequently. It will have a more significant impact on this group than on others. Furthermore, the effect of social influence on BI was more substantial among individuals with 'High' and 'Medium' social media usage rates, and weaker among less frequent users (Low). It implies that people who spend a lot of time on social media are more likely to be influenced by others regarding m-government adoption decisions. Previous research by Ahmad and Khalid (2017), Beza et al. (2018), S. Kim et al. (2015), Mandari (2017), Mwalukasa et al. (2018), C. Song and Lee (2016) also investigated differences in individual's adoption behaviour with varying levels of experience and found mixed results.

6.2.7.7 Place

The study also investigated whether there were any differences in the characteristics of m-government adoption among citizens from various cities. Due to data discrepancies among groups, a detailed comparison across all locations was not possible. The comparison results that could be performed based on available reliable data revealed no significant differences between the groups.

However, the study compared Bengaluru, a metropolitan city, and other smaller cities, primarily semi-urban cities. According to the findings, the relationship of awareness with compatibility, ease of use, and relative advantage were much more substantial in other cities than in Bengaluru. It implies that awareness is more critical in smaller cities than in larger cities. Similar findings were found in previous literature in the banking sector by De Blasio (2008), S. Gupta et al. (2017).

Furthermore, the results showed that the influence of information quality on transparency was more potent in smaller cities. In comparison, the impact of social media on transparency was more substantial in larger cities. These factors reflect the developments and trends in metropolitan cities, which differ from those in smaller cities thereby impacting the technology adoption rates. As a result, it is critical to prioritize these factors before implementing m-governance strategies based on location. It implies that, while information quality is vital in both cities, it has a more significant impact in smaller cities. Previous research by De Blasio (2008), S. Gupta et al. (2017), Munyoka and Maharaj (2017) also revealed location-based differences in adoption behaviour for e-banking, EG, and m-banking systems.

6.3 IMPLICATIONS

This section discusses the implications of the study's findings from both a theoretical and practical standpoint. The section first discusses theoretical implications, followed by its managerial implications.

6.3.1 Theoretical Implications

The first significant contribution of the study is on insights obtained from the bibliometric analysis of the literature on m-government from the Scopus database. It is unique in terms of the following: first, it determines the most influential existing studies, second, it provides a helpful reference base, and third, it categorizes various sub-categories or themes and highlights under-researched areas. Overall, the analysis presents researchers and practitioners with a clear overview of m-government research and a direction for future research. Thus, systematization and categorization of literature contributes significantly towards the advancement of the m-government research field.

The empirical analysis of the study provides critical insights that are vital and make a significant contribution to the body of knowledge. The detailed investigation with empirical evidence into the adoption of m-government has explained some of the relationships between variables that needed further investigation and validation. The study examined the integrated model of URT and DOI theory and key external factors such as social influence, facilitating condition, and social media, a comprehensive and less explored theoretical model in the m-government field. The results validated the significance of attitudinal factors based on DOI theory, such as relative advantage and compatibility, in an Indian context. Though the scope is more relevant to the proposed smart cities of Karnataka. Examining and validating the indirect effects of awareness through attitudinal factors to BI are critical contributions, which have not been extensively explored in previous m-government literature. Besides this, the study found the relationships between awareness and BI via image, social influence, and trust to be significant with full serial mediation, which is yet another novel contribution to the body of knowledge. It reflects on the importance of awareness in various aspects of adoption and its role in developing trust.

The outcomes of this study also reveal the importance of trust in m-government adoption and its various relationships with other factors. The study found trust to be one of the most critical factors that have a significant favorable influence on BI and play a vital role as a mediator. Trust was found to be significantly influenced by the variables such as social influence, transparency, and social media. The results also implied the criticality of information quality over system quality in developing transparency and trust in m-government services, rather than directly impacting its adoption. Although these findings are partially contrary to a few of previous results, they are evidently acceptable outcomes that pave the way to further validation.

Another critical aspect of the results is a reflection on the role of social media in m-government services. As per the results, social media will undoubtedly play a positive role in raising awareness, developing trust and transparency, and strengthening the social influence dimensions of an individual's behaviour. The study discovered an indirect relationship between social media and social influence through image, which then impacts trust with partial mediation, indicating the importance of both direct and indirect paths. Furthermore, transparency acts as a mediator between social media and trust.

Investigating these relationships between social media and m-government adoption contributes significantly to a field of study that has received little attention. The other significant contribution is examining differences in the relationships among these variables across the various categories of demographic variables (moderation analysis). This aspect has been less explored and it provides a more in-depth understanding of m-government adoption behaviour. Overall, the study's results offer deeper perspectives and information into the relationships of variables about social media dimensions, m-government adoption factors, and intent to use m-government services. Furthermore, it opens up several newer avenues for potential study for the researchers.

6.3.2 Managerial/Practical Implications

This research provides some critical insights into citizens' perceptions of the m-government system from the proposed smart cities of Karnataka. M-government being a critical component for achieving the smart city goal, policymakers should consider these factors and properly strategize the introduction and enhancement of these services. In this regard, the study has adopted a comprehensive m-government adoption model that includes awareness and its influence, attitudinal factors under DOI theory. It also integrates uncertainty reduction theory which focuses on knowing the means for reducing uncertainty (i.e., trust and transparency). Also, the model incorporates two main quality factors, the social aspect of how others influence, and finally, the availability of necessary resources for using the system (facilitating condition).

The results revealed the importance of awareness on specific dimensions, hence policymakers should raise awareness on m-government services considering these inputs. The emphasis here should be on its presence and its benefits, features, and so on. This detailed information would increase public awareness of these services, as well as their influence on others. Based on the nature of the services and the target audience, the government can use awareness campaigns, posters, and training programs. Furthermore, as evidenced by the results, social media can also be used as an effective channel. Interaction with others in these mediums is faster and more efficient if channeled effectively. Here, social media advertisements and tutorial videos about these services on platforms like YouTube and Facebooks play a vital role. The increased awareness will then lead to strengthening attitudinal components such as relative advantage, compatibility, and so on, which are critical in the current context. Policymakers must also ensure that the m-government services implemented are significantly beneficial and fit the lifestyle of the majority of citizens.

Furthermore, the results showed that information quality has a significant impact on trust. As such, policymakers must ensure that the operation of these mobile-based services is very effective and that all necessary information and support services are included. The components of the services, particularly financial transactions, should be transparent, as this will significantly increase trust. Trust is currently found to be lower among citizens. Every local government should work on this to increase trust among the public in technology and the government and service providers. The study also proved trust to be crucial as it has both direct and indirect influence from other variables, and it then has a significant impact on BI.

Again, social media can play an essential role in increasing transparency and trust in the system. Citizens' trust in the m-government would be increased in case the government manages social media page effectively by interacting with the public regularly, soliciting their concerns and opinions, addressing these concerns, and communicating them back to the public. Furthermore, a customer support and feedback page where citizens can obtain complete information, ask experts questions and problems, and provide feedback will aid in the development of transparency and, as a result, enhance trust in these services. These discussions do not imply that social media should be the only channel used for this purpose. The government must be available on other platforms, such as physical offices, telephone and email support, and so on. Ultimately, policymakers should prioritize building public trust in all aspects.

Nonetheless, all of this is insignificant in the face of a locality's lack of resources to efficiently operate these m-government services. Therefore, before implementing these services, careful consideration should be given to the availability of resources in the locality and the public to use these m-government services. Furthermore, because males are more sensitive to facilitating conditions, the government should take adequate measures to ensure that these m-government services are implemented after careful consideration of the availability of necessary resources. It is critical because males play a vital role in Indian families and will be involved in most of these activities on m-government.

Furthermore, the impact of awareness and transparency was more significant among senior adults than among younger adults. Moreover, students are more inclined towards the use of social media to promote transparency in m-government. Similarly, impact of awareness and social media use on other relevant variables were greater among low-income individuals than higher-income individuals. Hence, these aspects should be considered to efficiently strategize their plans based on the target audiences' age and income.

The other critical insight that the policymakers should look for is the differences found among the people of Bengaluru, a metropolitan city, to other smart cities that are not of that kind. Here, these smaller cities exhibited a more substantial impact of awareness on attitudinal aspects, and also, information quality was significant in the development of transparency. However, the effect of social media on transparency was stronger among Bengaluru citizens than others. It implies that a greater emphasis on awareness and information quality through all possible channels would be beneficial for implementing m-government in smaller cities. Whereas for Bengaluru, social media can also be an impactful and effective channel.

Hence, the appropriate proportionate use of these channels based on these smart city's demographics (i.e. proposed smart cities) would result in greater success in m-government adoption. Finally, the study revealed broader and more detailed insights into the relationships among various m-government predictors and their significance in adopting these technologies. Furthermore, citizens' differences in smart cities were provided, which policymakers need to reckon before implementing m-government projects in a specific town. Besides this, the government must communicate effectively to the public about m-government projects, their role benefits, purpose, and clarity on how the government delivers services and support, including the channels. It will then aid in the public's successful adoption and development of a long-term intention to use these services.

Chapter 7
CONCLUSION AND FUTURE SCOPE

7.1 OVERVIEW

The chapter summarises and provides information on the achievement of the research objectives defined in the study. It also discusses some of the study's limitations and presents the future scope in which the researchers can contribute to the m-government field.

7.2 ACCOMPLISHMENT OF RESEARCH OBJECTIVES

The success of m-government being an essential component in the attainment of smart city mission, the study investigated the influence of critical factors on the citizen's adoption of m-government services from the proposed smart cities of Karnataka. In the process, the study examined in detail the relationships of variables and their influence on m-government adoption intention. Over this process, the study systematically examined and addressed the specific objectives laid down at the beginning of the research work.

The study's first objective was to identify the factors that are crucial in comprehensively explaining m-government adoption.

With the need to comprehensively explain the adoption of m-government, a detailed systematic review using bibliometric analysis laid out several important pieces of literature. The review of these studies paved the way for identifying the factors and theories critical to the current context of m-government in India. The two IS adoption theories, DOI and URT, are combined with external factors such as awareness, social influence, and facilitating conditions. These theories primarily include relative advantage, ease of use, computability, image under DOI, trust, and transparency of URT, and quality dimensions such as information and system quality. Another distinguishing and novel feature of the conceptual model is the inclusion of the factor social media influence. Here, social media's role in developing trust, transparency, awareness, image, and social influence on m-government adoption is investigated.

The second objective is to assess the strength of the relationships of these factors towards the intention to use m-government services.

The study collected primary data from Karnataka's proposed smart cities to establish the relationship among the factors using empirical evidence (1444 responses). PLS-SEM was used to investigate the direct, mediating, and moderating effect of the variables considered in the study due to its suitability under complex model conditions. The analysis of direct relationships among factors revealed the statistical significance of the constructs relative advantage, compatibility, facilitating condition, and trust with BI to use m-government services. At the same time, awareness, ease of use, image, social influence, transparency, information quality, and system quality were found to have a negligible direct relationship with BI. However, the majority of it was discovered to have an indirect influence via the factor trust. Even social media has been shown to play an essential role in m-government adoption.

The third objective focuses on examining the role of social media influence on m-government adoption.

With web-2 technologies playing an increasingly important role in these digital platform-based services in recent years, it is critical to understand citizens' attitude toward using social media for m-government services. With this goal in mind, the study investigated the role of social media in enhancing trust and transparency and its role in developing image, social influence, and awareness. The results also showed all of social media's direct and indirect influences (i.e., mediation paths) to have significant effects, implying partial mediation. The findings revealed a significant impact of social media on all aspects of m-government services, which is both novel and important. It indicates that the policymakers must keep a close eye on this aspect.

The fourth objective is on assessment of the mediating role of attitudinal factors between awareness and BI.

The bootstrap approach in PLS-SEM, a well-accepted technique for performing mediation analysis, was used to identify the role of attitudinal factors in the relationship between awareness and BI. According to the findings, awareness of specific aspects, particularly relative advantage and compatibility, will play a critical role in adopting m-government services. Furthermore, image and social influence were discovered to play an essential mediating role in enhancing trust and thus impacting the BI. However, there was no mediation effect for ease of use. These findings emphasize the importance of focusing on a value-based approach to see a significant improvement in using these services. At the same time, social aspects such as image and social influence among individuals are essential in increasing trust in m-government services.

The fifth objective is on assessing the mediating role of trust and transparency between quality dimensions and BI.

Of the two quality dimensions studied, information quality was found to have a significant indirect impact on BI, with transparency and trust acting as mediators in the process. However, the study could not prove the indirect influence of system quality due to a lack of evidence. Here, the analysis couldn't show the significant relationship of system quality to trust as it exhibited a suppression effect with a sign reversal. Hence, we may assume that information quality is the more critical quality dimension, which increases system transparency. A transparent system will then raise an individual's trust in m-government services, leading to a favourable intention to use these services.

The sixth objective analyzes the differences in adoption characteristics across the different categories of demographic factors (i.e., moderating effect).

A multi-group analysis is carried out, in which the data is first tested for its suitability to compare across groups (i.e., the invariance test). Then a comparative analysis is carried out. Here, gender, age, education, occupation, income, location, EG Experience, m-government Experience, and SM Experience were all considered. Even though the results showed only minor differences among groups, it revealed a few critical insights. This will help in strategizing implementation and development activities of m-government. For instance, the study found the indirect effect of awareness to have a more significant impact among senior citizens, government employees, lower-income individuals, less frequent SM users, and people from all cities except Bengaluru. It was also observed that differences in social aspects and social media was stronger among Bengaluru citizens, frequent SM users, students, and youth. SM's role in social aspects (image and social influence) was more substantial among frequent SM users and younger generations such as students. SM was also more effective in increasing transparency among Bengaluru residents and students. Furthermore, while the facilitating condition significantly impacted males, transparency was valued far more among individuals with a post-graduate degree or higher, low and middle income, from other cities (excluding Bengaluru), and senior adults. As a result, except for the EG and m-government experiences, all hypotheses under the demographic factor were accepted.

To summarize, the study makes a significant contribution because the integrated DOI-URT model, in conjunction with other external factors, provides a comprehensive explanation of m-government adoption, which has received little attention in previous studies. The findings on the significance of relative advantage and compatibility, both direct and indirect, reflect on the value of utilitarian functions over other aspects in adopting m-government. Similarly, information quality and transparency proved critical in fostering trust and, as a result, reducing people's uncertainty about the system. Thus, developing confidence in the system is one of the essential aspects that policymakers cannot afford to overlook. According to the findings, using social media in conjunction with m-government services may play a vital role in all of these aspects in the current context. As a result, it can be regarded as a critical channel for delivering services and increasing e-WOM among citizens and experts. It is expected to be a strategic component in the success of m-government if done effectively.

Overall, these findings are critical and have validated previous work in a few cases. In addition, it has opened up new avenues for further inquiry. The study thus makes an essential contribution to the field of research by investigating all possible direct, mediation, and moderation relationships and providing a comprehensive explanation for m-government adoption. The study findings are undeniably significant, and they will aid policymakers in effectively implementing various m-government projects under the Smart Cities Mission. Thus, the study made a novel contribution to the field of research and significantly contributed to the advancement of knowledge.

7.3 LIMITATIONS AND FUTURE SCOPE

Despite the study's theoretical and practical contributions, it does have some limitations that should be carefully considered when putting these insights into practice. First, the use of convenience and snowball sampling methods in the data collection process has limitations in terms of generalizability of results, which should be carefully considered even though it is an acceptable approach. Furthermore, because the study's scope was limited to proposed smart cities in Karnataka, the findings cannot be directly applied to other cities. Before generalization, cultural differences and population characteristics should be carefully considered. Since this study is also cross-sectional, it is limited to a specific period; thus, a longitudinal study would provide deeper insights.

In terms of future scope, further extensions of the study in other cultural settings and nations may strengthen and validate the conceptual framework proposed in the study. The insignificance of the direct influence of quality dimensions, ease of use, and the suppression effect of image and system quality, in particular, necessitates further investigation into their relationships. It will substantially support and validate the current findings, which contradict some of the previous literature. Moreover, as the study of social media influence on m-government services is still in its early stages, further research on these topics is required to validate the study's findings.

Future studies can also extend this study to specific applications such as electricity bill payment systems, passport services, and so on, where particular factors such as transaction cost, security and risk factors, and so on may be critical. Also, specific case studies focusing on rural areas, specific groups of people (such as marginalized communities, lower-income groups), and so on may provide additional valuable insights. These insights are critical and believed to be crucial for the success of m-government. In addition, the study only looked at the influence of predictor variables on intention to use; advanced research into its role in actual usage could make a significant difference because situational factors may influence actual use.

Furthermore, the country's Covid-19 pandemic environment limited further inquiry, particularly expert interviews (government officials involved in m-government decision making), which would have strengthened and validated the study's findings. This qualitative study of experts is an essential future aspect on which the researchers can concentrate their efforts. The bibliometric analysis also identified several critical themes in m-government research and indicated the scope of future research on each of these themes. It can be investigated by the researchers in the future as an extension to this field of research.

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APPENDICES

Appendix I: Final Modified Questionnaire after Pilot Study

Government Services through Mobile Phone

Dear Respondents,
I Sunith Hebbar, Ph.D. scholar from the National Institute of Technology- Karnataka, Surathkal (Reg. No. 187097SM004) kindly request you to fill this Questionnaire and help me in pursuing my Ph.D. in the area of mobile government.

Note:

Mobile Government refers to the use of mobile and wireless technologies such as mobile internet by the government to provide the government services to public. Examples: ***Use of Mobile phones for paying electricity/water bills, gas booking, issuing various identity cards, transportation services like ticket booking etc.***
In simple words "Government Services through Mobile Phone".

The information provided by you will be used only for the research purpose and any information that can be identified with you will be kept confidential. Your participation in the survey is entirely voluntary and you can withdraw from it at any time.
For any questions you can contact me at sunithhebbar@rediffmail.com (Mobile: 9986886286)

I agree to participate in this survey on M-Government.

Name: E-mail id.: Signature

Q1)	Do you own a Smartphone?	Yes □ No □		
Q2)	What is the most common way to access the Internet on your mobile?	Mobile Data ( )	Wi-Fi at office/school ( )	Wi-Fi at home ( )
Q3)	How **frequently** are you using **government services** on **Mobile phone**? Once in Month □ Few times in a month □ Few times in a year □			
Q4)	Have you used **Computer/Laptop** for **using** government services before? Yes □ No □			
How much do you agree with the following statements:				
(1-strongly disagree 2-disagree 3-neutral 4-agree 5-strongly agree)				
Q5)	I am aware of various m-government services in India. **1** □ **2** □ **3** □ **4** □ **5** □			
Q6)	I know the advantages of using m-government services. **1** □ **2** □ **3** □ **4** □ **5** □			
Q7)	Using m-government services increases efficiency compared with personal interaction with physical offices. **1** □ **2** □ **3** □ **4** □ **5** □			

Q8)	Using m-government services will save citizens' time compared with personal interaction with physical offices. **1** □ **2** □ **3** □ **4** □ **5** □
Q9)	I can use the m-government services from anywhere. **1** □ **2** □ **3** □ **4** □ **5** □
Q10)	Learning to use government service through mobile phone is easy for me. **1** □ **2** □ **3** □ **4** □ **5** □
Q11)	It is easy for me to access and avail government services through mobile phone. **1** □ **2** □ **3** □ **4** □ **5** □
Q12)	Seeking government service through mobile phone would fit into my lifestyle. **1** □ **2** □ **3** □ **4** □ **5** □
Q13)	I think seeking government service through mobile phone would fit well with the way that I like to operate. **1** □ **2** □ **3** □ **4** □ **5** □
Q14)	I like to seek government service through mobile phone more than personal interaction with physical offices. **1** □ **2** □ **3** □ **4** □ **5** □
Q15)	People who adopt m-government have a high profile. **1** □ **2** □ **3** □ **4** □ **5** □
Q16)	People who adopt m-government have higher level of prestige. **1** □ **2** □ **3** □ **4** □ **5** □
Q17)	People who adopt m-government have a better social status. **1** □ **2** □ **3** □ **4** □ **5** □
Q18)	Transactions using m-government applications are safe. **1** □ **2** □ **3** □ **4** □ **5** □
Q19)	User's privacy is well protected in m-government applications. **1** □ **2** □ **3** □ **4** □ **5** □
Q20)	I believe that the m-government services are reliable. **1** □ **2** □ **3** □ **4** □ **5** □
Q21)	Security measures in m-government services are enough. **1** □ **2** □ **3** □ **4** □ **5** □
Q22)	I believe that m-government services are trustworthy. **1** □ **2** □ **3** □ **4** □ **5** □

Q23)	List any FIVE **m-government** services that you are **aware of or have used**.
Q24)	I expect the working processes of m-government would be transparent. **1** □ **2** □ **3** □ **4** □ **5** □
Q25)	I expect the government would give a clear idea of how m-government services work. **1** □ **2** □ **3** □ **4** □ **5** □
Q26)	I believe the government will provide me with complete guidance on the operation of m-government services. **1** □ **2** □ **3** □ **4** □ **5** □
Q27)	I believe I will have opportunities to provide feedback on m-government services. **1** □ **2** □ **3** □ **4** □ **5** □
Q28)	I believe the government will provide reliable information about its m-government services. **1** □ **2** □ **3** □ **4** □ **5** □
Q29)	My friends and family think I should use m-government. **1** □ **2** □ **3** □ **4** □ **5** □
Q30)	My colleagues/peers think I should use m-government. **1** □ **2** □ **3** □ **4** □ **5** □
Q31)	People who are important to me think that I should use m-government. **1** □ **2** □ **3** □ **4** □ **5** □
Q32)	I have the necessary resources (like mobile, internet etc.) to use m-government services. **1** □ **2** □ **3** □ **4** □ **5** □
Q33)	I have the necessary knowledge to use m-government services. **1** □ **2** □ **3** □ **4** □ **5** □
Q34)	I expect information provided by m-government applications to be accurate. **1** □ **2** □ **3** □ **4** □ **5** □
Q35)	I expect information provided by m-government applications are relevant to my needs. **1** □ **2** □ **3** □ **4** □ **5** □
Q36)	I expect m-government applications provide me with sufficient information. **1** □ **2** □ **3** □ **4** □ **5** □

Q37)	I expect government will rectify the information error if any on a regular basis. **1** □ **2** □ **3** □ **4** □ **5** □
Q38)	I expect to connect with the authority concerned by using m-government applications whenever needed. **1** □ **2** □ **3** □ **4** □ **5** □
Q39)	I expect the interface of m-government applications would be easy to use. **1** □ **2** □ **3** □ **4** □ **5** □
Q40)	I expect the m-government applications to quickly load text and graphics. **1** □ **2** □ **3** □ **4** □ **5** □
Q41)	I expect m-government to enable me to personalize notifications and presentation of information that I use. **1** □ **2** □ **3** □ **4** □ **5** □
Q42)	I expect the m-government sites to be visually attractive. **1** □ **2** □ **3** □ **4** □ **5** □
Q43) How many times **a day** you look at **Social media** (Facebook, YouTube, Instagram, Twitter etc.)? Not every day ( ) Once a day ( ) 2-5 times a day ( ) 5-10 times a day ( ) 10+ times ( ) Not Using ( )	
Q44) Do you follow social media **advertisements**? Yes ( ) No ( ) Maybe ( )	
Q45) Have you **used social media** to acquire **information on m-government services**? Yes ( ) No ( )	
Q46)	I believe that social media will help to raise awareness about m-government services. **1** □ **2** □ **3** □ **4** □ **5** □
Q47)	Social media helps to obtain information and knowledge about m-government services. **1** □ **2** □ **3** □ **4** □ **5** □
Q48)	I believe government communication regarding m-government services on social media is reliable. **1** □ **2** □ **3** □ **4** □ **5** □
Q49)	Individual trust can be earned if the government's presence on social media is sincere. **1** □ **2** □ **3** □ **4** □ **5** □

Q50)	I believe government on social media provides accurate information. **1** □ **2** □ **3** □ **4** □ **5** □
Q51)	I believe that transparency between citizens and the government is obtainable in social media. **1** □ **2** □ **3** □ **4** □ **5** □
Q52)	I came to know about m-government services through the discussions with friends and others on social media platform. **1** □ **2** □ **3** □ **4** □ **5** □
Q53)	The Expert's opinion and reviews about the services on social media are credible and accurate. **1** □ **2** □ **3** □ **4** □ **5** □
Q54)	Sharing m-government user feedback on social media is useful. **1** □ **2** □ **3** □ **4** □ **5** □
Q55)	I intend to use m-government services in the future. **1** □ **2** □ **3** □ **4** □ **5** □
Q56)	I believe using m-government services is very helpful. **1** □ **2** □ **3** □ **4** □ **5** □

	Please provide your personal details [Mark tick (√)]
Gender	Male □ Female □ Other □
Age	18-30yrs □ 31-45yrs □ 46-60yrs □ Above 60yrs □
Education (highest level)	Not Professionally Educated ( ) Primary/Secondary ( ) Graduate ( ) Post-Graduation and above ( )
Occupation	Student ( ) Self-Employed ( ) Private Employee ( ) Government Employee ( ) Not currently employed ( )Retired ( )
Marital Status	Married □ Single □
Monthly Household Income	Less than 20,000 ( ) 20,000 – 40,000 ( ) 41,000 - 60,000 ( ) 61,000 - 80,000 ( ) Above 80,000 ( )
Place	Bengaluru □ Davanagere □ Dharwad □ Hubbali □ Mangaluru □ Shivamogga □ Tumakuru □ Belagavi □

Appendix II: Questionnaire in Kannada Language

ಮೊಬೈಲ್ ಫೋನ್ ಮೂಲಕ ಸರಕಾರಿ ಸೇವೆಯ ಅಧ್ಯಯನ

ಪ್ರೀತಿಯ ಮಾಹಿತಿದಾರರೆ,
ನಾನು ಸುನಿತ್ ಹೆಬ್ಬಾರ್, (ಸಂಶೋಧನಾ ವಿದ್ಯಾರ್ಥಿ, ಎನ್.ಐ.ಟಿ.ಕೆ., ಸುರತ್ಕಲ್ (ನೋಂದಣಿ ಸಂಖ್ಯೆ - 187097SM004) "ಮೊಬೈಲ್ ಸರಕಾರ" ಎಂಬ ವಿಷಯದ ಕುರಿತು ಸಂಶೋಧನೆ ನಡೆಸುತ್ತಿದ್ದೇನೆ. ನಾನು ನೀಡಿದ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸುವುದರ ಮೂಲಕ ನನ್ನ ಪಿಹೆಚ್.ಡಿ ಅಧ್ಯಯನಕ್ಕೆ ಸಹಕರಿಸಬೇಕಾಗಿ ವಿನಂತಿ.

ಸೂಚನೆ: 'ಮೊಬೈಲ್ ಸರ್ಕಾರ'ವು ವೈರಲೆಸ್ ಅಂತರ್ಜಾಲದ ಮೂಲ ಸೌಕರ್ಯವನ್ನು ಬಳಸಿಕೊಂಡು ಮಾಡಲು ಸಾಧ್ಯವಿರುವ ಸರಕಾರಿ ಸೇವೆಗಳನ್ನು ಸಾರ್ವಜನಿಕರಿಗೆ ಪರಿಚಯಿಸುತ್ತದೆ.
ಉದಾಹರಣೆಗೆ, ಮೊಬೈಲ್ ಫೋನಿನ ಮೂಲಕ ವಿದ್ಯುತ್ ಬಿಲ್, ನೀರಿನ ಬಿಲ್, ಗ್ಯಾಸ್ ಬುಕಿಂಗ್, ಗುರುತು ಚೀಟಿಗಳನ್ನು ನೀಡಲು, ಟಿಕೆಟ್ ಬುಕಿಂಗ್'ಗಾಗಿ (ಸರಕಾರಿ ಸಂಸ್ಥೆಗಳ) ಈ ಸೇವೆಯನ್ನು ಬಳಸಿಕೊಳ್ಳಬಹುದು.

ಸರಳವಾಗಿ ಹೇಳುವುದಾದರೆ, "ಮೊಬೈಲ್ ಸರ್ಕಾರ= ಮೊಬೈಲ್ ಫೋನ್ ಮೂಲಕ ಸರಕಾರಿ ಸೇವೆ".

ನೀವು ಒದಗಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಸಂಶೋಧನಾ ಉದ್ದೇಶಕ್ಕಾಗಿ ಮಾತ್ರ ಬಳಸಲಾಗುತದೆ ಮತ್ತು ನಿಮೊಂದಿಗೆ ಗುರಿತಿಸಬಹುದಾದ ಯಾವುದೇ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗುತ್ತದೆ. ಸಮೀಕ್ಷೆಯಲ್ಲಿ ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆ ಸಂಪೂರ್ಣವಾಗಿ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿದೆ ಹಾಗು ನೀವು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ಅದರಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು.

ಸಂದೇಹಗಳಿದ್ದಲ್ಲಿ ಸಂಪರ್ಕಿಸಬೇಕಾದ ವಿಳಾಸ: sunithhebbar@rediffmail.com (ಮೊಬೈಲ್: 9986886286)
ಮೊಬೈಲ್ ಸರಕಾರಿ ಸೇವೆಗಳ ಈ ಸಮೀಕ್ಷೆಯಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಾನು ಒಪ್ಪಿರುತ್ತೇನೆ.

ಹೆಸರು: ಇ-ಮೇಲ್ ಐಡಿ: ಸಹಿ

1)	ನಿಮ್ಮಲ್ಲಿ ಸ್ಮಾರ್ಟ್ ಫೋನ್ ಇದೆಯೇ?	ಹೌದು **( )** ಇಲ್ಲ **( )**	
2)	ನೀವು ಮೊಬೈಲ್ ನಲ್ಲಿ ಅಂತರ್ಜಾಲವನ್ನು ಹೇಗೆ ಉಪಯೋಗಿಸುತ್ತೀರಿ?		
	ಮನೆಯಲ್ಲಿ ವೈಫೈ **( )**	ಶಾಲೆ/ಕಚೇರಿಯಲ್ಲಿ ವೈಫೈ **( )**	ಮೊಬೈಲ್ ಡಾಟ **( )**
3)	ನೀವು ಸರ್ಕಾರೀ ಸೇವೆಗಳನ್ನು ಆಗಾಗ ಬಳಸುತ್ತಿರುವಿರಾ?		
	ತಿಂಗಳಿಗೊಮ್ಮೆ **( )**	ತಿಂಗಳಲ್ಲಿ ಕೆಲವುಬಾರಿ **( )**	ವರ್ಷದಲ್ಲಿ ಕೆಲವುಬಾರಿ **( )**
4)	ನೀವು ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಕಂಪ್ಯೂಟರ್/ಲ್ಯಾಪ್ಟಾಪ್ ನಲ್ಲಿ ಉಪಯೋಗಿಸಿದ್ದೀರ? ಹೌದು **( )** ಇಲ್ಲ **( )**		

ಕೆಳಗಿನ ಹೇಳಿಕೆಗಳನ್ನು ನೀವು ಎಷ್ಟು ಒಪ್ಪುತ್ತೀರಿ :
*(**1-**ಖಂಡಿತವಾಗಿ ಒಪ್ಪುವುದಿಲ್ಲ **2-**ಒಪ್ಪುವುದಿಲ್ಲ **3-**ತಟಸ್ಥ **4-**ಒಪ್ಪುತ್ತೇನೆ **5-**ಖಂಡಿತವಾಗಿ ಒಪ್ಪುತ್ತೇನೆ)*

5)	ಭಾರತದಲ್ಲಿರುವ ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಗ್ಗೆ ನಾನು ಜಾಗೃತನಾಗಿದ್ದೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
6)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಉಪಯೋಗದ ಅನುಕೂಲತೆಯನ್ನು ನಾನು ತಿಳಿದಿದ್ದೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
7)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಳಕೆಯು ಕಚೇರಿಗಳಲ್ಲಿ ವೈಯಕ್ತಿಕವಾಗಿ ಮಾಡುವ ವ್ಯವಹಾರಕ್ಕಿಂತ ಕ್ಷಮತೆಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. **1** □ **2** □ **3** □ **4** □ **5** □
8)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸುವುದರಿಂದ ಸಾರ್ವಜನಿಕರ ಸಮಯ ಉಳಿತಾಯವಾಗುತ್ತದೆ. **1** □ **2** □ **3** □ **4** □ **5** □
9)	ನಾನು ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಎಲ್ಲಿಯೂ ಸುಲಭವಾಗಿ ಉಪಯೋಗಿಸಬಹುದು. **1** □ **2** □ **3** □ **4** □ **5** □
10)	ಮೊಬೈಲ್ ಫೋನಿನ ಮೂಲಕ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸಲು ಕಲಿಯುವುದು ನನಗೆ ಸುಲಭವಾಗಿದೆ. **1** □ **2** □ **3** □ **4** □ **5** □
11)	ನನಗೆ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಮೊಬೈಲ್ ಮೂಲಕ ಪಡೆದುಕೊಳ್ಳುವುದು ಮತ್ತು ಬಳಕೆ ಮಾಡುವುದು ಸುಲಭ. **1** □ **2** □ **3** □ **4** □ **5** □
12)	ಮೊಬೈಲ್ ಮೂಲಕ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಹುಡುಕುವುದು ನನ್ನ ಜೀವನ ಶೈಲಿಗೆ ಹೊಂದುತ್ತದೆ. **1** □ **2** □ **3** □ **4** □ **5** □
13)	ಮೊಬೈಲ್ ಫೋನಿನ ಮೂಲಕ ಸರ್ಕಾರಿ ಸೇವೆಯನ್ನು ಬಳಸುವುದು ನಾನು ಕಾರ್ಯನಿರ್ವಹಿಸಲು ಇಷ್ಟಪಡುವ ರೀತಿಗೆ ಸರಿಹೊಂದುತ್ತದೆಯೆಂದು ಭಾವಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
14)	ಕಚೇರಿಯೊಂದಿಗೆ ವೈಯಕ್ತಿಕ ಸಂವಹನಕ್ಕಿಂತ ಹೆಚ್ಚಾಗಿ ನಾನು ಮೊಬೈಲ್ ಫೋನಿನ ಮೂಲಕ ಸರ್ಕಾರಿ ಸೇವೆಯನ್ನು ಪಡೆಯಲು ಇಚ್ಛಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □

15)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಯನ್ನು ಅಳವಡಿಸಿ ಕೊಂಡವರು ಉನ್ನತ ಪ್ರೊಫೈಲ್ ಹೊಂದಿರುತ್ತಾರೆ. **1** □ **2** □ **3** □ **4** □ **5** □
16)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡವರು ಉನ್ನತ ಪ್ರತಿಷ್ಠೆಯುಳ್ಳವರು. **1** □ **2** □ **3** □ **4** □ **5** □
17)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡವರು ಉತ್ತಮ ಸಾಮಾಜಿಕ ಸ್ಥಾನಮಾನವನ್ನು ಹೊಂದಿರುತ್ತಾರೆ. **1** □ **2** □ **3** □ **4** □ **5** □
18)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಮೂಲಕ ವ್ಯವಹಾರ ಸುರಕ್ಷಿತವಾಗಿದೆ. **1** □ **2** □ **3** □ **4** □ **5** □
19)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಅಪ್ಲಿಕೇಶನ್ ಗಳಲ್ಲಿ ಗೌಪ್ಯತೆಯನ್ನು ಚೆನ್ನಾಗಿ ರಕ್ಷಿಸಲಾಗಿದೆ. **1** □ **2** □ **3** □ **4** □ **5** □
20)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ವಿಶ್ವಸನೀಯವೆಂದು ನಾನು ನಂಬಿದ್ದೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
21)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ಸಾಕಷ್ಟು ಸುರಕ್ಷಿತವಾಗಿವೆ. **1** □ **2** □ **3** □ **4** □ **5** □
22)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ಭರವಸೆಗೆ ಯೋಗ್ಯವೆಂದು ನಂಬುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
23) ನಿಮಗೆ ತಿಳಿದಿರುವ ಅಥವಾ ಉಪಯೋಗಿಸಿರುವ ಐದು ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಪಟ್ಟಿ ಮಾಡಿರಿ.	
24)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ಕಾರ್ಯಪ್ರಗತಿಯು ಪಾರದರ್ಶಕವಾಗಿರಬೇಕೆಂದು ಬಯಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
25)	ಸರ್ಕಾರವು ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ಹೇಗೆ ಕಾರ್ಯನಿರ್ವಹಿಸುತ್ತವೆಂಬುದನ್ನು ಸ್ಪಷ್ಟ ಚಿತ್ರವನ್ನು ನೀಡಬೇಕೆಂದು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □

26)	ಸರ್ಕಾರಿ ಸೇವೆಯ ಕಾರ್ಯಾಚರಣೆಯ ಬಗ್ಗೆ ಸರ್ಕಾರವು ನಂಗೆ ಸಂಪೂರ್ಣ ಮಾರ್ಗದರ್ಶನವನ್ನು ಒದಗಿಸುತ್ತದೆ ಎಂದು ನಂಬುತ್ತೇನೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
27)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಗ್ಗೆ ಪ್ರತಿಕ್ರಿಯೆ ನೀಡಲು ನನಗೆ ಅವಕಾಶಗಳಿವೆಯೆಂದು ನಾನು ನಂಬುತ್ತೇನೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
28)	ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಗ್ಗೆ ಸರ್ಕಾರವು ವಿಶ್ವಾಸಾರ್ಹ ಮಾಹಿತಿಯನ್ನು ಒದಗಿಸುತ್ತದೆ ಎಂದು ನಾನು ನಂಬುತ್ತೇನೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
29)	ನನ್ನ ಸ್ನೇಹಿತರು ಮತ್ತು ಕುಟುಂಬದವರು ನಾನು ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸಬೇಕೆಂದು ಭಾವಿಸುತ್ತಾರೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
30)	ನನ್ನ ಸಹೋದ್ಯೋಗಿಗಳು/ಗೆಳೆಯರು ನಾನು ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸಬೇಕೆಂದು ಭಾವಿಸುತ್ತಾರೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
31)	ನನಗೆ ಮುಖ್ಯವಾದ ಜನರು ನಾನು ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸಬೇಕೆಂದು ಭಾವಿಸುತ್ತಾರೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
32)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸಲು ಅಗತ್ಯವಾದ ಸಂಪನ್ಮೂಲಗಳು (ಮೊಬೈಲ್, ಅಂತರ್ಜಾಲ) ನನ್ನಲ್ಲಿವೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
33)	ನನಗೆ ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸುವುದಕ್ಕೆ ಬೇಕಾದ ಅಗತ್ಯ ಜ್ಞಾನವಿದೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
34)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ಒದಗಿಸಿದ ಮಾಹಿತಿಯು ನಿಖರವಾಗಿದೆ ಎಂದು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐
35)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ಒದಗಿಸಿದ ಮಾಹಿತಿಯು ನನ್ನ ಅಗತ್ಯಗಳಿಗೆ ಸಂಬಂಧಿಸಿದೆಯೆಂದು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☐

36)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳು ನನಗೆ ಸಾಕಷ್ಟು ಮಾಹಿತಿಯನ್ನು ಒದಗಿಸುತ್ತವೆ ಎಂದು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
37)	ಮಾಹಿತಿ ದೋಷವನ್ನು ಸರ್ಕಾರವು ನಿಯಮಿತವಾಗಿ ಸರಿಪಡಿಸುತ್ತದೆ ಎಂದು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
38)	ಅಗತ್ಯವಿದ್ದಲ್ಲಿ ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸುವ ಮೂಲಕ ಸಂಬಂಧಪಟ್ಟ ಪ್ರಾಧಿಕಾರದೊಂದಿಗೆ ಸಂಪರ್ಕ ಸಾಧಿಸಲು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
39)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಇಂಟರ್ಫೇಸ್ ಬಳಸಲು ಸುಲಭವೆಂದು ನಾನು ಭಾವಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಅಪ್ಲಿಕೇಶನ್ ಗಳು ಪಠ್ಯ ಮತ್ತು ಗ್ರಾಫಿಕ್ಸನ್ನು ತ್ವರಿತವಾಗಿ ಲೋಡ್ ಮಾಡುತ್ತವೆ ಎಂದು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
40)	ಅಧಿಸೂಚನೆ ಮತ್ತು ನಾನು ಬಳಸುವ ಮಾಹಿತಿಯ ಪ್ರಸ್ತುತಿಯನ್ನು ವ್ಯಕ್ತಿಗತಗೊಳಿಸಲು ಮೊಬೈಲ್ ಸರ್ಕಾರ ನನಗೆ ಅವಕಾಶ ನೀಡುತ್ತದೆ ಎಂದು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
41)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ತಾಣಗಳು ನೋಡುವುದಕ್ಕೆ ಆಕರ್ಷಿಕವಾಗಿರಬೇಕೆಂದು ನಾನು ನಿರೀಕ್ಷಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □

42) ನೀವು ದಿನವೊಂದಕ್ಕೆ ಎಷ್ಟು ಬಾರಿ ಸಾಮಾಜಿಕ ಜಾಲತಾಣಗಳನ್ನು ನೋಡುತ್ತೀರಿ? (ಫೇಸ್ ಬುಕ್, ಯು-ಟ್ಯೂಬ್, ಇನ್ಸ್ಟಾಗ್ರಾಮ್, ಟ್ವಿಟ್ಟರ್ ಇತ್ಯಾದಿ)?

ಪ್ರತಿದಿನ ಇಲ್ಲ **( )** ದಿನಕ್ಕೊಮ್ಮೆ **( )** ದಿನಕ್ಕೆ 2-5 ಬಾರಿ **( )**

ದಿನಕ್ಕೆ 5-10 ಬಾರಿ **( )** 10+ ಬಾರಿ **( )** ಬಳಸುವುದಿಲ್ಲ **( )**

43) ನೀವು ಸಾಮಾಜಿಕ ಜಾಲತಾಣಗಳಲ್ಲಿ ಜಾಹಿರಾತುಗಳನ್ನು ಅನುಸರಿಸುತ್ತೀರಾ?

ಹೌದು **( )** ಇಲ್ಲ **( )** ಇರಬಹುದು **( )**

44) ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಗ್ಗೆ ಮಾಹಿತಿಯನ್ನು ಪಡೆಯಲು ನೀವು ಸಾಮಾಜಿಕ ಜಾಲತಾಣಗಳನ್ನು ಬಳಸಿದ್ದೀರ?

ಹೌದು **( )** ಇಲ್ಲ **( )**

45)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಗ್ಗೆ ಜಾಗೃತಿ ಮಾಡಿಸಲು ಸಾಮಾಜಿಕ ಜಾಲತಾಣವು ಸಹಾಯಕಾರಿ. **1** □ **2** □ **3** □ **4** □ **5** □
46)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಗ್ಗೆ ಮಾಹಿತಿ ಮತ್ತು ಜ್ಞಾನವನ್ನು ಪಡೆಯಲು ಸಾಮಾಜಿಕ ಜಾಲತಾಣ ಸಹಾಯ ಮಾಡುತ್ತದೆ. **1** □ **2** □ **3** □ **4** □ **5** □
47)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಬಗ್ಗೆ ಸಂವಹನ ನಡೆಸುವಾಗ ಸಾಮಾಜಿಕ ಜಾಲತಾಣವು ವಿಶ್ವಾಸಾರ್ಹವೆಂದು ನಾನು ಪರಿಗಣಿಸುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
48)	ಸಾಮಾಜಿಕ ಜಾಲತಾಣದಲ್ಲಿ ಸರ್ಕಾರದ ಉಪಸ್ಥಿತಿಯು ನಿಷ್ಪಾಯುತವಾಗಿದ್ವರೆ ವೈಯಕ್ತಿಕ ನಂಬಿಕೆಯನ್ನುಗಳಿಸಬಹುದು. **1** □ **2** □ **3** □ **4** □ **5** □
49)	ಸಾಮಾಜಿಕ ಜಾಲತಾಣದ್ದಲ್ಲಿ ಸರ್ಕಾರವು ನಿಖರವಾದ ಮಾಹಿತಿಯನ್ನು ಒದಗಿಸುತದ್ದೆಎಂದು ನಾನು ನಂಬುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
50)	ನಾಗರಿಕರ ಮತ್ತು ಸರ್ಕಾರದ ನಡುವಿನ ಪಾರದರ್ಶಕತೆ ಸಾಮಾಜಿಕ ಜಾಲತಾಣದಲ್ಲಿ ಪಡೆಯಬಹುದೆಂದು ನಾನು ನಂಬುತ್ತೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
51)	ಸಾಮಜಿಕ ಜಾಲತಾಣದ ವೇದಿಕೆಯಲ್ಲಿ ಸ್ನೇಹಿತರು ಮತ್ತು ಇತರರೊಂದಿಗೆ ಚರ್ಚೆಯ ಮೂಲಕ ನಾನು ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಂಡೆನು. **1** □ **2** □ **3** □ **4** □ **5** □
52)	ಸೇವೆಗಳ ಬಗ್ಗೆ ಸಾಮಜಿಕ ಜಾಲತಾಣದಲ್ಲಿನ ತಜ್ಞರ ಅಭಿಪ್ರಾಯ ಮತ್ತು ವಿಮರ್ಶೆಗಳು ವಿಶ್ವಾಸಾರ್ಹ ಮತ್ತು ನಿಖರವಾಗಿವೆ. **1** □ **2** □ **3** □ **4** □ **5** □
53)	ಸಾಮಾಜಿಕ ಜಾಲತಾಣದಲ್ಲಿ ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳ ಅನುಭವವನ್ನು ಹಂಚಿಕೊಳ್ಳುವುದು ಸಹಾಯಕಾರಿ. **1** □ **2** □ **3** □ **4** □ **5** □
54)	ನಾನು ಭವಿಷ್ಯದಲ್ಲಿ ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸುವುದಕ್ಕೆ ಇಚ್ಛಿಸಿದ್ದೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □
55)	ಮೊಬೈಲ್ ಸರ್ಕಾರಿ ಸೇವೆಗಳನ್ನು ಬಳಸುವುದರಿಂದ ತುಂಬಾ ಸಹಾಯವಾಗುವುದೆಂದು ನಾನು ನಂಬಿದ್ದೇನೆ. **1** □ **2** □ **3** □ **4** □ **5** □

	ನಿಮ್ಮ ವಿವರ
ಲಿಂಗ	ಗಂಡು ( ) ಹೆಣ್ಣು ( ) ಇತರ ( )
ವಯಸ್ಸು	18-30yrs ( ) 31-45yrs ( ) 46-60yrs ( ) Above 60yrs ( )
ವಿದ್ಯಾರ್ಹತೆ	ವೃತ್ತಿಪರವಾಗಿ ವಿದ್ಯಾವಂತನಲ್ಲ ( ) ಪ್ರಾಥಮಿಕ ( ) ಪದವಿ ( ) ಸ್ನಾತಕೋತ್ತರ ಮತ್ತು ಉನ್ನತ ಪದವಿ ( )
ವೃತ್ತಿ	ವಿದ್ಯಾರ್ಥಿ ( ) ಸ್ವ-ಉದ್ಯೋಗಿ ( ) ಖಾಸಗಿ ನೌಕರ ( ) ಸರ್ಕಾರಿ ನೌಕರ ( ) ಪ್ರಸ್ತುತ ಉದ್ಯೋಗದಲಿಲ್ಲ ( ) ನಿವೃತ್ತ ( )
ವೈವಾಹಿಕ ಸ್ಥಿತಿ	ವಿವಾಹಿತ ( ) ಏಕ ಮಾತ್ರ(ಒಬ್ಬ) ( )
ತಿಂಗಳ ಆದಾಯ (ರೂಪಾಯಿ)	20,000 ಕಿಂತ ಕಡಿಮೆ ( ) 20,000 – 40,000 ( ) 41,000 - 60,000 ( ) 61,000 - 80,000 ( ) 80,000 ಕಿಂತ ಹೆಚ್ಚು ( )
ಸ್ಥಳ	ಬೆಂಗಳೂರು ( ) ದಾವಣಗೆರೆ ( ) ಧಾರ್ವಾಡ ( ) ಹುಬ್ಬಳಿ ( ) ಮಂಗಳೂರು ( ) ಶಿವಮೊಗ್ಗ ( ) ತುಮಕೂರು ( ) ಬೆಳಗಾವಿ ( )

Appendix III: Details of Experts Involved in Face Validity of the Questionnaire

Expert's Name and Affiliation	Details on Expertise
Dr. Sreejith A. (Ph.D. in the area of E-government) Assistant Professor, School of Management (SOM), NITK.	Subject area expert involved in the various research activities in the area of e/m government.
Dr. Kiran K. B. (Ph.D. in Economics) Professor, School of Management (SOM), NITK.	Academic expert involved in the various research activities in the area economics, marketing and consumer behaviour studies.
Dr. K. V. Sriram (Ph.D. in Marketing) Associate Professor, Humanities and Management, MIT, Manipal.	Academic expert with vast experience in both industry and research in the area of marketing.
Dr. Sumukh H. (Ph.D. in Innovation Management) Assistant Professor, Humanities and Management, MIT, Manipal.	Academic expert with expertise in marketing and consumer behaviour research.
Mr. Venkatesh P. (M. Sc. Information Science) Technical Product Owner, Reliance Digital Platform and Project Services Limited.	Technical expert involved in the software development of various e/m government projects
Dr. Praveen S. (Ph.D. in English Literature) Associate Professor, Humanities and Management, MIT, Manipal.	An expert in English language
Dr. Soumyalatha H. (M.A., M.Phil. in Kannada Literature). Associate Professor, Dr G Shankar Government Women's First Grade College & PG Study Centre, Udupi	An expert in local language Kannada

Appendix IV: Skewness and Kurtosis of All Items in the Latent Variables

Statistics						
	N		Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
	Valid	Missing				
AW1	1444	0	-.535	.064	-.174	.129
AW2	1444	0	-.601	.064	-.191	.129
RA1	1444	0	-.886	.064	.586	.129
RA2	1444	0	-1.251	.064	1.383	.129
RA3	1444	0	-1.001	.064	.640	.129
EU1	1444	0	-1.046	.064	1.009	.129
EU2	1444	0	-.953	.064	.790	.129
CMP1	1444	0	-.876	.064	.463	.129
CMP2	1444	0	-.798	.064	.517	.129
CMP3	1444	0	-.932	.064	.535	.129
IM1	1444	0	.012	.064	-.708	.129
IM2	1444	0	.155	.064	-.718	.129
IM3	1444	0	.006	.064	-.756	.129
T1	1444	0	-.366	.064	-.041	.129
T2	1444	0	-.393	.064	-.187	.129
T3	1444	0	-.473	.064	.191	.129
T4	1444	0	-.213	.064	-.359	.129
T5	1444	0	-.493	.064	.229	.129
TRN1	1444	0	-.621	.064	.397	.129
TRN2	1444	0	-.759	.064	.337	.129
TRN3	1444	0	-.630	.064	.240	.129
TRN4	1444	0	-.609	.064	.260	.129
TRN5	1444	0	-.649	.064	.510	.129
SI1	1444	0	-.534	.064	-.014	.129
SI2	1444	0	-.536	.064	.017	.129
SI3	1444	0	-.566	.064	.145	.129
FC1	1444	0	-1.152	.064	1.361	.129
FC2	1444	0	-.907	.064	.588	.129
IQ1	1444	0	-.877	.064	.604	.129
IQ2	1444	0	-.676	.064	.166	.129
IQ3	1444	0	-.681	.064	.263	.129
IQ4	1444	0	-.612	.064	-.148	.129
IQ5	1444	0	-.730	.064	.205	.129
SQ1	1444	0	-.799	.064	.478	.129
SQ2	1444	0	-.794	.064	.183	.129
SQ3	1444	0	-.676	.064	.114	.129
SQ4	1444	0	-.656	.064	-.028	.129
SM1	1444	0	-.835	.064	.593	.129
SM2	1444	0	-.821	.064	.573	.129
SM3	1444	0	-.478	.064	-.060	.129
SM4	1444	0	-.761	.064	.361	.129
SM5	1444	0	-.468	.064	-.034	.129
SM6	1444	0	-.429	.064	-.189	.129
SM7	1444	0	-.515	.064	-.304	.129
SM8	1444	0	-.359	.064	-.065	.129
SM9	1444	0	-.724	.064	.174	.129
BI1	1444	0	-1.131	.064	1.639	.129
BI2	1444	0	-1.163	.064	1.588	.129

Appendix V: Table of Results for Invariance Test of Demographic Factors

Table A1: Outer loadings difference between two groups in MGA for invariance test (Gender, Age, and Education)

c is differences in outer loadings →	Gender		Age						Education					
	Male-Female		Young - Middle		Young - Senior		Middle - Senior		G - PS		Pg-G		Pg-PS	
	c	p-value	c	p-value	c	p-value	c	p-value	c	p-value	c	p-value	c	p-value
AW1←Awareness	-0.068	0.127	0.027	0.591	-0.084	0.154	-0.111	0.055	0.101	0.276	-0.009	0.853	0.093	0.330
AW2←Awareness	0.035	0.403	-0.078	0.127	-0.057	0.213	0.021	0.677	-0.004	0.981	-0.005	0.907	-0.009	0.961
BI1←BhvIntention	0.039	0.213	-0.040	0.198	-0.083	0.097	-0.043	0.356	-0.022	0.616	-0.001	0.978	-0.024	0.621
BI2←BhvIntention	0.030	0.447	-0.061	0.073	-0.021	0.685	0.079	0.120	0.063	0.185	-0.022	0.601	0.041	0.478
CMP1←Compatibility	0.019	0.604	0.070	0.068	0.039	0.431	-0.030	0.554	0.050	0.516	-0.013	0.739	0.037	0.658
CMP2←Compatibility	0.012	0.749	-0.001	0.976	-0.031	0.530	-0.029	0.542	-0.032	0.629	-0.013	0.752	-0.045	0.526
CMP3←Compatibility	-0.027	0.461	-0.069	0.087	-0.014	0.778	0.055	0.306	0.007	0.952	-0.042	0.295	-0.034	0.602
EU1←EaseofUse	0.058	0.065	0.007	0.845	0.000	0.973	-0.007	0.843	0.113	0.110	-0.038	0.260	0.075	0.308
EU2←EaseofUse	-0.030	0.362	0.017	0.630	-0.051	0.227	-0.068	0.123	0.093	0.231	-0.019	0.558	0.073	0.363
FC1←FacCondition	0.046	0.427	-0.022	0.704	-0.121	1.000	-0.099	1.000	0.046	0.652	-0.020	0.738	0.026	0.808
FC2←FacCondition	-0.002	0.969	0.014	0.791	0.086	1.000	0.072	1.000	-0.121	0.146	0.110	0.027	-0.011	0.876
IM1←Image	0.022	0.797	-0.068	0.447	-0.002	0.967	0.065	0.528	0.013	0.939	0.013	0.884	0.026	0.861
IM2←Image	-0.107	0.158	-0.115	0.190	-0.177	0.032	-0.062	0.479	0.046	0.703	0.086	0.314	0.132	0.249
IM3←Image	0.057	0.451	0.097	0.263	0.049	0.637	-0.048	0.663	-0.051	0.571	-0.029	0.736	-0.080	0.423
IQ1←InfoQuality	-0.020	0.581	-0.040	0.217	0.201	0.013	0.241	0.002	-0.001	0.931	0.015	0.687	0.013	0.856
IQ2←InfoQuality	0.040	0.267	0.009	0.823	0.027	0.660	0.018	0.776	-0.002	0.921	0.085	0.025	0.083	0.173
IQ3←InfoQuality	0.012	0.735	-0.019	0.553	0.019	0.771	0.038	0.524	-0.084	0.054	-0.007	0.850	-0.091	0.051
IQ4←InfoQuality	0.000	0.983	0.023	0.568	-0.070	0.295	-0.093	0.189	-0.003	0.930	-0.146	0.001	-0.149	0.013
RA1←RelativeAdvantage	-0.066	0.087	0.053	0.207	-0.025	0.601	-0.078	0.130	0.032	0.634	0.009	0.815	0.041	0.538

RA2←RelativeAdvantage	0.087	0.018	0.000	0.990	-0.021	0.663	-0.022	0.671	-0.029	0.567	0.016	0.670	-0.012	0.799
RA3←RelativeAdvantage	0.038	0.327	-0.115	0.003	-0.075	0.196	0.040	0.455	0.021	0.717	-0.048	0.240	-0.028	0.624
SI1←SocInf	0.027	0.479	0.010	0.824	-0.028	0.681	-0.037	0.612	-0.080	0.072	0.009	0.827	-0.071	0.117
SI2←SocInf	-0.009	0.784	-0.058	0.130	-0.003	0.916	0.056	0.384	-0.089	0.024	0.037	0.328	-0.053	0.161
SI3←SocInf	-0.039	0.306	-0.009	0.831	0.092	0.149	0.101	0.173	-0.067	0.078	-0.012	0.800	-0.079	0.070
SM2←SocialMedia	-0.010	0.887	0.037	0.629	0.061	0.595	0.024	0.876	-0.086	1.000	-0.040	0.598	-0.126	1.000
SM3←SocialMedia	0.041	0.509	-0.140	0.029	-0.065	0.492	0.075	0.520	-0.090	1.000	-0.101	0.131	-0.191	1.000
SM4←SocialMedia	0.035	0.614	-0.101	0.154	0.072	0.660	0.173	0.199	0.278	1.000	-0.136	0.051	0.142	1.000
SM5←SocialMedia	0.077	0.146	-0.034	0.522	0.000	0.957	0.034	0.805	0.053	1.000	-0.010	0.858	0.042	1.000
SM6←SocialMedia	0.195	0.001	-0.012	0.837	-0.079	0.397	-0.066	0.498	0.012	1.000	-0.060	0.384	-0.047	1.000
SM8←SocialMedia	-0.035	0.581	-0.022	0.745	-0.084	0.390	-0.062	0.561	-0.032	1.000	0.046	0.486	0.014	1.000
SM9←SocialMedia	0.027	0.686	0.055	0.461	-0.173	0.083	-0.228	0.052	0.003	1.000	-0.032	0.654	-0.029	1.000
SQ1←SysQuality	-0.015	0.802	0.056	0.389	0.123	0.353	0.068	0.670	-0.003	0.928	0.000	0.994	-0.003	0.929
SQ2←SysQuality	0.018	0.771	-0.068	0.234	0.004	0.990	0.072	0.525	-0.011	0.873	-0.027	0.662	-0.038	0.628
SQ3←SysQuality	-0.012	0.828	-0.077	0.193	0.005	0.959	0.082	0.433	0.065	0.450	-0.093	0.138	-0.028	0.713
SQ4←SysQuality	0.056	0.405	-0.052	0.439	-0.113	0.288	-0.061	0.530	-0.018	0.829	0.014	0.838	-0.003	0.930
T2←Trust	0.027	0.646	-0.122	0.044	-0.182	0.029	-0.060	0.383	0.037	0.742	0.072	0.219	0.109	0.229
T3←Trust	0.016	0.743	0.071	0.144	0.083	0.216	0.012	0.895	0.006	0.973	0.076	0.110	0.082	0.207
T4←Trust	0.040	0.502	0.003	0.972	-0.088	0.213	-0.091	0.213	-0.060	0.413	0.027	0.680	-0.033	0.663
T5←Trust	0.081	0.088	-0.072	0.156	0.009	0.905	0.081	0.274	0.072	0.250	-0.059	0.259	0.013	0.853
TI←Trust	-0.067	0.223	-0.113	0.054	-0.012	0.849	0.101	0.165	0.107	0.182	-0.034	0.568	0.073	0.417
TRN2←Transparency	0.034	0.409	-0.009	0.836	-0.052	0.353	-0.043	0.440	0.054	0.460	0.027	0.536	0.080	0.257
TRN3←Transparency	0.048	0.195	-0.023	0.537	-0.035	0.498	-0.012	0.796	-0.030	0.568	0.008	0.826	-0.022	0.668
TRN4←Transparency	-0.001	0.962	-0.021	0.585	0.039	0.488	0.060	0.279	-0.032	0.550	-0.016	0.670	-0.049	0.391
TRN5←Transparency	0.012	0.723	-0.040	0.268	0.006	0.932	0.046	0.351	0.030	0.600	0.020	0.572	0.050	0.339

Table A2: Outer loadings difference between two groups in MGA for invariance test (Occupation)

c is differences in outer loadings →	GE-NCE		GE-PE		GE-St		PE-NCE		PE-St		SE-GE		SE-NCE		SE-PE		SE-St		St-NCE	
	c	p	c	p	c	p	c	p	c	p	c	p	c	p	c	p	c	p	c	p
AW1←Awareness	0.13	0.12	0.14	0.05	0.13	0.12	-0.01	0.88	0.00	0.96	-0.06	0.38	0.07	0.38	0.08	0.17	0.07	0.35	-0.01	0.95
AW2←Awareness	-0.13	0.19	-0.16	0.08	-0.04	0.75	0.03	0.61	0.12	0.06	0.19	0.02	0.06	0.26	0.03	0.51	0.15	0.02	-0.09	0.19
BI1←BhvIntention	0.10	0.11	0.01	0.79	0.06	0.29	0.10	0.05	0.05	0.23	0.07	0.11	0.17	0.00	0.08	0.02	0.13	0.00	0.04	0.49
BI2←BhvIntention	0.02	0.78	0.00	0.90	0.10	0.09	0.01	0.83	0.08	0.10	0.05	0.25	0.07	0.14	0.06	0.10	0.16	0.00	-0.08	0.16
CMP1←Compatibility	-0.10	0.25	-0.09	0.26	-0.12	0.13	-0.01	0.87	-0.03	0.50	0.13	0.12	0.03	0.57	0.04	0.44	0.01	0.90	0.03	0.64
CMP2←Compatibility	0.00	0.96	-0.02	0.83	0.05	0.47	0.02	0.76	0.07	0.21	0.03	0.72	0.03	0.67	0.01	0.82	0.08	0.26	-0.05	0.47
CMP3←Compatibility	0.07	0.25	0.10	0.08	0.15	0.03	-0.03	0.54	0.05	0.36	-0.09	0.19	-0.01	0.82	0.01	0.77	0.06	0.33	-0.08	0.21
EU1←EaseofUse	0.03	0.57	0.03	0.51	0.04	0.55	0.00	0.99	0.01	0.93	-0.06	0.44	-0.03	0.72	-0.03	0.70	-0.02	0.79	0.00	0.93
EU2←EaseofUse	-0.02	0.81	0.02	0.67	0.03	0.61	-0.04	0.37	0.01	0.82	-0.05	0.52	-0.07	0.33	-0.03	0.66	-0.02	0.81	-0.05	0.37
FC1←FacCondition	0.01	1.00	0.12	1.00	0.22	1.00	-0.11	0.13	0.10	0.20	-0.04	1.00	-0.03	1.00	0.08	1.00	0.18	1.00	-0.12	0.07
FC2←FacCondition	0.05	1.00	-0.03	1.00	-0.01	1.00	0.08	0.38	0.02	0.77	0.06	1.00	0.11	1.00	0.03	1.00	0.05	1.00	0.07	0.53
IM1←Image	-0.14	0.45	-0.05	0.79	-0.09	0.58	-0.09	0.48	-0.04	0.66	-0.04	0.81	-0.18	0.28	-0.09	0.53	-0.13	0.37	-0.05	0.73
IM2←Image	0.06	0.66	0.01	0.84	0.17	0.18	0.05	0.72	0.16	0.09	0.01	0.96	0.07	0.62	0.02	0.80	0.18	0.16	-0.11	0.37
IM3←Image	0.18	0.25	0.07	0.60	0.02	0.92	0.11	0.37	-0.05	0.55	0.02	0.88	0.20	0.17	0.09	0.45	0.04	0.76	0.16	0.19
IQ1←InfoQuality	0.06	0.45	0.09	0.15	0.02	0.78	-0.03	0.60	-0.07	0.08	-0.01	0.87	0.05	0.51	0.08	0.13	0.01	0.93	0.04	0.52
IQ2←InfoQuality	0.10	0.18	0.09	0.14	0.09	0.15	0.01	0.91	0.00	0.94	-0.08	0.25	0.02	0.86	0.01	0.93	0.01	0.89	0.01	0.96
IQ3←InfoQuality	0.02	0.74	-0.07	0.20	-0.03	0.57	0.09	0.06	0.03	0.39	0.03	0.65	0.05	0.45	-0.04	0.59	0.00	0.98	0.06	0.33
IQ4←InfoQuality	-0.13	0.18	-0.04	0.72	-0.02	0.90	-0.09	0.08	0.02	0.66	0.04	0.75	-0.09	0.27	0.00	0.95	0.02	0.77	-0.11	0.05
RA1← RelAdv	0.05	0.51	0.05	0.39	0.05	0.46	0.00	0.92	0.00	0.97	0.02	0.82	0.07	0.36	0.07	0.25	0.07	0.31	0.00	0.95
RA2←RelAdv	-0.01	0.99	0.02	0.72	0.00	0.94	-0.03	0.58	-0.02	0.62	-0.01	0.85	-0.02	0.79	0.01	0.87	-0.02	0.85	-0.01	0.90
RA3← RelAdv	0.02	0.77	0.08	0.20	0.07	0.32	-0.06	0.28	-0.01	0.83	-0.01	0.89	0.01	0.86	0.07	0.20	0.06	0.33	-0.05	0.44
SI1←SocInf	-0.07	0.33	-0.05	0.47	0.00	0.94	-0.02	0.62	0.05	0.32	-0.05	1.00	-0.12	1.00	-0.10	1.00	-0.05	1.00	-0.08	0.24
SI2←SocInf	0.04	0.62	-0.03	0.68	0.06	0.38	0.07	0.26	0.09	0.04	0.19	1.00	0.23	1.00	0.16	1.00	0.25	1.00	-0.02	0.73

SI3←SocInf	0.01	0.87	-0.04	0.66	-0.02	0.79	0.05	0.42	0.01	0.81	-0.11	1.00	-0.10	1.00	-0.15	1.00	-0.14	1.00	0.04	0.59
SM2←SocialMedia	0.35	0.01	0.17	0.08	0.09	0.31	0.18	0.11	-0.07	0.34	-0.13	0.36	0.22	0.18	0.04	0.70	-0.04	0.85	0.26	0.02
SM3←SocialMedia	0.11	0.35	-0.03	0.74	0.04	0.67	0.15	0.15	0.07	0.33	0.17	0.13	0.29	0.03	0.14	0.15	0.21	0.05	0.08	0.50
SM4←SocialMedia	0.15	0.18	0.15	0.11	0.18	0.06	0.00	0.96	0.03	0.68	0.05	0.64	0.20	0.09	0.20	0.06	0.23	0.04	-0.03	0.71
SM5←SocialMedia	0.04	0.68	0.03	0.58	0.15	0.06	0.00	0.99	0.12	0.06	-0.17	0.15	-0.13	0.30	-0.14	0.23	-0.02	0.95	-0.12	0.17
SM6←SocialMedia	0.22	0.13	0.04	0.65	0.14	0.25	0.18	0.06	0.10	0.15	-0.04	0.77	0.18	0.18	0.00	0.92	0.10	0.36	0.08	0.44
SM8←SocialMedia	-0.14	0.22	-0.16	0.14	-0.09	0.42	0.02	0.85	0.07	0.36	0.32	0.01	0.18	0.10	0.17	0.11	0.23	0.03	-0.05	0.53
SM9←SocialMedia	0.00	0.98	0.03	0.74	0.09	0.40	-0.03	0.73	0.06	0.43	0.02	0.87	0.02	0.84	0.05	0.61	0.11	0.32	-0.09	0.35
SQ1←SysQuality	-0.02	0.87	0.03	0.70	0.14	0.23	-0.05	0.50	0.11	0.18	0.27	1.00	0.25	1.00	0.30	1.00	0.41	1.00	-0.16	0.11
SQ2←SysQuality	-0.12	0.36	-0.15	0.18	-0.15	0.23	0.03	0.69	0.00	0.97	-0.04	1.00	-0.16	1.00	-0.19	1.00	-0.19	1.00	0.03	0.76
SQ3←SysQuality	0.19	0.07	0.12	0.16	0.17	0.08	0.07	0.42	0.04	0.54	-0.13	1.00	0.06	1.00	-0.01	1.00	0.03	1.00	0.03	0.78
SQ4←SysQuality	0.03	0.84	-0.01	0.92	0.10	0.36	0.04	0.75	0.11	0.21	-0.83	1.00	-0.80	1.00	-0.83	1.00	-0.72	1.00	-0.07	0.52
T2←Trust	0.06	0.56	0.04	0.59	0.19	0.10	0.02	0.86	0.14	0.07	0.06	0.64	0.12	0.28	0.10	0.27	0.24	0.04	-0.12	0.24
T3←Trust	0.07	0.50	-0.01	0.90	-0.02	0.82	0.08	0.32	-0.01	0.87	-0.06	0.59	0.01	0.92	-0.07	0.45	-0.08	0.42	0.09	0.32
T4←Trust	-0.11	0.30	0.07	0.46	0.03	0.75	-0.19	0.02	-0.04	0.54	-0.09	0.52	-0.20	0.07	-0.02	0.96	-0.06	0.64	-0.14	0.09
T5←Trust	-0.03	0.71	-0.06	0.40	-0.01	0.94	0.03	0.66	0.06	0.35	0.20	0.02	0.16	0.03	0.13	0.03	0.19	0.01	-0.03	0.72
TI←Trust	0.11	0.43	0.03	0.73	0.05	0.63	0.08	0.45	0.02	0.78	0.05	0.74	0.15	0.25	0.08	0.44	0.10	0.38	0.06	0.62
TRN2←Transparency	0.05	0.54	0.08	0.28	0.09	0.24	-0.03	0.59	0.02	0.77	-0.03	0.70	0.01	0.84	0.04	0.51	0.06	0.43	-0.05	0.49
TRN3←Transparency	-0.07	0.46	-0.06	0.51	-0.06	0.54	-0.01	0.77	0.00	0.99	0.14	0.07	0.08	0.23	0.09	0.05	0.09	0.09	-0.01	0.80
TRN4←Transparency	0.02	0.81	-0.02	0.88	0.05	0.48	0.03	0.54	0.07	0.17	0.02	0.87	0.03	0.65	0.00	0.96	0.07	0.34	-0.04	0.54
TRN5←Transparency	0.07	0.32	0.03	0.63	0.14	0.05	0.04	0.38	0.11	0.01	-0.02	0.80	0.05	0.39	0.01	0.81	0.12	0.04	-0.07	0.25

Table A3: Outer loadings difference between two groups in MGA for invariance test (Income)

c is differences in outer loadings →`	**i24-i46**		**i24-i68**		**i24-i8+**		**i24-ib2**		**i46-i68**		**i46-i8+**		**i46-ib2**		**i68-i8+**		**i68-ib2**		**ib2-i8+**	
	c	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**
AW1←Awareness	0.11	0.08	0.01	0.91	0.14	0.07	0.04	0.48	-0.10	0.26	0.07	0.44	-0.07	0.28	0.17	0.09	0.03	0.72	0.14	0.07
AW2←Awareness	-0.01	0.87	0.00	0.94	-0.14	0.13	0.04	0.46	0.01	0.84	-0.13	0.23	0.05	0.48	-0.15	0.15	0.04	0.57	-0.22	0.07
BI1←BhvIntention	-0.01	0.88	0.02	0.74	0.01	0.79	0.02	0.70	0.02	0.65	0.02	0.71	0.02	0.61	0.00	0.95	0.00	1.00	0.00	0.94
BI2←BhvIntention	0.03	0.37	-0.01	0.81	0.01	0.89	0.08	0.07	-0.04	0.44	-0.03	0.59	0.05	0.35	0.02	0.78	0.09	0.17	-0.08	0.18
CMP1←Compatibility	0.03	0.47	0.19	0.02	0.12	0.09	0.06	0.15	0.15	0.06	0.09	0.23	0.03	0.50	-0.07	0.55	-0.12	0.14	0.06	0.43
CMP2←Compatibility	-0.02	0.60	0.00	1.00	-0.01	0.87	0.02	0.73	0.03	0.72	0.02	0.81	0.04	0.42	-0.01	0.91	0.01	0.81	-0.02	0.69
CMP3←Compatibility	-0.07	0.20	-0.03	0.71	-0.10	0.16	-0.10	0.04	0.04	0.68	-0.03	0.71	-0.03	0.50	-0.06	0.51	-0.07	0.40	0.01	0.90
EU1←EaseofUse	0.03	0.48	0.11	0.07	0.00	0.94	0.08	0.07	0.08	0.22	-0.03	0.63	0.05	0.28	-0.11	0.14	-0.03	0.67	-0.08	0.18
EU2←EaseofUse	-0.06	0.17	0.00	0.99	-0.01	0.87	-0.02	0.67	0.06	0.38	0.05	0.42	0.04	0.40	-0.01	0.89	-0.02	0.77	0.01	0.88
FC1←FacCondition	0.03	0.67	-0.02	0.81	0.00	0.97	0.07	0.37	-0.06	0.61	-0.04	0.69	0.04	0.69	0.02	0.86	0.09	0.40	-0.07	0.43
FC2←FacCondition	0.00	1.00	-0.01	0.88	0.04	0.63	0.01	0.89	-0.01	0.89	0.04	0.66	0.01	0.91	0.05	0.66	0.02	0.83	0.03	0.73
IM1←Image	0.15	0.24	-0.16	1.00	0.09	0.54	0.14	0.19	-0.31	1.00	-0.06	0.68	-0.01	0.94	0.25	1.00	0.30	1.00	-0.05	0.70
IM2←Image	0.13	0.27	0.10	1.00	0.04	0.75	0.00	0.98	-0.03	1.00	-0.09	0.46	-0.13	0.23	-0.06	1.00	-0.10	1.00	0.04	0.75
IM3←Image	-0.20	0.11	0.12	1.00	-0.17	0.24	-0.05	0.61	0.31	1.00	0.03	0.84	0.15	0.17	-0.28	1.00	-0.17	1.00	-0.12	0.37
IQ1←InfoQuality	-0.05	0.36	0.00	0.93	-0.13	0.01	-0.01	0.91	0.05	0.52	-0.07	0.20	0.05	0.42	-0.12	0.06	0.00	0.99	-0.12	0.02
IQ2←InfoQuality	-0.05	0.41	0.04	0.57	-0.02	0.74	0.04	0.34	0.08	0.24	0.03	0.61	0.09	0.13	-0.05	0.42	0.01	0.89	-0.06	0.23
IQ3←InfoQuality	0.03	0.53	-0.03	0.51	0.02	0.71	-0.06	0.14	-0.07	0.23	-0.01	0.82	-0.10	0.04	0.06	0.33	-0.03	0.53	0.09	0.07
IQ4←InfoQuality	0.02	0.80	-0.02	0.74	0.03	0.63	0.00	0.94	-0.04	0.62	0.01	0.84	-0.01	0.85	0.05	0.51	0.03	0.69	0.03	0.67
RA1← RelAdv	0.04	0.48	0.06	0.61	-0.05	0.38	-0.02	0.63	0.01	0.94	-0.10	0.17	-0.07	0.27	-0.11	0.31	-0.08	0.46	-0.03	0.59
RA2← RelAdv	-0.03	0.57	-0.05	0.42	-0.07	0.20	-0.03	0.50	-0.02	0.77	-0.04	0.52	0.00	1.00	-0.02	0.78	0.02	0.76	-0.04	0.47
RA3← RelAdv	0.01	0.91	0.03	0.65	0.11	0.10	0.10	0.03	0.03	0.72	0.11	0.13	0.10	0.06	0.08	0.41	0.07	0.40	0.01	0.91

SI1←SocInf	0.09	0.30	-0.03	0.67	-0.03	0.63	-0.08	0.12	-0.11	0.21	-0.12	0.17	-0.17	0.02	0.00	0.99	-0.05	0.43	0.05	0.39
SI2←SocInf	0.01	0.96	0.01	0.91	0.06	0.31	0.06	0.17	0.01	0.96	0.05	0.45	0.06	0.35	0.04	0.57	0.05	0.48	-0.01	0.88
SI3←SocInf	-0.10	0.16	-0.08	0.17	-0.01	0.88	-0.02	0.75	0.02	0.86	0.09	0.21	0.08	0.21	0.07	0.24	0.06	0.23	0.01	0.88
SM2←SocialMedia	-0.08	0.38	-0.09	0.53	-0.04	0.74	-0.03	0.76	-0.01	0.94	0.05	0.66	0.05	0.53	0.05	0.72	0.06	0.65	-0.01	0.94
SM3←SocialMedia	-0.05	0.59	0.01	0.99	-0.13	0.17	-0.09	0.28	0.06	0.73	-0.08	0.38	-0.04	0.61	-0.14	0.38	-0.10	0.52	-0.04	0.66
SM4←SocialMedia	0.01	0.92	0.08	0.58	-0.11	0.29	-0.04	0.64	0.07	0.65	-0.12	0.29	-0.05	0.60	-0.19	0.23	-0.12	0.40	-0.07	0.46
SM5←SocialMedia	-0.13	0.08	-0.15	0.22	-0.08	0.35	-0.04	0.61	-0.01	0.89	0.05	0.57	0.10	0.16	0.06	0.60	0.11	0.32	-0.05	0.57
SM6←SocialMedia	0.05	0.55	0.16	0.31	0.17	0.10	0.12	0.13	0.11	0.51	0.12	0.27	0.07	0.40	0.01	0.91	-0.04	0.86	0.05	0.67
SM8←SocialMedia	-0.10	0.18	0.05	0.77	0.18	0.10	0.02	0.77	0.15	0.28	0.29	0.00	0.13	0.07	0.13	0.39	-0.03	0.89	0.16	0.12
SM9←SocialMedia	0.05	0.57	0.03	0.84	0.16	0.17	0.10	0.21	-0.02	0.88	0.10	0.40	0.04	0.60	0.13	0.45	0.07	0.63	0.06	0.62
SQ1←SysQuality	-0.05	0.59	0.09	0.48	-0.08	0.37	-0.02	0.80	0.14	0.27	-0.03	0.75	0.03	0.73	-0.17	0.14	-0.11	0.34	-0.06	0.46
SQ2←SysQuality	-0.06	0.51	0.08	0.43	-0.01	0.90	0.04	0.63	0.14	0.20	0.05	0.64	0.10	0.28	-0.09	0.42	-0.04	0.69	-0.05	0.59
SQ3←SysQuality	0.00	1.00	-0.05	0.61	-0.01	0.95	-0.02	0.81	-0.05	0.65	-0.01	0.96	-0.02	0.84	0.04	0.66	0.03	0.76	0.01	0.87
SQ4←SysQuality	-0.04	0.68	-0.11	0.27	0.01	0.92	0.03	0.75	-0.08	0.50	0.05	0.64	0.07	0.49	0.13	0.27	0.14	0.17	-0.02	0.85
T2←Trust	-0.07	0.34	0.09	0.46	-0.04	0.61	0.04	0.57	0.16	0.14	0.03	0.70	0.12	0.10	-0.13	0.26	-0.05	0.72	-0.09	0.27
T3←Trust	-0.01	0.87	-0.09	0.20	-0.11	0.10	0.02	0.75	-0.09	0.29	-0.10	0.19	0.03	0.67	-0.01	0.92	0.12	0.14	-0.13	0.06
T4←Trust	0.00	0.98	-0.05	0.66	-0.07	0.47	-0.13	0.09	-0.05	0.67	-0.07	0.49	-0.13	0.10	-0.02	0.86	-0.08	0.43	0.06	0.48
T5←Trust	0.07	0.33	-0.05	0.42	0.01	0.91	0.03	0.66	-0.13	0.10	-0.06	0.46	-0.05	0.52	0.06	0.43	0.08	0.20	-0.02	0.82
TI←Trust	-0.11	0.11	-0.07	0.47	0.03	0.76	-0.02	0.81	0.04	0.65	0.15	0.11	0.09	0.14	0.10	0.37	0.05	0.56	0.05	0.59
TRN2←Transparency	-0.11	0.13	-0.14	0.03	-0.07	0.24	-0.07	0.22	-0.04	0.57	0.03	0.62	0.03	0.56	0.07	0.28	0.07	0.22	0.00	0.96
TRN3←Transparency	0.01	0.83	0.02	0.78	0.08	0.15	0.04	0.35	0.01	0.92	0.06	0.30	0.03	0.56	0.05	0.44	0.02	0.72	0.03	0.55
TRN4←Transparency	-0.02	0.70	-0.09	0.10	-0.07	0.23	-0.01	0.87	-0.07	0.23	-0.05	0.46	0.01	0.79	0.03	0.64	0.09	0.12	-0.06	0.28
TRN5←Transparency	0.02	0.74	0.00	0.97	0.03	0.54	-0.04	0.36	-0.02	0.76	0.01	0.85	-0.06	0.31	0.03	0.59	-0.04	0.48	0.07	0.17

Table A4: Outer loadings difference between two groups in MGA for invariance test (Place)

c is differences in outer loadings →`	Bel-Bn		Bel-HD		Bel-M		Bn-HD		Bn-M		HD-M		Bel-Others	
	c	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**
AW1←Awareness	0.18	0.00	0.20	0.01	0.06	0.36	0.01	0.91	-0.12	0.08	-0.14	0.15	-0.07	0.14
AW2←Awareness	0.04	0.31	0.04	0.53	0.05	0.35	0.00	0.94	0.01	0.91	0.01	0.98	0.01	0.91
BI1←BhvIntention	0.12	0.00	0.14	0.01	0.12	0.02	0.01	0.84	-0.01	0.85	-0.02	0.75	-0.05	0.07
BI2←BhvIntention	0.13	0.00	0.10	0.03	0.09	0.07	-0.03	0.48	-0.04	0.46	-0.01	0.90	-0.03	0.06
CMP1←Compatibility	0.07	0.04	0.11	0.14	0.19	0.00	0.04	0.55	0.13	0.08	0.08	0.44	0.02	0.50
CMP2←Compatibility	0.15	0.00	0.19	0.01	0.11	0.06	0.05	0.60	-0.04	0.54	-0.08	0.40	-0.05	0.15
CMP3←Compatibility	0.13	0.00	0.17	0.01	-0.05	0.48	0.04	0.66	-0.18	0.00	-0.21	0.01	-0.07	0.04
EU1←EaseofUse	0.07	0.06	0.07	0.37	0.03	0.64	0.00	1.00	-0.04	0.45	-0.04	0.64	-0.05	0.12
EU2←EaseofUse	0.08	0.01	0.34	1.00	0.05	0.42	0.25	0.00	-0.03	0.56	-0.03	0.81	0.01	0.75
FC1←FacCondition	0.32	1.00	0.38	1.00	0.23	1.00	0.06	0.53	-0.09	0.12	-0.15	0.14	0.00	0.95
FC2←FacCondition	0.01	1.00	0.11	1.00	-0.01	1.00	0.10	0.29	-0.02	0.79	-0.12	0.28	-0.05	0.37
IM1←Image	0.18	0.01	0.35	1.00	0.07	0.44	0.17	1.00	-0.10	0.35	-0.28	1.00	-0.03	0.67
IM2←Image	0.10	0.21	-0.10	1.00	0.16	0.20	-0.19	1.00	0.06	0.67	0.25	1.00	-0.03	0.73
IM3←Image	-0.10	0.19	0.01	1.00	-0.12	0.30	0.11	1.00	-0.02	0.86	-0.12	1.00	0.05	0.49
IQ1←InfoQuality	0.11	0.00	0.17	0.00	0.20	0.00	0.06	0.24	0.08	0.27	0.02	0.84	0.01	0.83
IQ2←InfoQuality	0.12	0.01	0.22	0.00	0.11	0.14	0.10	0.12	-0.01	0.84	-0.11	0.25	-0.05	0.16
IQ3←InfoQuality	0.04	0.41	0.07	0.29	-0.07	0.39	0.03	0.58	-0.10	0.09	-0.13	0.07	-0.02	0.47
IQ4←InfoQuality	0.11	0.06	0.06	0.39	0.17	0.07	-0.05	0.37	0.06	0.50	0.11	0.25	0.00	0.99
RA1←RelativeAdvantage	0.11	0.01	0.14	0.04	0.16	0.02	0.02	0.78	0.05	0.53	0.02	0.81	-0.03	0.45
RA2←RelativeAdvantage	0.16	0.00	0.17	0.01	0.16	0.02	0.01	0.95	0.00	0.94	-0.01	0.90	-0.09	0.01
RA3←RelativeAdvantage	0.12	0.00	0.20	0.00	0.17	0.01	0.08	0.25	0.04	0.57	-0.04	0.68	0.00	0.95

SI1←SocInf	-0.02	1.00	-0.05	1.00	-0.02	1.00	-0.03	0.56	0.00	0.96	0.03	0.69	0.02	0.71
SI2←SocInf	0.06	1.00	0.04	1.00	0.00	1.00	-0.02	0.60	-0.06	0.12	-0.04	0.40	-0.03	0.40
SI3←SocInf	0.20	1.00	0.14	1.00	0.18	1.00	-0.07	0.19	-0.03	0.60	0.04	0.54	-0.06	0.15
SM2←SocialMedia	0.03	0.72	0.20	0.31	0.04	0.75	0.17	0.29	0.01	0.94	-0.16	0.39	-0.02	0.72
SM3←SocialMedia	0.23	0.04	0.20	0.16	0.24	0.05	-0.03	0.70	0.01	0.96	0.04	0.72	-0.11	0.08
SM4←SocialMedia	0.21	0.03	0.21	0.17	0.19	0.12	0.00	0.96	-0.02	0.79	-0.02	0.91	-0.11	0.06
SM5←SocialMedia	0.18	0.02	0.21	0.07	0.22	0.06	0.03	0.75	0.04	0.78	0.01	0.97	-0.04	0.45
SM6←SocialMedia	0.28	0.00	0.51	0.00	0.10	0.41	0.23	0.12	-0.18	0.10	-0.41	0.02	-0.12	0.06
SM8←SocialMedia	0.27	0.00	0.27	0.10	0.41	0.00	0.00	0.96	0.14	0.25	0.13	0.48	-0.09	0.12
SM9←SocialMedia	0.33	0.00	0.50	0.00	0.32	0.00	0.17	0.25	-0.01	0.89	-0.18	0.32	-0.09	0.18
SQ1←SysQuality	0.27	1.00	0.32	1.00	0.20	1.00	0.04	0.61	-0.07	0.52	-0.11	0.37	-0.04	0.53
SQ2←SysQuality	0.17	1.00	0.12	1.00	0.30	1.00	-0.05	0.40	0.13	0.12	0.18	0.07	0.02	0.75
SQ3←SysQuality	-0.04	1.00	-0.14	1.00	-0.06	1.00	-0.10	0.20	-0.03	0.74	0.08	0.48	-0.05	0.38
SQ4←SysQuality	0.04	1.00	-0.05	1.00	0.00	1.00	-0.09	0.26	-0.04	0.65	0.05	0.64	-0.06	0.32
T2←Trust	0.26	0.00	0.38	0.00	0.24	0.02	0.12	0.22	-0.02	0.78	-0.14	0.28	-0.08	0.14
T3←Trust	0.11	0.08	0.26	0.01	0.02	0.71	0.15	0.06	-0.08	0.17	-0.24	0.01	0.01	0.84
T4←Trust	0.19	0.03	0.22	0.05	0.26	0.03	0.04	0.73	0.07	0.54	0.03	0.82	-0.01	0.86
T5←Trust	0.16	0.02	0.12	0.23	0.04	0.71	-0.04	0.61	-0.12	0.17	-0.08	0.48	-0.07	0.13
TI←Trust	0.04	0.49	0.20	0.08	0.12	0.27	0.16	0.11	0.08	0.46	-0.08	0.55	0.04	0.45
TRN2←Transparency	0.13	0.00	0.22	0.00	0.21	0.00	0.09	0.20	0.08	0.28	-0.01	0.90	-0.04	0.27
TRN3←Transparency	0.15	0.00	0.15	0.03	0.15	0.01	0.00	0.98	0.01	0.92	0.01	0.93	-0.05	0.14
TRN4←Transparency	0.12	0.03	0.03	0.59	0.09	0.14	-0.08	0.13	-0.03	0.53	0.05	0.40	-0.02	0.59
TRN5←Transparency	0.13	0.00	0.10	0.06	0.08	0.07	-0.04	0.48	-0.05	0.29	-0.01	0.85	-0.05	0.09

Table A5: Outer loadings difference between two groups in MGA for invariance test (Experience)

c is differences in outer loadings →`	EG Experience		MG Experience						SM Experience					
	EG_Y - EG_N		**Less-Frequent**		**Less-Average**		**Frequent-Average**		**High-Low**		**High-Medium**		**Medium-Low**	
	c	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**	**c**	**p**
AW1←Awareness	-0.09	0.06	-0.04	0.46	0.06	0.32	0.11	0.04	0.04	0.57	0.01	0.89	0.03	0.64
AW2←Awareness	0.10	0.06	-0.03	0.62	-0.12	0.08	-0.09	0.10	0.07	0.31	0.00	0.93	0.08	0.26
BI1←BhvIntention	-0.06	0.05	0.08	0.04	0.07	0.03	0.00	0.91	-0.07	0.10	-0.09	0.06	0.02	0.61
BI2←BhvIntention	0.04	0.29	0.02	0.71	-0.01	0.81	-0.03	0.38	-0.02	0.65	0.01	0.73	-0.09	0.08
CMP1←Compatibility	-0.01	0.78	0.04	0.35	0.01	0.78	-0.03	0.50	-0.12	0.01	0.00	0.92	-0.12	0.00
CMP2←Compatibility	-0.08	0.02	0.03	0.57	-0.01	0.86	-0.03	0.41	0.03	0.50	0.04	0.35	-0.01	0.84
CMP3←Compatibility	0.00	0.93	0.06	0.27	0.00	0.97	-0.06	0.19	0.02	0.72	0.02	0.62	0.00	0.95
EU1←EaseofUse	0.02	0.51	0.01	0.85	-0.05	0.23	-0.06	0.12	-0.13	0.00	-0.01	0.87	-0.12	0.00
EU2←EaseofUse	-0.06	0.05	0.06	0.17	0.00	0.93	-0.07	0.07	0.05	0.24	0.03	0.47	0.02	0.66
FC1←FacCondition	0.05	0.45	0.08	0.29	-0.05	0.44	-0.14	0.02	0.01	0.88	0.02	0.78	0.00	0.96
FC2←FacCondition	0.00	0.97	-0.01	0.93	0.07	0.33	0.08	0.16	0.03	0.65	0.06	0.26	-0.03	0.63
IM1←Image	-0.13	0.09	-0.14	0.22	-0.02	0.84	0.11	0.25	-0.15	0.10	0.06	0.53	-0.21	0.01
IM2←Image	0.01	0.93	0.00	0.95	0.06	0.53	0.06	0.54	0.02	0.88	-0.05	0.56	0.07	0.47
IM3←Image	0.16	0.04	0.06	0.57	-0.06	0.55	-0.12	0.18	0.03	0.69	0.03	0.68	0.00	0.99
IQ1←InfoQuality	0.04	0.25	-0.02	0.77	-0.03	0.48	-0.02	0.63	0.03	0.51	-0.01	0.90	0.04	0.38
IQ2←InfoQuality	0.02	0.54	0.05	0.35	-0.06	0.16	-0.11	0.00	-0.01	0.84	0.00	0.92	-0.01	0.77
IQ3←InfoQuality	-0.02	0.45	-0.04	0.40	-0.03	0.42	0.00	0.92	-0.04	0.38	-0.01	0.82	-0.03	0.42
IQ4←InfoQuality	-0.05	0.19	0.06	0.26	-0.01	0.88	-0.07	0.11	0.02	0.78	0.01	0.81	0.01	0.92
RA1←RelativeAdvantage	-0.03	0.46	0.18	0.00	0.00	1.00	-0.18	0.00	-0.01	0.90	0.07	0.13	-0.08	0.11
RA2←RelativeAdvantage	-0.07	0.05	-0.03	0.58	-0.04	0.43	-0.01	0.80	-0.07	0.13	0.06	0.20	-0.13	0.01

RA3←RelativeAdvantage	0.02	0.68	0.14	0.00	0.09	0.03	-0.05	0.27	0.03	0.60	0.03	0.53	0.00	0.97
SI1←SocInf	0.05	0.25	-0.07	0.21	-0.09	0.09	-0.02	0.60	0.03	0.60	0.03	0.45	0.00	0.96
SI2←SocInf	-0.01	0.84	0.06	0.22	0.01	0.82	-0.05	0.22	-0.02	0.70	0.02	0.59	-0.04	0.40
SI3←SocInf	0.05	0.19	0.03	0.53	0.02	0.74	-0.01	0.76	0.04	0.36	0.14	0.00	-0.10	0.06
SM2←SocialMedia	-0.01	0.84	0.05	0.56	0.10	0.24	0.05	0.56	-0.07	0.48	0.09	0.24	-0.16	0.10
SM3←SocialMedia	-0.04	0.51	0.03	0.68	0.08	0.29	0.05	0.51	-0.17	0.09	-0.12	0.08	-0.05	0.58
SM4←SocialMedia	-0.14	0.03	-0.05	0.51	0.09	0.24	0.14	0.07	-0.09	0.36	-0.01	0.92	-0.08	0.35
SM5←SocialMedia	0.01	0.91	0.04	0.53	0.06	0.30	0.02	0.69	-0.06	0.46	-0.03	0.60	-0.03	0.65
SM6←SocialMedia	0.14	0.02	-0.03	0.72	0.01	0.89	0.04	0.61	-0.03	0.74	0.10	0.15	-0.13	0.15
SM8←SocialMedia	0.05	0.37	0.03	0.68	0.13	0.07	0.10	0.17	-0.05	0.56	0.12	0.07	-0.17	0.06
SM9←SocialMedia	-0.14	0.03	0.18	0.02	0.12	0.12	-0.07	0.38	-0.01	0.89	0.02	0.75	-0.03	0.69
SQ1←SysQuality	0.02	0.82	0.05	0.56	-0.07	0.44	-0.12	0.08	0.02	0.87	-0.09	0.21	0.11	0.24
SQ2←SysQuality	-0.05	0.43	-0.02	0.89	-0.05	0.62	-0.03	0.60	-0.03	0.67	0.10	0.09	-0.14	0.09
SQ3←SysQuality	0.09	0.16	0.07	0.42	0.19	0.04	0.12	0.07	0.00	0.99	0.06	0.31	-0.06	0.43
SQ4←SysQuality	-0.08	0.22	-0.02	0.84	-0.05	0.64	-0.03	0.71	-0.01	0.86	0.06	0.36	-0.08	0.39
T2←Trust	0.03	0.66	0.03	0.68	0.09	0.23	0.06	0.36	-0.14	0.10	0.01	0.83	-0.15	0.05
T3←Trust	0.08	0.11	-0.01	0.84	-0.04	0.51	-0.03	0.63	0.16	0.01	0.17	0.00	0.00	0.96
T4←Trust	0.04	0.55	0.08	0.29	0.02	0.81	-0.06	0.40	0.13	0.13	0.17	0.01	-0.04	0.62
T5←Trust	0.07	0.19	-0.04	0.51	0.04	0.47	0.08	0.16	-0.17	0.01	0.01	0.89	-0.18	0.01
TI←Trust	0.06	0.26	0.06	0.39	0.02	0.82	-0.05	0.47	-0.11	0.14	-0.02	0.79	-0.09	0.18
TRN2←Transparency	-0.03	0.45	-0.02	0.76	-0.05	0.43	-0.03	0.53	-0.15	0.01	-0.06	0.28	-0.10	0.05
TRN3←Transparency	0.03	0.43	0.07	0.13	0.04	0.35	-0.03	0.49	0.03	0.58	-0.01	0.91	0.04	0.48
TRN4←Transparency	-0.03	0.50	0.01	0.82	-0.12	0.01	-0.13	0.00	-0.01	0.78	0.07	0.09	-0.09	0.06
TRN5←Transparency	-0.01	0.66	-0.04	0.41	-0.02	0.69	0.02	0.61	0.08	0.09	0.06	0.17	0.03	0.54

Research Publications

The details of journal and conference articles published or communicated from the current study are:

International Journal Publications

Hebbar, S., & Kiran K., B. (2019) “Social Media Influence and Mobile Government Adoption: A Conceptual Framework and its Validation”, *International Journal of Electronic Government Research,* Vol.15, No.3, pp.37-58.

Hebbar, S., & Kiran K., B. (2022) “A Bibliometric Analysis on Mobile Government Research”, *International Journal of Electronic Governance*, Vol.13 No.4, pp.350-385

Hebbar, S., & Kiran K., B. (202X) “Does Social Media and e-WOM Influence M-Government Services? A Citizen's Perspective from India”, *International Journal of Electronic Government Research,* Vol.18, No.1, pp.1-27.

Hebbar, S., & Kiran K., B. (202X) “Social Media Integrated Mobile Government Adoption Model: Investigating Adoption Behavior in Karnataka's Smart Cities”, Information and Management. (Under Review)

Hebbar, S., & Kiran K., B. (202X) “Does Social Media Attitude and eGov Experience Moderates Relationship on mGov Adoption? The Citizen’s Perspective from India”, *Information Systems and Management* (Under Review)

International Conference Publication

Hebbar, S., & Kiran K., B. (2021) “Understanding the Adoption of Mobile Government Services: The Role of Social Media”, *In International Conference On Law and Economics, 2021, 25-28 November, 2021, Tiruchirappalli, Tamil Nadu.*

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Curriculum Vitae

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Educational Background

Ph. D. (Thesis Submitted)	National Institute of Technology-Karnataka	2021
M. Tech in Engineering Management	Manipal Institute of Technology, Manipal	2011
M.B.A. in Marketing	Sikkim Manipal University (Distance Education)	2016
B.E. in Mechanical Engineering	Dayananda Sagar College (VTU)	2009

Professional Experience

- ❖ Worked as a Trainee at Sealed Air India for about One year.
- ❖ Worked as an Assistant Lecturer at National Institute of Technology, Surathkal, in Mechanical department for 6 months (December 2011- June 2012).
- ❖ 5+ years of teaching experience at Department of Humanities and Management, MIT Manipal.

Skill Sets

Tally, MS Word, MS Excel, MS Project, SPSS, AMOS, SmartPLS, and Vensim

Roles and Responsibilities

- ❖ Subjects Taught: Engineering Economics, Financial Management, Introduction to Industrial Engineering, Complex Business Dynamics.
- ❖ Departmental examination in charge at Manipal Institute of Technology.
- ❖ Guided M.Tech. Projects in the area of general management.

Research Publications

1. Rodrigues, L. L., Hebbar, S. & Herle, R. (2011, July). "Bullwhip Effect Mitigation in Trading System: A System Dynamics Approach." *In Proceedings of the World Congress on Engineering (Vol. 1, pp. 6-8).*
2. Rodrigues, L. L., Motlagh, F. G., Rao, S. and Hebbar, S. (2011, November). "Identifying the optimum warehouse capacity requirement: A system dynamics approach. *In 2011 UKSim 5th European Symposium on Computer Modelling and Simulation* (pp. 220-224). IEEE.
3. Padiwal, A., Michael, L. K. and Hebbar S. (2019). "Consumer Perception towards Social Media Advertisements: A study done in a semi-urban city of South India." *Indian Journal of Marketing*, 49(2), 38-51.
4. Hebbar, S. and Kiran K., B. (2019). "Social Media Influence and Mobile Government Adoption: A Conceptual Framework and its Validation", *International Journal of Electronic Government Research*, 15(3), 37-58.
5. Hebbar, S., and Kiran K., B. (202X). "A Bibliometric Analysis on Mobile Government Research." *International Journal of Electronic Governance*, Vol.13 No.4, pp.350-385.
6. Hebbar, S., & Kiran K., B. (2022) "Do Social Media and e-WOM Influence M-Government Services? A Citizen's Perspective from India", *International Journal of Electronic Government Research*, Vol.18, No.1, pp.1-27.

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