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| RESEARCH ARTICLE

Antecedents and Consequences of ICT Adoption in MSME

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| ABSTRACT
The Fourth Industrial Revolution stimulated by digital transformation hasimproved the way we live in this world, do our jobs and communicate with each other. The businesses have started to use ICT extensively to improve operations.In fact,Van et al. (2003) findings revealed that investments in technologywere a significant factor in United States better productivity growth than that of Europe in late 1990s.Thus, it becomes imperative for developing nations to devoteresources and adopt ICT in order to increase productivity and beat competition. The present research is an attempt to understand the factors that determine the adoption of ICT by MSMEs that enable them to perform better inemerging economies like India. The present study uses Technology Organisation Environment framework to elicit factors that determine ICT adoption intentions in MSMEs. The results reveal the relative advantage, compatibility of technology and management support have a strong impact on ICT adoption intention of MSMEs. Also complexity of technology has a significant inverse (negative) impact on ICT adoption intention while as decentralised decision making has no impact on ICT adoption intention. Lastly the firms that have high ICT adoption intention tend to have better firm performance.

| KEYWORDS

Information Communication Technology(ICT), adoption intention, TOE framework, Firm performance.

| ARTICLE INFORMATION

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1. Introduction

The Fourth Industrial Revolution,which has been fuelled by the digital transformation,hasimpacted the way we live in this world, do our jobs and communicate with each other. This revolution has transformed the industry completely by the extensive use of Information Communication Technology (ICT), Web3, block chain, robotics,artificial intelligence (AI), Internet of Things (IoT), quantum computing and other related technologiesThe Micro Small Medium Enterprise (MSME) sector which is a dynamic and vibrant sector in global economies has been no exception to this transformation.In industrialised nations, MSMEs make substantial use of ICT.(Giotopoulos et al , (2017) where as in developing countries,usage has been on the rise off late particularly after Covid-19 pandemic in India (Kumar et al, 2023). The MSMEs have often been regarded as the growth engines of Indian economy as they have provided employment opportunities to a large population (Drucker, P. 2014), promoted inclusive growth& regional development, increased exports, and contributed enormously to Gross Domestic Product (Van Stel, Carree&Thurik, 2005).

The adoption of ICT has globally enabled MSMEs to enhance effectiveness, efficiency, competitiveness, and improve customer relationship by remodelling their operational paradigms (Ongori&Migiro, 2011). In India MSMED Act, 2006 categorises MSMEs into two broad categories namely manufacturing and services. The act defines business concerns on account of investment in "Plant & machinery and Equipments"as shown in Table 1.

"Composite Criteria: Investment in Plant and Machinery/Equipment and Annual Turnover			
Classification	**Micro**	**Small**	**Medium**
MSME Enterprises and Enterprises rendering Services	Investment in P&M/Equipment not more than INR 1 crore and Annual Turnover not more than INR 5 crores	Investment in P&M/Equipment not more than INR 10 crores and Annual Turnover not more than INR 50 crores	Investment in P&M/Equipment not more than INR 50 crores& Annual Turnover not more than INR 250 crores

Table 1:*Revised MSME Classification (w.e.f. July 1, 2020) Source:www.msme.gov.in"*

As per the official figures, there are an estimated 633.88 Lakh MSME units registered in India, Out of 633.88 Lakh units, 196.65 lakh units are engaged in manufacturing, 230.35 are in services and 206.85 in different trades(Annual Reports MSME, GOI, 2019). In India MSMs have been able to generate 11.10 Crore of employment opportunities by using relative less capital. The Micro Small and Medium Enterprises in the Indian Economy contribute significantly to manufacturing (45%), Exports (40%) and Employment (59%). The MSMEs have also been instrumental in contribution to other sectors. Despite these important contributions made by MSMEs to the Indian economy, The MSMEs in India are faced with numerous hurdles, some of which include inadequate infrastructure, limited access to institutional credit lines, and low rates of Information Communication Technology (ICT) adoption. It has been reported by various researchers that large organisations tend to invest 4-5% of gross revenues on Information Technology infrastructure while as MSME tend to invest relatively low in absolute numbers (Misra& Mondal, 2011). Further, Van Ark et al. (2003) findings show that investments in information communication technologywere a significant factor in United States better productivity growth than that of Europe in late 1990s.Thus, it becomes imperative for developing nations to invest andadopt ICT to increase productivity and beat competition. Due to globalization Indian MSMEs have come under pressure particularly exports because of the high quality and low cost substitutes offered by global players thereby decreasing their market share. It has been reported by various research studies that to stay competitive MSMEs must invest and adopt ICT as it helps to increase productivity, market share, provide better customer service and at the same time help reducing various cost particularly manufacturing, distribution and marketing cost (Hanggraeni, 2021).

The current study investigates the elements that influence ICT adoption and its impact on MSMEs' business performance. The objective is to provide a thorough understanding of the variables affecting ICT adoption and its consequences in MSMEs. Specifically the current study intends to answer two research questions.

RQ1: Investigate the antecedents that influence the adoption of ICT in MSME organisations

RQ2:Examine the influence of ICT adoption in MSME on organisation performance.

The cost benefit analysis of ICT adoption by MSMEs have revealed the benefits that accrue to ICT adoption like cost reduction, enhanced customer, availability of new business prospects, organisational effectiveness and market intelligence (Tan, Chong, Lin, &Eze, 2010; Ongori&Migiro, 2011; Kumar et al, 2023) exceed cost (personnel training, licensing, facility upgrading etc) involved in ICT adoption. The past researches in this direction have generally been carried out in developed economies (Giotopoulos et al, 2017). However, in developing economies like India few studies have been carried out in this direction particularly focusing on antecedents of ICT adoption alone through various technology adoption models (Kumar &Samalia, 2016; Raut et al, 2017; Singh, Thakkar &Jenamani, 2022). Little emphasishas been dedicated in the research to understand consequences of ICT adoption in MSMEs.. The present research is an attempt to fill this void and provide direction for future research in this direction.

2. Theoretical Framework and Hypotheses Development

In understanding the adoption of technology at the firm level and individual level various models have been proposed in the literature for better understanding of the phenomenon. These models have been useful in understanding how individuals, organisations, and society embrace and accept new technology. In this direction, the earliest model proposed was Diffusion of Innovation (Valente & Rogers, 1995; Rogers,1995; 2010) which focused on innovation-decision process comprising knowledge, persuasion, choice, execution, and confirmation steps. Based on their readiness to accept innovation, adopters were classified as innovators, early majority,early adopters, late majority, and laggards in this paradigm.Next model that attempted to explain adoption of technology was Technology Acceptance Model (Davis F, 1985) which focused on perceived ease of use (PEOU) and perceived usefulness (PU) to explain individual technology adoption. The Tornatzky& Fleischer (1990)Technology-Organization-Environment (TOE) framework isanother attempt to explain adoption of technology by organisation by considering internal and external factors through technology-organisation and environment factors. The UTAUT by Venkatesh et al. (2003) is considered an addition to the TAM since it considers a variety of other factors such as social impact, enabling conditions, and behavioural intention. The purpose of UTAUT was to expand a comprehensive framework for studying technology acceptance in diverse contexts. Other attempts in the literature to explain technology adoption include the task technology fit model, social cognitive

theory, and incentive model. The Technology-Organization-Environment (TOE) framework (Tornatzky& Fleischer, 1990) is a comprehensive model that describes how organisations accept and utilise technologyfor advancements. According to the framework, three factorsimpact the technology adoption decisions of a company. These are technology perspective, organisation perspective, and the environment prespectivet. The term technology refers to intrinsic characteristics of technology itself, such as its usefulness, complexity and simplicity of use, compatibility with current systems. The organisational context refers to firm's and its resources' characteristics, such as the quality of employees' technology use knowledge, management structure, and amount of resource slack while environment refers to the external environment in which the firm operates, including conditions such as regulatory requirements, market conditions, and cultural& social norms. This study's conceptual model (figure 1), which is based on the aforementioned theories, underlines the importance of factors related to technology and also internal organisational variables in an effort todetermineorganisations decision towards acceptance and implementationsof ICT. The environmental factors have not been considered, the environment has been controlled for. Thus the conceptual model relies mostly on technology and organization factors (Tornatzky& Fleischer, 1990) which are considered most appropriate while studying the technology adoption of organisations and more precisely about MSMEs adoption of technology (Ramdani, Chevers& Williams, 2013; Giotopoulos et al, 2017; AlBar& Hoque, 2019; Amini& Javid, 2023).

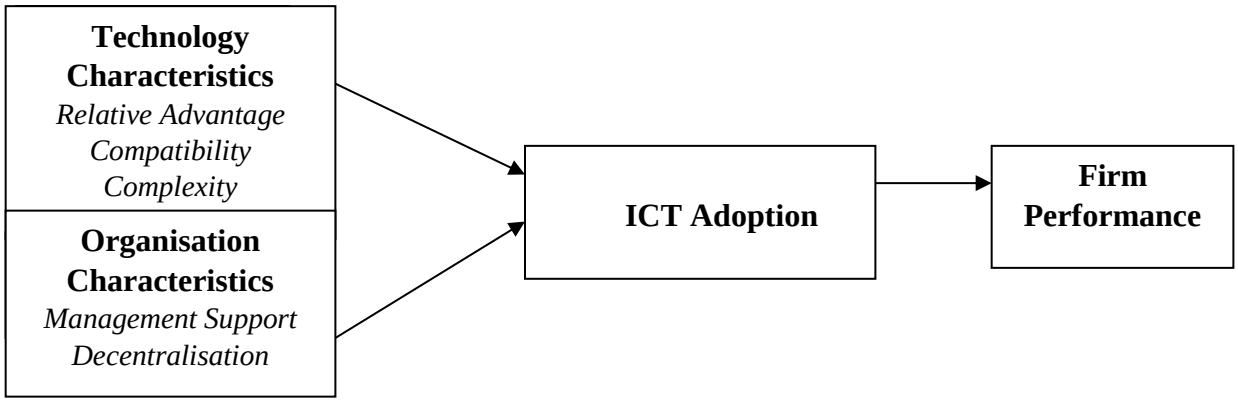

Figure1: The Conceptual Model of Study

The acceptance of the ICT by MSMEs has been associated with better organisation performance through various studies (Cuevas-Vargas, Aguirre & Parga-Montoya, 2022; Tarutė&Gatautis 2014; Setiowati, Daryanto&Arifin, 2015). The brief of important constructs of importance are briefly discussed below.

2.1 Technological Context: Technology characteristics are considered as one of the reasons that influencesorganisations implementation of technology. As per Baker (2012), adoption intention of firm is determined by the technical skills of the human resource, user time and information technology infrastructure. The technological context comprises factors such as relative advantage,complexity and compatibility. According to Rogers, a relative advantage is "the degree to which an innovation is perceived as being better than the idea it supersedes". It highlights the advantages and disadvantages that an organisation may face when it approves or declines a technological innovation. Compatibility is defined as"the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters". While as complexity is defined as "the degree to which an innovation is perceived as relatively difficult to understand and use". It has been reported in various studies that the more existing systems are better and compatible with new technologies are more likely it is to be adopted, and technologies that are highly complex require specialized technical skills and are less likely to be adopted by organizations quickly (Ramdani, Chevers& Williams, 2013; Awa, Ojiabo&Orokor, 2017; Al Hadwer, Tavana, Gillis &Rezania, 2021). As a result, we contend that technological context factors are likely to have a major impact on decisions about ICT adoption and use in MSMEs. Thus we formulate hypotheses as under.

H1: Relative advantage hassignificant positive impact on MSME inclination to use ICT.

H2: Compatibility of technology has positive significant impact on MSME inclination to exploit ICT.

H3: Complexity of technology has significant impact on MSME inclination to utilize ICT.

2.2 Organisational Context: Organisation context is concerned with describing the factors that influence an organisations intention to adopt new technologies, specifically it includes factors such as organisational size; top management support in adoption of new technology, organisation culture, the centralisation & formalisationof decision-making (Angeles 2014). As per Bruque&Moyano, 2007) the top management support characteristics may have a substantial impact on a firm's choice to adopt new technology. The supportive and decentralized decision making motivates employees and increase likelihood of adoption of

ICT by MSMEs (Rashid, 2001; Lertwongsaten&Wongpinunwatna, 2003; Alshamaila et al.,2013;). The following hypotheses are presented based on the preceding discussion.

H4: Top management support has positive and significant effect on ICT adoption among MSMEs.

H5: Decentralisation of decision-making is significantly and positively associated with ICT adoption in MSMEs.

2.3 ICT Adoption and Organisational Performance: The ICT adoption by the MSMEs helps them to develop and expand their competitive advantage and improve firm performance. This improved firm performance by virtue of acceptance of innovative technologies may get reflected in terms of better firm performance matrices (low defects, low costs, low inventory, efficient production, high quality products, motivated employees, skilled employees etc). The superior firm performance by acceptance of innovative technologies has been reported in previous studies as well (Chairoel, Widyarto&Pujani,2015; Nugroho, Prijadi&Kusumastuti, 2022). The adoption of new technologies enables MSMEs to remain relevant to changes in dynamic environment by developing new capabilities and competitive advantage. The following hypotheses are presented based on the preceding discussion.

H6: The ICT acceptance has significant positive impact on the organisational performance of MSMEs.

3. Data and Methodology

The present empirical research is based on dataset collected from 251 MSMEs in three North India states ((J&K, Punjab & HP).The data was collected using survey method from MSME enterprises having registered offices in three North India states (J&K, Punjab & HP). The respondentsincluded business owners or senior managers with decision making power in sample enterprises. The structured questionnaire as survey instrument was distributed to 360 respondents both physically and electronically. Only 259 responses were received after numerous reminders. Initial data purification revealed 6(six) incomplete replies, which were deleted for further investigation; 2 (two) outlier responses were also excluded as they had extreme values. The data analysis was performed on 251responses for results and interpretation.

3.1 The Measures for Present Study

All of the instrument's measuring items were adapted from previous related studies with little to no modifications in item description to fit present research context. For measurement of technology perspective construct in terms of relative advantages of technology, complexity of system and compatibility of technologies different items from different studies have been used. The items for measurement of technology were adapted from Premkumar& Roberts (1999) and AlBar& Hoque (2019). The organisational perspective construct is measured in terms of top management support and decentralised decision making by adopting items from AlBar& Hoque (2019) and Giotopoulos et al (2017).The items for ICT adoption intention have been customised from Elbeltagi, et al (2013) and AlBar& Hoque (2019) to fit the present research context. The 5point interval Likert scale was used to compute all the items in scale were 1 denotes “strongly disagree" and 5 denotes "strongly agree".

4. Data Analysis and Results

The data for present study has beenanalysed using SPSS20 and Amos20 software. Descriptive statistics was used to analyse the fundamental properties of data collected. Exploratory Factor Analysis (EFA), a multivariate statistical tool, was utilised to investigate the factor structure A multivariate statistical analytic approach, structural equation modelling (SEM), is also usedcomprising of two models. The first being measurement model and other being structural model. SEM is a predictive modelling approach that prioritises forecasting when evaluating statistics models for elucidating causal linkages (Hair et al., 2017). The table below represents the demographic summary of participants of survey.

Respondent	No.
Gender	
Male	153
Female	98
Age	
20 to 30	25
31 to 40	74
41 to 50	87
Above 51	65
Job Title	
Owner	35

Junior Manager	25
Middle Manager	82
Sr. Manager	109
Experience with Technology	
Less than 3 years	168
3 or more	83

Table 1: Demographic Profile of respondents

4.1 Common method bias

The Harman one-factor test was used to examine common method bias (CMB), asthe single questionnaire contained both dependent and independent variables and data was collected from respondents in single instance.The results revealed, the largest single factor explained only 26.82%that is less than threshold value of 40%, indicating that CMB is not a concern for present study (Fuller et al., 2016; Kock, 2015). The variance inflation factors (VIF) of components were also determined, and the largest inner VIF value was 2.604, which was lower than the cutoff value of 3.30, suggesting CMB was not an issue in present study.

4.2 Exploratory Factor Analysis (EFA)

The data collected was first analysed for normality by determining kurtosis and skewness. The kurtosis and skewness values were within the limit between -7 to +7 and between -2 to +2 respectively (Bryne, 2010). After the normality was verified data was subjected to exploratory factor analysis using principal component analysis with varimax rotation. The EFA extracted seven stable factors which explained70.327% variance. The results of EFA are shown below in Table 2.

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
COX1	.810						
COX2	.800						
COX3	.757						
DC3		.805					
DC2		.766					
DC1		.719					
RA1			.822				
RA3			.737				
RA2			.708				
OP2				.804			
OP1				.803			
OP3				.791			
AI3					.800		
AI1					.776		
AI2					.695		
MS2						.842	
MS3						.717	
MS1						.591	
CM1							.811
CM3							.745
CM2							.736

Table 2: Exploratory factor analysis

4.3 The Measurement Model

The measurement model was developed to confirm the factors of the scale. The measurement model had all the goodness of fit measures above the threshold value indicating the scale had stable constructs and measured intended constructs. The measure model is shown in figure 2 below. The model fit indices of confirmatory factor analysis /measurement model are given below

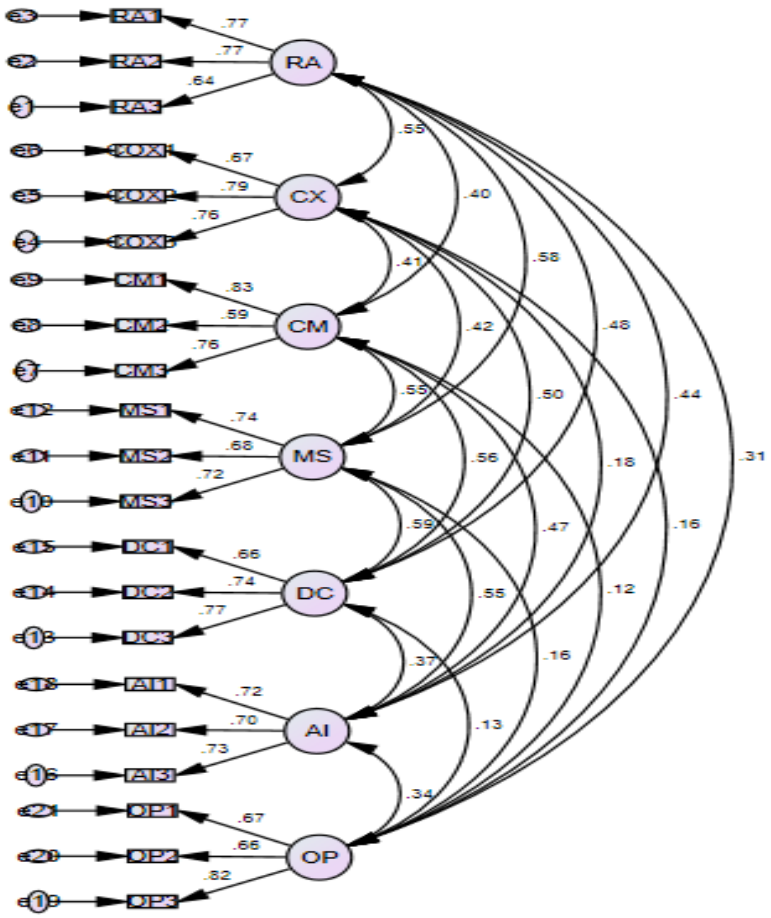

Figure2: Measurement model along with standardized coefficients

The measurement model had CMIN/DF = 2.027, GFI = 0.885, AGFI = 0.842, CFI = 0.908, RMR = 0.069 and RMSEA = 0.060. Further, inorder to validate the appropriateness of instrument for intended measurement construct reliability and validly were estimated.Cronbach's alphawhich is the reliability measure of scale was greater than the cut off value of 0.70 also composite Reliability was greater than 0.7 (Hair et al., 2017) suggesting reliability of scale. Inorder to verify the constructs were unique and different discriminant validity was estimated. The convergent and discriminant validity was assessed. The average variance extracted (AVE) was estimated and found to be greater than 0.5 in each case (suggesting convergent validity) and the square root of AVE which is represented by diagonal in table 3 was contrasted with the correlation between the constructs. In each case the correlation coefficient among the constructs was lesser than squareroot of AVE suggesting discriminant validity of constructs (Fornell&Larcker, 1981).

	CR	AVE	MSV	MaxR(H)	AI	RA	CX	CM	MS	DC	OP
AI	0.758	0.510	0.301	0.758	**0.714**						
RA	0.772	0.532	0.341	0.783	0.444	**0.730**					
CX	0.787	0.554	0.298	0.796	0.176	0.546	**0.744**				
CM	0.776	0.541	0.312	0.808	0.472	0.401	0.410	**0.735**			
MS	0.760	0.514	0.350	0.762	0.549	0.584	0.420	0.553	**0.717**		
DC	0.770	0.529	0.350	0.776	0.367	0.475	0.498	0.559	0.592	**0.727**	
OP	0.761	0.517	0.115	0.781	0.339	0.307	0.165	0.122	0.158	0.131	**0.719**

Table 3: Reliability, Convergentand Discriminant Validity Analysis Results

4.4 Structural Model

The structural model has been developed using Amos software inorder to analyse the different paths between the components and to test present study hypotheses.The structural model involves calculating the path coefficientsinorder to assessstrength of the correlations between independent and dependent variables.

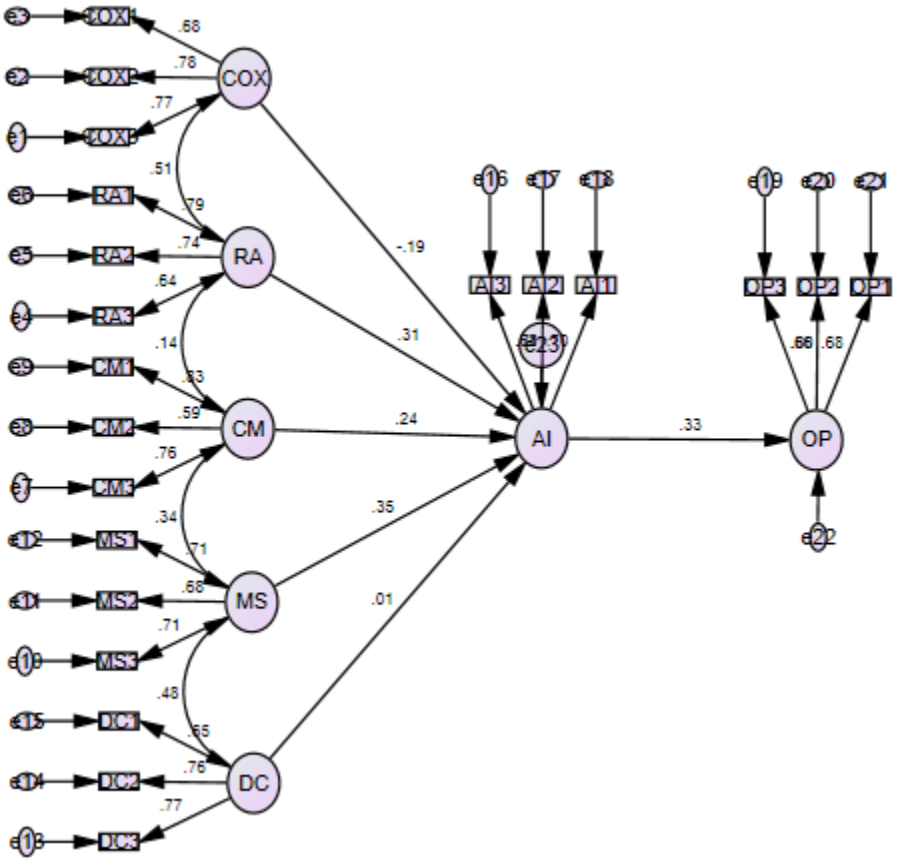

Figure 3: Structural Model for Path Analysis and Hypotheses Testing

The final model fit indices were calculated (after correlating certain error terms and variables) the values were found proper compared to recommended values. The structural model CMIN / DF = 2.753 which is less than threshold value of 3 (three). The values of goodnessof fit indices were AGFI = 0.801, GFI = 0.862, CFI = 0 .853, NFI = 0.798, and RMSEA = 0.059.

Following the validation of the structural model's model fit indices. The next step is to compute path estimates and put the hypothesis to the test. The maximum likelihood technique (Albright and Park, 2009) was utilized to estimate the path and test hypotheses. The summary of hypotheses test results are presented in table 4.

Hypotheses	Path	SRW	p-Value	Result
H1	RA→AI	0.31	0.002	Accepted
H2	CM→AI	0.24	0.008	Accepted
H3	COX→AI	-0.19	0.042	Accepted
H4	MS→AI	0.35	0.002	Accepted
H5	DC→AI	0.01	0.954	**Rejected**
H6	AI→OP	0.33	***	Accepted

Table 4: *Hypotheses Results* *** *p < 0.01 & SRW(Standardized Regression Weight)*

5. Discussion

The present study used the TOE paradigm to examine the variables that influence ICT acceptance in MSME organisations and their impact on the firm performance. The results of the present study reveal relative advantage as part of technology TOE framework hasa significant positive impact on MSME organisation inclination to use ICT in day to day operations (H1- accepted). Thus the new innovative technologies that offer advancements over existing technology tend to be more rapidly accepted by MSMEs. The results also reveal compatibility has a positive and significant impact on MSME organisation inclination to adopt ICT. (H2 –

Accepted). Thus new technologies which are highly compatible with existing technology are more likelypreferred by MSMEs to be accepted, adopt and included in operations. Organisations prefer to adopt new innovative technologies if new technologies are compatible with the existing technologies/systems that the firm are currently using. However the results also revealed complexity of new technology has significant negative impact on ICT adoption by MSME organisations.Thus complex technologies are not easily adopted by the organisations (H3- Accepted). It is more likely that new technologies that are complex, organisations will be more hesitant rather been open to adopt such complex technologies.

The results further revealed that support of top management and encouragement towards new technology is an important antecedent in terms of ICT acceptance by MSME organizations (H4-accepted). Organisations in which top-level managers are open to change and embraces technology as means of superior performance are more willing to accept innovative technology compared to organisation were top management is not open to change. Surprisingly the decentralised decision making does not act as an antecedent of ICT adoption by MSME firms (H5-rejected). Although decentralised organisation were anticipated to be more receptive to innovative technology but the data suggests such organisations do not embrace innovative technologies quickly. One of the possible reasons for such behaviour can be low formalisation, loose chain of command and no concentrated authority to make final decision.Further the ICT adoption has positive and significantinfluence on the performance of MSMEs.Thus, firms that encourage and adopt new technology tend to have superior performance than organisation that do not adopt and take leverage of technology. The results of this study are in conformity with earlier similar studies (Aligarh, Sutopo&Widarjo, 2023; AlBar& Hoque, 2019; Gangwar, Date & Ramaswamy,2015) that have analysed antecedents of ICT acceptance and its influence on organisational performance.

5.1 Implications

The current study has managerial as well as theoretical implications. The present investigationadds to existing literature by verifying technology perspective in terms of relative advantage of technology & compatibility of technology are important consideration in determining MSMEs behaviour to adopt new technology while as complexity of technology acts as an inhibitor to adopt new technology (ICT). Further, the study also highlights organisational perspective in the form of top management support towards innovative technology as important antecedents of ICT adoption by MSMEs. Further the study also highlights ICT adoption as an important precursor of superior organisation performance. The study also highlights decentralisation decision making does not have any significant impact on ICT adoption by MSMEs. These findings are in line with various previous studies (AlBar& Hoque, 2019). The managerial implications of the study highlight the MSMEs that are able to demonstrate better performance generally adopt new technologies and interventions in the area of ICT. Further it enables managers to focus on factors that can foster an environment that imbibes technology adoption by focussing and improving factors like relative advantage of technology, top management support and compatibility of new technology with existing.

5.2 Limitation of Present Study

The present research like all other researches had certain limitations. The present study was carried out on manufacturing MSMEs the future research could be carried out on service organisations or taking both simultaneously manufacturing & service organisations.The present study is a single cross section the longitudinal studies could also be interesting as they can explain the adoption cycles and rates across the life of an organisations.The present study was conducted in three North Indian states. Future studies can include all states from India.The present study explores only TOE framework the. Future studies can make use of other adoption models either singly or combination of few models.

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