DETERMINANTS OF TECHNOLOGY ADOPTION IN INDIAN MSMES: AN EXPLORATORY FACTOR ANALYSIS

Sujeet Shivaji Patil, Shri Mata Vaishno Devi University
Ashutosh Vashishtha, Shri Mata Vaishno Devi University

ABSTRACT

In today's business situation, MSMEs are the main source of growth for the development of any country. MSMEs are also very important in giving good job opportunities to the population of any country. They are also an important part of the expansion of entrepreneurial endeavors through innovations in business. In the 73rd round of the National Sample Survey (NSS) that was conducted in 2015-16, a total of 11.10 crore jobs were created across the country, both in rural and urban areas (Ministry of MSME(GOI), 2023). Despite the fact that MSMEs are expanding in every field, technology adoption is not regarded as a critical factor for MSMEs. As a result, this research paper is a study to examine the factors affecting MSMEs' adoption of technology. This research paper will help the MSMEs owner to know which factor is the main barrier that is affecting them to adopt technology in the industry.

Keywords: MSMEs, Technology, Growth and Development of Economy, Factor Analysis.

INTRODUCTION

MSMEs have been an important and active sector of the economy of our country for the last 50 years, contributing to socio-economic development by promoting entrepreneurship and creating good employment opportunities at lower capital costs. The broad timeline of MSMEs' evolution in India is in the succeeding paragraphs. Before the MSMED Act 2006 came into existence, the MSME's non-agriculture segment was comprised of various industries that were also mainly traditional, like coir, khadi, and silk; small-scale service and business enterprises (SSSBEs); small-scale industries (SSIs); cottage and village industries; and they were known as small-scale industries. Subsequently, the MSME Act 2006, merged all the diversified industries; it also included the service sector and medium enterprises. As per this act, MSMEs were classified into three types of enterprises: a micro enterprise, in which the investment in plant and machinery or equipment does not exceed one crore rupees and turnover does not exceed five crore rupees; a small enterprise, in which the investment in plant and machinery or equipment does not exceed ten crore rupees and turnover is not more than fifty crores; and a medium enterprise, where the investment in plant and machinery or equipment does not exceed fifty crores and turnover is not more than two hundred fifty crore rupees.

MSMEs helped the economy of India grow since 1991 when the trade reforms came and al the 2006 MSMED Act. This sector has also seen growth in GDP because of exports and more job opportunities. India's GDP will become the second largest in the world by 2050.(Pati, 2018)The Indian government has implemented several initiatives to address MSMEs' problems, but experts argue that no measures are adequate.(Pushkar Dubey, 2020).On July 1, 2020, a new classification went into effect, and it was based on investment in plant and machinery/equipment that was different for manufacturing and service units, and it had very low financial limits. Since then, the economy has also changed. The revision of MSME classification criteria was announced under the Aatma Nir Bhar Bharat Package on May 13, 2020, in response to the need to streamline and provide smooth business operations.

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

According to the most recent definition of MSME, there will be no difference between the manufacturing and service sectors. In addition, a new turnover criterion was added to the previous classification criterion, which was solely based on investment in plant and machinery. The definition of micro manufacturing and service units was expanded to include an investment of Rs. 1 crore and a turnover of Rs. 5 crores. The small unit limit has been raised to Rs. 10 crore of investment and Rs. 50 crores of turnover. Similarly, the medium unit limit was raised to Rs. 20 crores in investment and Rs. 100 crores in turnover. On June 1, 2020, the Government of India decided to revise the MSME Definition further upward. It is now Rs. 50 crore of investment and Rs. 250 crores of turnover for medium enterprises. There are industrial revolutions that have acted as turning points in the past, had positive effects on industrial sectors, and transformed all the functions and operations of the industries. Further to this, Industry 4.0, which stands for the fourth industrial revolution, is trying to introduce technologies like IoT, IoS, Big Data, etc. that will increase the efficiency and productivity of the industries and also bring about positive change in the manufacturing industries (Bakhtari et al., 2020)

Objective of the Study

In Indian MSMEs, various challenges are being faced by them, like lack of bank credit, competition from multinational companies, poor infrastructure, and a lack of technologies. Changes are being observed from time to time in every aspect, whether it is in employment or in the country's growth. However, currently, the aspect that is causing trouble for MSMEs is the adoption of technology. The adoption of technology in MSMEs will accelerate their growth and enable our country to compete with other developed nations at a global level. Therefore, keeping these things in consideration, this article will explain and bring out the various factors that are preventing MSMEs from adopting technology and contribute to the following objectives:

1. To identify the factors affecting MSMEs' adoption of technology.
2. To identify hidden constructs using exploratory factor analysis.
3. To develop a comprehensive model of technology adoption by MSMEs.

LITERATURE REVIEW

An extensive literature review was carried out on the subject, and the following paragraphs will explain the significant existing literature in the field of study.

In this study researcher examined SME finance issues from banks, analyzing published statistics and primary data to determine reasons for bank reluctance to lend and potential solutions to improve SME access to bank finance.(Manikandan, 2000). The lack of diffusion of past inventions, low R&D investment, and low technology achievement index in India, along with limited technical expertise among entrepreneurs, contribute to lower levels of innovation in small enterprises in Bangalore compared to Northeast England(Subrahmanya, 2005). Despite strong policies, Indian SMEs struggle with credit, technology, and infrastructure. Challenge: expanding SME advantages across sectors and focusing on employment generation. To help Indian SMEs prosper, policymakers must solve these concerns (Das, 2008)

(Dixit & Pandey, 2011) used co-integration analysis to look at the relationship between SMEs' output, exports, employment, number of SMEs, and fixed investments and India's GDP, total exports, and employment (both public and private) from 1973-74 to 2006-07. Their study showed that the output of SMEs has a positive effect on India's GDP. Wage inequality in developing countries has increased over the past 20 years, with trade and capital account liberalization increasing the profitability of skill-biased new technologies. However, cross-firm heterogeneity in technology adoption is observed due to differences in productivity, fixed

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

costs, and credit constraints. The model's predictions are confirmed by firm-level data(Sahu et al., 2012). Internationalisation may save SMEs by reducing risks and enhancing R&D intensity. Governments should promote cross-border trade and collaboration to help them grow and expand knowledge and markets. Research suggests that SME survival depends on domestic and international partners, and empirical studies of internationalisation can explain SME advantage(Lee et al., 2012). MSMEs are crucial to a nation's economic and social development. The entrepreneurial spirit boosts economic growth through efficiency, adaptability, and invention. MSMEs account for 45% of industrial output, 40% of exports, 60 million jobs, and 1.3 million jobs annually. With over 8,000 products, the company manufactures high-quality goods for domestic and international markets(Roy, 2013). The MSME sector is vital for achieving the target of increasing the manufacturing sector's GDP contribution from 16% to 25% by 2022, as per the proposed National Manufacturing Policy, and the researcher in his research paper evaluated the present and future outlook of MSMEs in India (Dey, 2014). MSMEs are crucial to Prime Minister Narendra Modi's 'Make in India' initiative, contributing to 8% of the country's GDP. The manufacturing sector, which currently accounts for 15% of India's GDP, has been negatively impacted by consumer spending decline and confidence levels. Empowering MSMEs is being taken to ensure their continued growth (Bhadauria, 2015).

Technology helps smaller firms succeed globally. Technology should be adopted throughout the value chain, including manufacturing and support activities like administration, HR, and design. MSMEs' productivity and competitiveness depend on efficient technology adoption. Innovative technology is essential for small businesses to survive.(FICCI-CMSME, 2016). MSME contributes 8% of India's GDP, 45% of manufacturing, and 36% of exports, but their distribution is uneven due to a lack of raw materials, entrepreneurial skills development, and financial and technical assistance.(Ali & Husain, 2017). Human Resource Management (HRM) functions and practices are crucial in today's knowledge-based economy, as they ensure efficiency in product production and a satisfactory standard of living. HRM studies help businessmen understand the economy, market, organization, and related areas, making them an integral source of knowledge(Virk, 2017). India's MSMEs sector drives growth, creates jobs, and reduces regional inequality. Their progress is greater than that of the entire industrial sector. The study suggests that MSMEs can help the Indian economy develop uniformly and use natural resources. Their uniqueness must be explicitly nurtured to continue contributing(Gade, 2018). Customer digitization has increased data traffic and tech startups in India, a digitalization experiment. These sectors struggle to adapt to rapid digitalization. Building smart cities, revitalizing mid-sized towns, digitizing India, and becoming an international production hub are part of India's new economic model. MSMEs dominate these ecosystems.(Venkatesh & Kumari, 2018). MSMEs play a crucial role in sustainable development, contributing to economic growth, job creation, and poverty alleviation, also they make up a significant portion of private sector entities in both developed and developing countries, contributing to 42% of GDP and 60% of employment and their growth has shown positive impacts on the Sustainable Development Goals (SDGs), including poverty reduction and gender equality(Liu, 2018). MSMEs that engage in trade activities dominate the industry. The sector contributes 40-50% of India's total export, 30% of the GDP, and 32% to Gross Value Added. MSMEs create about 40% of the total employment, with 55% in urban cities and 45% in rural areas (Boateng et al., 2019). A study on Indonesian MSMEs' adoption of e-marketplace and Instagram revealed that factors such as competitive pressure, financial resources, perceived risk, and top management support influence their adoption, while perceived benefits, top management support, and vendor support also influence their adoption (Purwandari et al., 2019).

Factors such as foreign exchange rate, fixed investment, and government financial support impact MSME export performance. However, poor raw material availability may negatively impact export performance, as determined by Levene's Test for Equality of

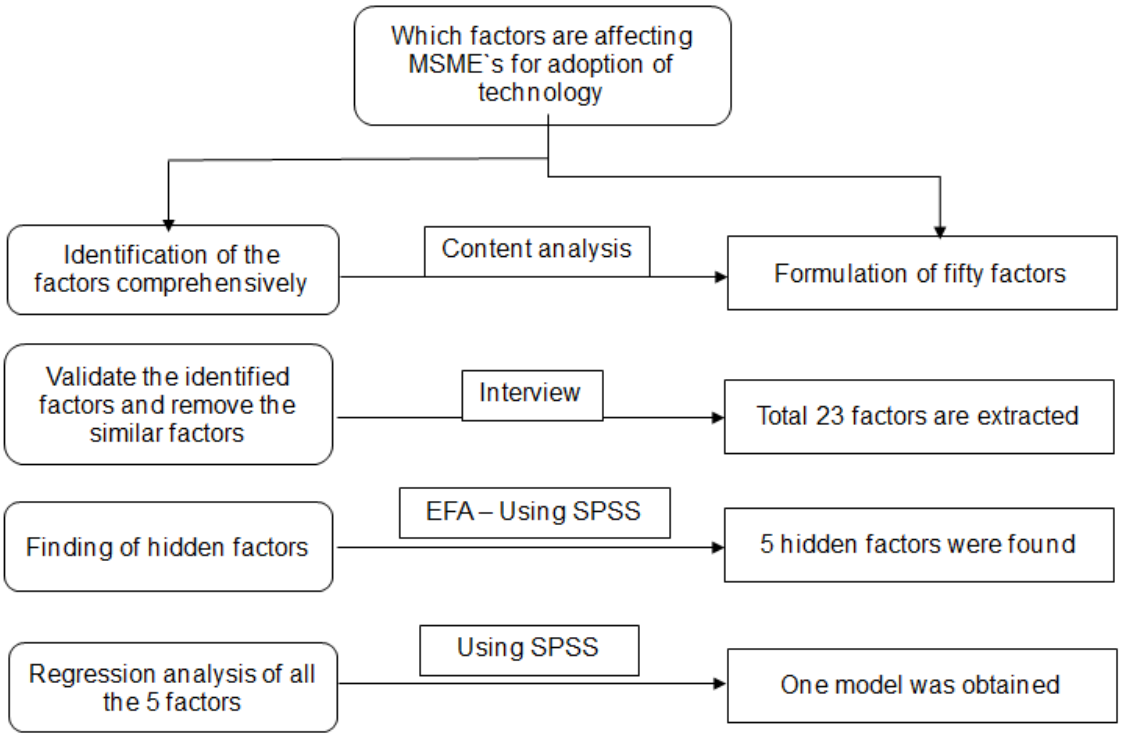
Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

Variants (Bandopadhyay & Khan, 2020). There is a significant positive impact of e-payment and e-commerce services on the performance of MSME supply chains in Indonesia, and the researcher in his study identifies ten barriers to digitalization in MSMEs and proposes open innovation solutions to help accelerate the digital transformation of MSMEs in Indonesia (Kilay et al., 2022). The study also emphasizes the importance of considering how long technology systems take to reach their full potential and preparing and training employees for effective use. The report also emphasizes the importance of IT training for management.(Help et al., 2022). A pandemic's negative effects spur internal and external entrepreneurial innovation. Lack of skills, market issues, internet infrastructure, and pandemic constraints have hampered digital enterprise. Researchers' findings inform government digital entrepreneurship policy for economic recovery.(Cueto et al., 2022). Researcher found that Ethiopian MSMEs need tax breaks to grow and survive during the COVID-19 pandemic (Deyganto, 2022). The COVID-19 pandemic has severely impacted 95% of MSMEs, but digitalization has been crucial for survival and growth. A survey of over 1500 e-commerce platforms show increased online sales during the pandemic.(Technology, n.d.)

METHODOLOGY

This section is about the methodology that has been used to write this research paper. A list of 50 factors was created after analyzing the content to determine the factors affecting MSMEs' adoption of the technology for the study. After that, a survey comprised of 50 questions based on these factors was created to capture the wide range of MSMEs active in the manufacturing, ancillary, and service sectors. The survey covered broad aspects of various business performance dimensions. The purpose of this survey was to gather opinions on the significance of the identified factors for the adoption of technology by MSMEs in India.

The statistical SPSS software version 27 was used for exploratory factor analysis to identify the hidden factors. Followed by carrying out linear regression analysis to determine which factor among the hidden factors is having the greatest impact. The flow chart of research methodology is shown in Figure 1.



Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

FIGURE 1
FLOW CHART OF RESEARCH METHODOLOGY APPLIED IN THIS RESEARCH PAPER

Identification of the Factors

The first step of this study was to identify the factors that affect the adoption of technology in MSMEs. The collection and analysis of the data to identify research problems from literature, official documents, websites, databases, and other studies is effective in the research field (Holsti, 1969). To find out the variables affecting technology adoption in MSMEs, extensive references were taken from academic literature and government policy-related documents.

Research was carried out from databases available on the internet, and the main keywords that were used to find the academic literature were: technology, MSMEs, and factors affecting the adoption of technology. Accordingly, with the help of the research papers and journals obtained from these keywords, a list of variables was prepared. Also, newspaper reports, the Annual Report of MSME by the Government of India, and the websites of MSMEs were referred to. This helped in raising awareness about the policies that the government has introduced for the introduction of technology to the MSME sector.

On the basis of the analysis from the literature on the study topic, fifty variables were identified and accordingly the coding was done for the ease of understanding.

Further these 50 variables were reduced and modified to 23 variables because some of the variables were seemed to be similar. This was done after carrying out semi structured interview with four experts in the field and the profile of these four experts are given in table 1 and the list of the selected 23 variables are given in table 2 And questions which were asked in the interview are as under:

Q1 Are all variables communicated properly and easily understandable? If they are not, then what corrections are to be made?
Q2 Any variable mentioned in the list is not valid?
Q3 Are there any variables in the list with the same meaning?
Q4 Are there any variables that are not mentioned in the list?

Table 1
PROFILE OF THE EXPERTS WHO HAVE BEEN INTERVIEWED

Sr No.	Designation of Expert	rtment	Mode of Interview
1.	Additional Secretary	M/O MSME	Face to Face
2.	Professor	University	Face to Face
3.	Senior Banking Official	Bank	Face to Face
4.	CEO	Private Industry	Mobile Phone

Exploratory Factor Analysis

Exploratory Factor analysis is carried out with the SPSS software for the reduction of the data into the main factors. To carry out the exploratory factor analysis, the first test that is executed to get the Kaiser-Meyer-Olkin Measure (KMO) and Bartlett's test to check whether the survey is suitable for exploratory factor analysis or not. A value above 0.6 to 0.7 is considered sufficient for analysing the EFA output. The p value should be lower than the

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

significance level ($p<0.05$) for exploratory factor analysis to be suitable.(Shrestha, 2021) Cronbach`s alpha value is to be checked to examine the reliability of the data sets. The significant value should be more than 0.6 (Table 2).

The questions were designed for responses on a five-point scale from strongly agree to strongly disagree (5 to 1) for ease of response. The survey was conducted through email, phone, and personal meetings. Questionnaires were distributed to a number of industries all over the country; however, a sample size of 221 was collected. A sample questionnaire is mentioned in table 2.

Table 2
SELECTED VARIABLES AFTER THE INTERVIEW

Ser No	Selected Variable	Variable Code
	Cost Reduction Benefit	Q1
	Technology Knowledge Hierarchy	Q7
	Market Demand Survey for Technology	Q8
	R&D Product Development	Q12
	External Technical Support R&D	Q13
	Government Schemes Awareness	Q17
	Vendor Tech Contract Simplicity	Q21
	Tech Adoption Costs	Q23
	Tech Adoption Business Ops	Q24
	Tech Decision Support Profitability	Q25
	Strategic Tech Adoption	Q26
	Tech Enhanced Productivity Competitiveness	Q27
	Tech Support Availability	Q29
	Vendor Tech Support	Q31
	Qualified Tech Employees	Q33
	Cost Prohibitive Tech Skills	Q34
	Tech Positive Attitude Employees	Q35
	Tech Quick Learning Employees	Q36
	Employee Management SOP	Q38
	Government Tech Incentives	Q40
	Tech Subsidies Tax Relief	Q42
	Cluster Support Tech Adoption	Q46
	Gov Tech Training Centers	Q47

Analysis Result

Exploratory factor analysis is carried out on 23 variables using SPSS software. The results of various tests are in the succeeding paragraphs.

KMO and Bartlett`s Test

In this study, the KMO value was 0.800, which is close to 1, and Bartlett's test was also found adequate. As a result, further exploratory factor analysis was carried out because the result was above the minimum requirement.

Cronbach`s Alpha Test

The Cronbach Alpha test was conducted, which came out to be 0.856 for 23 variables, which was in the range, so it was found that the sample is reliable. The table 3 shows the values of KMO, Bartlett's test, and Cronbach's alpha.

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

Table 3 KMO AND BARTLETT`S TEST		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		
Bartlett's Test of Sphericity	Approx. Chi-Square	1725.164
	Df	253
	Sig.	0.000
Reliability Statistics	Cronbach Alpha Test	0.856
	No. of Items	23

Communality Value is the proportion of variance between the observed factor in the questionnaire and the factors obtained from the data. In this analysis the communality value comes out to be an average of **0.608**, which is above **0.5**; therefore, all items are well reflected by the extracted factors. Result is shown in the table 4.

Table 4 COMMUNALITY VALUE		
Communalities		
Component	**Initial Value**	**Extraction Value**
Q1	1.000	.525
Q7	1.000	.643
Q8	1.000	.580
Q12	1.000	.391
Q13	1.000	.470
Q17	1.000	.475
Q21	1.000	.608
Q23	1.000	.625
Q24	1.000	.539
Q25	1.000	.678
Q26	1.000	.734
Q27	1.000	.622
Q29	1.000	.643
Q31	1.000	.590
Q33	1.000	.545
Q34	1.000	.575
Q35	1.000	.580
Q36	1.000	.709
Q38	1.000	.620
Q40	1.000	.656
Q42	1.000	.653
Q46	1.000	.652
Q47	1.000	.744

Eigen Values

As per the analysis, it was found that only six factors to be considered balanced can be eliminated from the report. After doing an analysis of these samples, we came to know that the cumulative variance of the six factors contributes to 60.254%. Result is reflected in the table 5.

Table 5 EIGEN VALUES						
Component	**Initial Eigen Values**			**Extraction Sum of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Total**
Q1	5.76	25.048	25.048	5.76	25.048	25

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

Q7	2.61	11.355	36.403	2.61	11.355	36.4
Q8	1.73	7.528	43.931	1.73	7.528	43.9
Q12	1.35	5.87	49.802	1.35	5.87	49.8
Q13	1.27	5.508	55.31	1.27	5.508	55.3
Q17	1.14	4.944	60.254	1.14	4.944	60.3
Q21	0.88	3.814	64.069			
Q23	0.85	3.692	67.761			
Q24	0.83	3.622	71.383			
Q25	0.79	3.429	74.811			
Q26	0.73	3.152	77.964			
Q27	0.69	3.003	80.967			
Q29	0.59	2.565	83.532			
Q31	0.58	2.505	86.037			
Q33	0.48	2.092	88.129			
Q34	0.47	2.04	90.169			
Q35	0.43	1.871	92.04			
Q36	0.38	1.653	93.693			
Q38	0.37	1.626	95.319			
Q40	0.33	1.416	96.734			
Q42	0.31	1.332	98.066			
Q46	0.23	1.021	99.087			
Q47	0.21	0.913	100			

Rotated Component Matrix

The varimax rotation method has been used with principal component analysis. Six factors have been found by looking at the values of rotated component matrix. Therefore, after analysing the rotated component matrix total six factors have been identified and they have been named as Adequacy of Infrastructure (F-1), Government Support (F-2), Competitiveness(F-3), Marketing(F-4), Finance(F-5) and Technological Orientation (F-6). However, factor six has been removed because only two variables were found in this factor. Result is reflected in table 6.

Table 6
ROTATED COMPONENT MATRIX

Component	F-1	F-2	F-3	F-4	F-5	F-6
Q1				0.67627		
Q7				0.7641		
Q8				0.61735		
Q12					0.5487	
Q13	0.54327					
Q17	0.59097					
Q21						0.71156
Q23					0.7759	
Q24			0.66895			
Q25			0.759			

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

Q26			0.83279			
Q27			0.70169			
Q29						0.71908
Q31	0.69333					
Q33	0.65958					
Q34					0.68125	
Q35	0.69199					
Q36	0.76034					
Q38	0.69102					
Q40		0.77374				
Q42		0.7374				
Q46		0.72802				
Q47		0.82972				

Regression Analysis

In order to gain a deeper understanding of the five factors that were extracted from the original set of 23 variables, a regression analysis was performed between each of the factors. In the selection process of dependent and independent variables, the output of the rotated component matrix from exploratory factor analysis was examined. The component with the highest value from the extracted factors, which was closest to 1, was chosen as the dependent variable. The remaining components of that factor were then selected as the independent variables. All six factors were subjected to the same procedure, but the sixth factor was excluded from consideration due to its limited number of variables. The selected output variables are determined by considering the main factors, which include:

As a result, we were able to generate five regression equations, one for each factor, with the output variable being the relevant variable in each factor. The results that have been considered for the comparison between the five-regression analysis are Adjusted R Squared values, D-W Statistics, Significance/ p value and residual statistics.

The comparison of different regression analyses according to the output has been enumerated in the table 7.

Table 7
REGRESSION ANALYSIS COMPARISON

Regression Analysis		Model -1	Model - 2	Model - 3	Model - 4	Model - 5
Dependent Variable		Q 36	Q 47	Q 26	Q 7	Q 23
Adjusted R Squared Value		.487	.545	.427	.242	.180
D – W Statistics		2.003	1.922	1.960	2.220	1.903
Sig level or p Value		.000	.000	.000	.000	.000
R Squared in %		48.7	54.5	42.7	24.2	18
Residual Statistics	Predicted Value	4.14	3.34	4.36	4.09	3.82
	Residual	-2.947	-3.19	-2.47	-2.28	3.03
	Standard residual	1.8	2.12	1.44	1.45	1.72

As per the results, it has been interpreted that Model 2 has the highest adjusted R-squared value (54.5%), indicating a better fit in terms of explaining the variance in the

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

dependent variable. The Durbin-Watson statistics are almost close to 2 for all the models, and they indicate no strong evidence of autocorrelation. The standard residuals of all models are the same; however, Model 2 has the highest value with a value of 2.12. Therefore, Model 2 fits to be the best model among all the models, as its adjusted R-squared value is the highest among all the models.

Model 2 has the dependent variable Q 47 and the independent variables Q40, Q42, and Q 46. The questions in the survey that was conducted are reflected in table 8.

Table 8
VARIABLES DISTRIBUTION

Question	Statement	Variable
Q47	While adoption of new technology, the technology centres established by government agencies were helpful for training of skilled manpower.	Dependent
Q40	The government agencies have provided incentives to encourage new technology adoption.	Independent
Q42	The enterprises gets subsidies and tax relief for adoption of new technology.	
Q 46	The government initiatives of cluster-based industry and design clinics were supportive in new technology adoption by enterprise.	

The model has made it clear that this factor is related to government support, and all of the questions that were included in this factor are related to government-provided training centres, incentives for supporting technology, subsidies or tax relief for technology implementation, and cluster-specific support for technology implementation.

DISCUSSION AND CONCLUSION

The adoption of new technology by micro, small, and medium-sized enterprises (MSMEs) in India is influenced by a variety of factors. These factors include support from the Indian government, infrastructure and competitiveness, marketing, and financial resources. These elements, once extracted, can assist policymakers and business owners in developing more successful programmes that encourage micro, small, and medium-sized enterprises to adopt new technology. According to the suggested model in the research paper, it is essential for the government to introduce additional financial benefits, improve infrastructure, and establish cluster-based R&D centers and training centers for the purpose of implementing technology in industries (according to the most recent evaluation study of the Micro and Small Enterprises – Cluster Development Programme of the Government of India). This will also contribute to the long-term development of micro, small, and medium-sized enterprises (MSMEs), as well as the expansion of the economy of the country. In addition, introducing innovation centers and hubs will help promote an environment of experimentation within the MSME sector. As a result, it will be a great deal easier to implement new technology in MSMEs if we give careful consideration to each of these facets and make an effort to cooperate with one another.

Future Scope

The validation and application of the identified factors influencing technology adoption in MSMEs in the Indian context is required, potentially through case studies or surveys involving a larger and more diverse sample of MSMEs. Furthermore, given the

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

dynamic nature of government initiatives and their impact on MSMEs, it would be beneficial to investigate specific policies and strategies that can strengthen government support for technology adoption. As technology evolves at a rapid pace, ongoing research should track the changing needs and challenges that MSMEs face in keeping up with technological advancements. Finally, efforts should be made to develop and evaluate practical interventions and programmes that can assist MSMEs in overcoming the barriers to technology adoption identified in this study, thereby contributing to the growth and competitiveness of India's MSME sector Table 9.

Table 9
SELECTED 50 VARIABLE

Ser No	Variable	Variable Code
	Cost Reduction Benefit	Q1
	Employee Suggestions	Q2
	Technology Implementation Information	Q3
	Technology Training Resources	Q4
	Technology Adaptability Market Goals	Q5
	Technology Strategic Growth	Q6
	Technology Knowledge Hierarchy	Q7
	Market Demand Survey for Technology	Q8
	Vendor Technology Implementation	Q9
	Technology Adoption Improvement	Q10
	Technology Development Customer Expectations	Q11
	R&D Product Development	Q12
	External Technical Support R&D	Q13
	Technology Investment Capability	Q14
	Financial Support Accessibility	Q15
	Fiscal Management Technology Adoption	Q16
	Government Schemes Awareness	Q17
	Cash Flow Transparency	Q18
	Compliance Security	Q19
	Regulations Protection of technology	Q20
	Vendor Tech Contract Simplicity	Q21
	Innovative Culture Tech Use	Q22
	Tech Adoption Costs	Q23
	Tech Adoption Business Ops	Q24
	Tech Decision Support Profitability	Q25
	Strategic Tech Adoption	Q26
	Tech Enhanced Productivity Competitiveness	Q27
	Rural Tech Infrastructure	Q28
	Tech Support Availability	Q29
	Tech Maintenance Sustainability	Q30
	Vendor Tech Support	Q31
	Supply Chain Tech Comfort	Q32
	Qualified Tech Employees	Q33
	Cost Prohibitive Tech Skills	Q34
	Tech Positive Attitude Employees	Q35
	Tech Quick Learning Employees	Q36
	Tech Retention Affordability	Q37
	Employee Management SOP	Q38
	Incentive For Tech Ideas	Q39
	Government Tech Incentives	Q40
	Tech Support Financing	Q41
	Tech Subsidies Tax Relief	Q42
	Government Assured Markets	Q43
	Government Security Deposit	Q44
	'Make In India' Tech Benefits	Q45
	Cluster Support Tech Adoption	Q46
	Gov Tech Training Centers	Q47

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

	Centralized Tech Info Platforms	Q48
	Tech Adoption Ease (Indian Market)	Q49
	Globalization Tech Boost (Indian Market)	Q50

REFERENCES

Ali, A., & Husain, F. (2017). MSME's in India: Problems, Solutions and Prospectus in Present Scenario. *International Journal of Engineering and Management Sciences, 5(*2), 109–115.

Bakhtari, A. R., Kumar, V., Waris, M. M., Sanin, C., & Szczerbicki, E. (2020). Industry 4.0 implementation challenges in manufacturing industries: An interpretive structural modelling approach. *Procedia Computer Science, 176,* 2384–2393.

Bandopadhyay, K., & Khan, T. L. (2020). Factors of Export Promotion of MSME in India with Special Reference to Raw Material Availability. SEDME (Small Enterprises Development, Management & Extension Journal): *A Worldwide Window on MSME Studies, 47*(1), 17–32.

Bhadauria, Dr. A. (2015). "Make in India": Need of Revamping Linkages of Service Sector with MSMEs. SSRN Electronic Journal, III(12), 92–96.

Boateng, K. Naveem, S., Nagaraju, Y.(2019). The Contribution of MSMEs to the Growth of the Indian and Global Economy. RESEARCH REVIEW International Journal of Multidisciplinary, *4*(3).

Cueto, L. J., Frisnedi, A. F. D., Collera, R. B., Batac, K. I. T., & Agaton, C. B. (2022). Digital Innovations in MSMEs during Economic Disruptions: Experiences and Challenges of Young Entrepreneurs. Administrative Sciences, 12(1).

Das, K. (2008). SMEs in India: Issues and Possibilities in Times of Globalisation. *Asian SMEs and Globalization, 10*(03), 69–97.

Dey, S. K. (2014). MSMEs in India: it's growth and prospects. *Abhinav-National Monthly Refereed Journal Of Research In Commerce & Management, 3*(8), 26–33.

Deyganto, K. O. (2022). The effect of tax incentives practices on the sustainability of micro, small and medium enterprises in Ethiopia during the outbreak of corona virus pandemic. *Journal of Innovation and Entrepreneurship, 11*(1).

Dixit, A., & Pandey, A. K. (2011). SMEs and Economic growth in India: cointegration analysis. *The IUP Journal of Financial Economics, 9(*2), 41–59.

FICCI-CMSME. (2016). New Age Technologies for for Business Development and Ease.

Gade, S. (2018). MSMEs ' Role in Economic Growth – a Study on India ' s Perspective Introduction : *International Journal of Pure and Applied Mathematics, 118*(18), 1727–1741.

Help, H., Feedback, S., Copyright, C., & Oficial, C. (2022). Technological change: necessary organisational strategy that affects workers. 1–8.

Holsti, O.R. (1969). Content analysis for the social sciences and humanities. *Reading. MA: Addison-Wesley (content analysis)*.

Kilay, A. L., Simamora, B. H., & Putra, D. P. (2022). The Influence of E-Payment and E-Commerce Services on Supply Chain Performance: Implications of Open Innovation and Solutions for the Digitalization of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia. Journal of Open Innovation: Technology, Market, and Complexity, 8(3).

Lee, H., Kelley, D., Lee, J., & Lee, S. (2012). SME survival: The impact of internationalization, technology resources, and alliances. *Journal of Small Business Management, 50*(1), 1–19.

Liu, C. K. (2018). Policy Brief: the Role of Micro-Small and Medium Enterprises in Achieving SDGs-1. Micro-, Small and Medium Enterprises (MSMEs) and their potential contributions to SDGs-2. MSMEs' Growth: Opportunities and Challenges.

Manikandan, S. (2000). A Study on startup and its impact on MSME in India with special reference to Maharashtra state. over.

Pati, M. R. (2018). MSME and its impact on Indian Economy with special reference to MSMED Act 2006. *IOSR Journal of Electrical and Electronics Engineering, 13*(1), 102–107.

Purwandari, B., Otmen, B., & Kumaralalita, L. (2019). Adoption factors of e-marketplace and instagram for micro, small, and medium enterprises (MSMEs) in Indonesia. ACM International Conference Proceeding Series, 111–116.

Pushkar Dubey, K. K. S. (2020). MSMEs in COVID-19 crisis and India's economic relief package: a critical review. *The International Journal of Indian Psychology, 8*(4), 6.

Roy, S. (2013). Small and Medium Enterprises in India. Small and Medium Enterprises in India, 134–136.

Sahu, Bhaskaran, E., Chandraiah, M., Vani, R., Mehta, S., Wani, V. P., Garg, T. K., Sharma, S. K., Rao, A. S., Bustos, P., Chandra, A., Pareek, V., Lahiri, R., Chaudhary, Y. B., Mesut Savrula Ahmet Incekarab, S. S., Srinivasan, R., Zhao, J., Bhaskaran, E., Chaminade, C., & Survey, L. (2012). Review on role of advance modern manufacturing technology in micro small and medium enterprises (msmes). *Innovative Journal of Business and Management, 5*(3), 1–11.

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.

Shrestha, N. (2021). Factor analysis as a tool for survey analysis. *American Journal of Applied Mathematics and Statistics*, *9*(1), 4-11.

Subrahmanya, M. B. (2005). Pattern of technological innovations in small enterprises: a comparative perspective of Bangalore (India) and Northeast England (UK). *Technovation, 25*(3), 269-280.

Technology, L. (n.d.). MSMEs Go Digital.

Venkatesh, J., & Kumari, R. L. (2018). India's Digital Transformation: Driving MSME Growth. IMPACT: *International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL), 6*(3), 49–60.

Virk, S. G. (2017). Role of Human Resource Manage ment in Micro , Small and Medium Enterprises (MSME) in India. *International Journal of Business Administration and Management. ISSN 2278-3660, 7(*1), 26–34.

Received: 19-Jan-2024, Manuscript No. AMSJ-24-14377; **Editor assigned:** 20-Jan-2024, PreQC No. AMSJ-24-14377(PQ); **Reviewed:** 30-Mar-2024, QC No. AMSJ-24-14377; **Revised:** 29-Apr-2024, Manuscript No. AMSJ-24-14377(R); **Published:** 01-Jul-2024

Citation Information: Shivaji Patil, S., & Vashishtha, A. (2024). Determinants of technology adoption in indian msmes: an exploratory factor analysis. *Academy of Marketing Studies Journal, 28*(5), 1-13.