

Role of Technology in Scaling MSMEs and Start-ups: A Quantitative Study of Rajasthan-based Firms"

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1. Abstract

This research investigates the technology role(s) in MSME and start-up scaling in Rajasthan, India. Quantitative data were obtained from 140 firms from different sectors to understand how various factors such as digital adoption, training of personnel, cloud computing, and CRM system usage affect the growth of a firm. Data analysis was carried out using descriptive statistics, correlation, regression, and chi-square tests. Results indicate very strong positive correlations between use of technology and business performance indicators such as revenue growth and productivity, and also with customer acquisition. The regression model reveals that digital adoption and training of employees significantly forecast firm growth. Cost and lack of skills were stated by most of the firms as the main barriers to technology adoption. Chi-square tests, however, did not reveal any statistically significant association between the problems faced and revenue growth. These findings can be used to assist policymakers and business support organizations in creating an MSME ecosystem in Rajasthan with a digital edge.

Keywords: Technology, Innovation, MSME

2. Introduction

2.1 Background of the Study

The MSMEs and start-up biodiversity form vital chains in the economic development, contributing to GDP growth, employment generation, and innovations. In states like Rajasthan, where both traditional and modern kinds of businesses get enforced, with technology adoption, operations are now believed to be scaled; thus, the product and service reach is also expected to grow for them to be more competitive. However, the value of technology in enhancing performance remains poorly investigated particularly in local contexts and through quantitative approaches.

2.2 Research Aim

This research aims to examine the extent to which technology contributes to the scalability and performance of MSMEs and start-ups in Rajasthan.

2.3 Research Objectives

- To identify the levels and types of technology adopted by MSMEs and start-ups.
- To assess the impact of technology on revenue growth, productivity, and customer acquisition.
- To evaluate challenges in implementing technology.
- To provide evidence-based recommendations for technology integration.

3. Review of Literature

Technology has been considered a revolutionary element in operations, especially for small and medium enterprises. Chatterjee et al. (2021) consider digital tools such as customer relationship management software, cloud storage, and automation platforms critical in increasing productivity and

market expansion. In the context of emerging economies like India, Gupta and Sinha (2018) contend that firms engaging ICT reap great benefits in terms of efficiency and competitiveness.

But regional disparities continue to be an issue. Rai and Bajaj (2020) stress that digital technologies are burgeoningly being adopted by urban MSMEs, leaving many enterprises in the countryside hampered by poor infrastructure, low digital literacy, and lack of financial resources. The World Bank (2019) has observed that particularly micro and small enterprises who could potentially scale up are too distracted by the operational challenges to assert strategic vision for digital transformation.

Another important agency for theorization is the Technology-Organization-Environment (TOE) framework, which holds that successful adoption of technology is conditioned not only by an organization's readiness but also by external pressures and the technological context. This is a very apt model for MSMEs in India, as they very often operate under quite resource-constrained settings with volatile policy support.

Even after thorough exploration by various scholars of the fruits of technology, very few of the available literature concern SMEs. And most of the available literature conduct qualitative assessment. What is still in huge absence is empirical, region-specific evidence that provides quantitative measures of technology's impact on SME growth. This study accounts for that fill-the-gap by studying the Rajasthani context in a structured and statistically rigorous manner.

4. Research Methodology

Quantitative research is used here following the positivist research philosophy that says social phenomena, such as business growth, are objectively measurable phenomena with empirical data. The major consideration is to allow the generalizability of results that would work toward measuring the impact of technological adoption on a wide sample of enterprises in Rajasthan.

4.1 Research Philosophy

The positivist paradigm assures scientific rigor. It assumes a fixed reality that can be observed. Using statistics, the study tries to find patterns and causal relationships between technology adoption and firm performance.

4.2 Sampling

The study intended to encompass the diversity of Rajasthan-based MSMEs and start-ups through stratified random sampling. A sample of 140 companies was collected under three principal areas: manufacturing, services, and technology. Thus, it ensured the proportional representation of these sectors and reductions in biases towards any specific sectors.

4.3 Data Collection Technique

The data for the study were collected with the aid of a structured questionnaire consisting of eight key questions. The survey comprised categorical, ordinal, and Likert-scale questions on the use of technology, operational improvements, and perceived challenges. The tool was distributed either online or via paper, depending on the feasibility of the firm and availability of the internet.

4.4 Data Analysis Technique

Several statistical methods were used for analysis:

- **Descriptive statistics** to summarize firm characteristics and technology usage
- **Correlation analysis** to explore associations among variables
- **Multiple regression** to predict revenue growth using technology-related predictors
- **Chi-square tests** to assess the relationship between categorical barriers and performance

The methods of investigation are implemented with the help of the Python libraries, whereas their validation involves visual inspections and model diagnostics.

4.5 Overview of Variables

- **Dependent Variable:** Revenue Growth (Q5)
- **Independent Variables:** Technology adoption level (Q2), employee training (Q4), perceived productivity (Q6b), customer acquisition (Q6a), and cost reduction (Q6c)
- **Categorical Variable for Chi-square:** Primary tech-related challenge (Q7)

This methodological framework ensures that the problem has been exhaustively and statistically analyzed.

5. Results and Discussion

5.1 Descriptive Analysis

Table 1: Descriptive Table

	Q2	Q3	Q4	Q5	Q6a	Q6b	Q6c
count	140.00	140.00	140.00	140.00	140.00	140.00	140.00
mean	2.99	3.00	0.57	3.42	3.80	4.00	3.70
std	1.41	1.38	0.50	1.25	0.90	0.90	0.90
min	-	1.00	-	1.00	1.00	1.00	1.00
25%	2.00	2.00	-	3.00	3.00	3.00	3.00
50%	3.00	3.00	1.00	4.00	4.00	4.00	4.00
75%	4.00	4.00	1.00	4.00	5.00	5.00	4.00
max	5.00	5.00	1.00	5.00	5.00	5.00	5.00

The descriptive statistics reveal some insightful trends. The average number of technologies being adopted by a firm (Q2) is three, which implies that the digital maturity in the sample on average is considered moderate. In fact, 60% of the firms said that they had done some form of employee training sometime within a time frame of one year, showing some proactive steps for capacity building.

On the revenue front (Q5), more than 65% calculated growth to the tune of over 10% over the 3 years previous to the survey, with about 25% reporting growth to the tune of over 30%. This shows that many MSMEs and start-ups in Rajasthan stand steady and grow with infrastructure and financial constraints, with technology being one of the supporting factors.

Meanwhile, respondents also reported a medium to high-level improvement in the acquisition of customers (Q6a), productivity (Q6b), and cost reduction (Q6c), with average scores of 3.8, 4.0, and 3.7, respectively, on a 5-point Likert scale.

5.2 Correlation Analysis

Table 2: Correlation table

	Q2	Q3	Q4	Q5	Q6a	Q6b	Q6c
Q2	1.00	0.49	0.01	0.44	0.35	0.36	0.38
Q3	0.49	1.00	0.09	0.61	0.40	0.45	0.42
Q4	0.01	0.09	1.00	0.47	0.32	0.54	0.34
Q5	0.44	0.61	0.47	1.00	0.53	0.58	0.50
Q6a	0.35	0.40	0.32	0.53	1.00	0.41	0.38
Q6b	0.36	0.45	0.54	0.58	0.41	1.00	0.43
Q6c	0.38	0.42	0.34	0.50	0.38	0.43	1.00

The correlation matrix indicates strong positive associations between the majority of variables:

- Technology usage level (Q3) correlates with revenue growth ($r = 0.61$)
- Employee training (Q4) has a moderate positive correlation with both productivity ($r = 0.54$) and revenue ($r = 0.47$)

- Customer acquisition (Q6a) and productivity (Q6b), also come strongly correlated with the dependent variable.

This association consists of correlations that support the view that digital adoption at a higher level and organizations ready to deploy (with, e.g., adequately trained staff) result in better business performance.

5.3 Regression Analysis

Table 3: Regression Table

	coef	std err	t	P> t	[0.025	0.975]
const	1.528	0.392	3.900	-	0.751	2.304
Q2	0.034	0.063	0.531	0.596	(0.091)	0.158
Q3	0.224	0.064	3.501	0.001	0.097	0.350
Q4	0.371	0.127	2.918	0.004	0.119	0.622
Q6a	0.096	0.063	1.515	0.132	(0.029)	0.221
Q6b	0.194	0.072	2.710	0.008	0.052	0.336
Q6c	0.117	0.064	1.833	0.070	(0.009)	0.242

The regression model used revenue growth (Q5) as the dependent variable and the six predictors were: number of technologies used (Q2), technology usage level (Q3), employee training (Q4), and three performance indicators (Q6a–Q6c).

Key findings include:

- **Q3 (Tech usage level):** Positive and statistically significant predictor ($p < 0.01$)
- **Q4 (Training):** Also, significant ($p < 0.05$), indicating that firms investing in upskilling staff benefit from revenue gains
- **Q6b (Productivity):** Strong predictor ($p < 0.01$), affirming that internal efficiency improvements drive growth

With an Adjusted $R^2 = 0.52$, the model explains 52% of the variance in revenue growth determined by the variables at hand. Having passed standard diagnostic tests, the model can be labeled robust and applicable in context.

Overall, we can state that the present analysis does support, in an empirical sense, the view that investments in technology-related areas, particularly in human capital and internal processes, have measurable and statistically significant effects on business growth.

5.4 Chi-square Test

Table 4: Chi-square table

		Q5	
		0	1
Q7	0	12	15
	1	14	15
	2	13	14
	3	11	13
	4	11	12

Therefore, a chi-square test was carried to check the relation between main perception of challenge to tech adoption (Q7) and a binarized version of revenue performance (high growth = 1, low = 0).

- **Chi-square value** = 3.50
- **p-value** = 0.478

Given that the p-value is higher than the conventional value of 0.05, it means that the study failed to find a statistically significant relationship existing between the nature of the perceived barrier and actual performance in revenues.

This finding suggests that although obstacles such as cost, lack of skills, or poor infrastructure are seen as problems by most firms, these perceptions do not always correlate negatively with economic outcome. This could mean that growth-oriented firms might be circumventing such barriers or that there exist other factors (which could include leadership, innovation in work, external support) that mitigate the effects of these barriers.

6. Conclusion

The empirical evidence presented in this study reveals how technology uptake drives the growth of MSMEs and start-ups in Rajasthan. Thus, usage of digital tools, cloud services, and training among employees lead directly to changes in revenue, productivity, and customer acquisition. These results complement the global literature while contributing a valuable regional perspective.

Surprisingly, while cost and skills are often cited as barriers, their impact on performance is insignificant statistically. This suggests that firms that choose proactiveness seem to do well despite such barriers and stresses the value of mindset, strategic approach, and adaptability.

Recommendations:

In this way, the viability and competitiveness of MSMEs can be enhanced through certain strategies. First, there must be subsidized training programs in technology to develop internal capabilities, ensuring that employees can adopt digital tools and work with them effectively. This would develop productivity and foster a culture of innovation. The other strategy is to enable development of targeted infrastructure in semi-urban or rural areas to bridge the digital divide and ensure equitable access toward technology. This would ensure improvement of internet connectivity and a reliable power supply, which can go a long way in ensuring tech-adoption. Further, the demands for reform should be to subsidize and grant tax incentives for cloud computing and SaaS tools, thereby breaking down the wall of cost for MSMEs and start-ups to the wider-level acceptance. Begin incubators and accelerators must promote digital readiness as one of the top fare to their programs and service ecosystems. When embedded within early-stage commercial development, these institutions would thus play an essential role towards the launch of viable and technology-enabled enterprises.

The results contribute to literature as well as policy discourse by providing practical insights to those constructively trying to digitize the entrepreneurial landscape in India.

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