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Technology In Elections: Unveiling The Potential And Challenges Of Elections With Evms In Pakistan

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Abstract

The emergence of technology has transformed every aspect of the contemporary world, and the electoral landscape is also benefiting from this transformation. Although new technologies are meant to make the electoral process more transparent and efficient, there are several challenges posed by this technological advancement, which may also adversely affect the results of elections. This research has been carried out to analyze the potential and challenges linked with Electronic Voting Machines (EVM) and the technological impact of EVM. Quantitative research has been conducted using a case study research design focusing on Pakistan. Special attention has been given to the use of EVM in India and Brazil to know the technological impact of the adoption of EVM in Pakistan. An expert sampling method has been used to get the insights and opinions of electoral and

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technological experts through a survey. The findings of this research highlight the significance of EVM in ensuring the efficiency of the electoral process, including fast results and an error-free polling process. Two distinct factors have been fetched using Factor Analysis concerning security apprehensions of EVM, such as hacking and manipulation issues, as challenges in the implementation of EVM. Contrary to this, special measures have been identified, like public awareness of technology and capacity building of human and infrastructure resources to achieve uninterrupted implementation of EVM. The findings further underscore the technological advancement with a need for robust security measures, easy-to-use interfaces of EVM, and regular security and audit enhancement of EVM machines to successfully implement EVM. The research promotes an understanding of the abilities of EVMs to promote legitimate elections. It guides lawmakers and the Election Commission of Pakistan on properly utilizing this technology. The paper claims that the intentional adoption and skillful oversight of EVMs can significantly enhance the reliability and efficiency of electoral processes, hence strengthening democracy.

Keywords: EVM in Pakistan, EVM Security, EVM and Elections, Democracy, Election Commission of Pakistan.

Introduction

Electing representatives through a free and fair voting process is the people's right (Debnath S. et al., 2017). Using elections, the people of a country choose their representatives for parliaments, Assemblies, and local governments. A country with more remote areas faces problems like slow retrieval of results, security risks for electoral officials, and the material and costs of elections during an election (Risnanto, S, 2020). Electoral frauds also affect democratic governments due to the hue and cry of electoral fraud. Developed countries also remained under hot discussion due to various allegations of electoral fraud. From the United States of America to Myanmar, Brazil, and Indonesia, these chants are familiar (Berlinski, N, 2023)

Several countries have shifted from traditional paper-based voting to Electronic Voting to curtail these issues. All electronic voting technologies, including biometric, electronic, and internet voting, are designed to improve voting over traditional methods in accuracy, efficiency, and resource consumption. In addition to the expense, it has accelerated the tabulation of results, boosted voter turnout, and enhanced accessibility (Hisamitsu & Takeda, 2007).

Recently, the use of electronic voting as an alternative to traditional voting has been raised in many countries, and the two best examples are Brazil and India. India’s tilt to technology from traditional voting has a remarkable background as they took this step from a constituency, Parur of Karela Assembly, in 1982 as an experiment. This process was widespread across India in 1998, and for the first time, EVM was used at all polling stations for Lok Sabha Elections in 2004 (Akhtar et al., 2021). It took 20 years to implement technology into elections, and different experiments have been underway since its first existence; moving toward enhanced technology is still underway as India used the Voter Verifiable Paper Audit Trail in 2019(Murugesan P & Dharwez Saganwali 2021).

Brazil's government shifted toward EVM in 1996 from the conventional voting system (Aranha, 2018). The Tribunal Superior Eleitoral (TSE) has significant trustworthiness in the electoral management process and jurisdiction over elections. The decision to tilt toward EVM was made due to issues relating to spoiled ballot papers and to combat fraud in result tabulation (Luiz et al., 2018). Another reason for switching toward EVM was the accessibility problem in the conventional voting system, as the system was complicated, wherein voters were required to identify a number of their candidates from the list or write the name of the preferred candidate. As per the reports, approximately 40 percent of votes were recorded as invalid, blank, or invalidly marked, and the illiteracy rate was marked at 20 percent in the Official Census of Brazil in 1990. The first test for electronic voting was carried out in 1996 in Santa Catarina (Aranha, 2018). Pakistan, like many other countries, has embraced the usage of EVMs in elections as a pilot project.

Despite the increasing use of electronic voting machines in elections worldwide, there is limited understanding of their impact on the electoral process and their role in promoting democracy. In particular, there is a lack of comprehensive studies on the potential and challenges of EVMs in Pakistan, where the technology has been widely adopted. This study is being carried out to know the significance of EVM in Pakistan and the technological readiness of Pakistan's electoral landscape for this technological transformation.

Research Methodology.

This research has been conducted using a quantitative research method with a case study approach. Adopting new electoral technology requires a research design that covers subtleties and challenges faced by the electoral management body on the ground. A case study design provides the opportunity for a holistic examination of the technological impact of EVM on the Pakistani elections. A purposive sampling technique has been used to collect technological expert opinions from tech-savvy and election experts. Technical experts with experience in EVM have been taken on board to conduct this research, and the survey results have been tested using SPSS to get a better and deeper view of the technological implications of EVM.

Results and Discussion

The adoption of EVM has excellent implications for technology in the electoral process in Pakistan. Several statistical operations are performed on the survey results, including correlation, regression, and factor analysis, to strive for deep analysis to find these implications and underscore the potential and challenges. Let's start with the correlation test.

Correlations			
		EVM	Technological Impact
EVM	Pearson Correlation	1	.265**
	Sig. (2-tailed)		.000
	N	252	252
Technological Impact	Pearson Correlation	.265**	1
	Sig. (2-tailed)	.000	
	N	252	252
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 1: Correlation of EVM and Technological Impact

Table 1 shows the correlation between the Technological impact of EVM Adoption. A weak positive correlation has been observed. The significance of this correlation is less than 0.01, meaning a significant correlation has been observed. This is done by calculating the slope coefficient and evaluating its significance using statistical tests such as the F-test and t-tests. OLS, or Ordinary Least Squares, offers a more sophisticated and statistically reliable comprehension of the relationship between variables, enhancing the fundamental understanding obtained from correlation analysis.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.265[a]	.070	.067	.37250
a. Predictors: (Constant), Technological Impact				

Table 2: Model Summary of Technological Impact on Adoption of EVM

From Table 2, we can interpret that the R Shows a weak positive correlation. The R-Square value is 0.070, which is 7 percent; it shows that technological impact can influence the adoption of EVM by only 7 percent, and other factors have impacted the remaining 93 percent.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.620	1	2.620	18.885	.000[b]
	Residual	34.690	250	.139		
	Total	37.310	251			
a. Dependent Variable: EVM						
b. Predictors: (Constant), Technological Impact						

Table 3: ANOVA test of Technological advancement on adoption of EVM

From the ANOVA test given in Table 3, we can explain that the F-statistic is 18.885, which is significant with a small p-value of .000.

It means the model better fits one predator. The model fits the data well, as the p-value is less than the traditional significance threshold 0.05.

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.895	.122		7.349	.000
	Technological Impact	.319	.073	.265	4.346	.000
a. Dependent Variable: EVM						

Table 4: Coefficients of Technological Advancement on the Adoption of EVM

The "Technological Impact" variable, as seen in Table 4, has an unstandardized coefficient of 0.895 and a standard error of 0.122, according to the coefficients table. An increase in technological impact increases 0.319 units of increase in the success of EVM.

3.1 Factor Analysis

The suitability of factor analysis for the dataset on the technological implication of Electronic Voting Machine (EVM) adoption was evaluated using the Kaiser-Meyer-Olkin (KMO)Measure of Sampling Adequacy and Bartlett's Test of Sphericity.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.711
Bartlett's Test of Sphericity	Approx. Chi-Square	73.189
	Df	10

	Sig.	.000

Table 5: KMO and Bartletts's test of technological impact on the adoption of EVM

Table 5 shows that the KMO measure resulted in a value of .711, suggesting a satisfactory degree of sufficiency for the factor analysis. Hutcheson and Sofroniou (1999) state that a KMO score above 0.7 is acceptable, indicating that the sample size and intercorrelations among variables were adequate for a dependable factor analysis.

In addition, the statistical significance of Bartlett's Test of Sphericity was confirmed (χ^2 = 73.189, df = 10, p < .001). This outcome confirms the suitability of the data for factor analysis, as it demonstrates that the correlation matrix of the variables is not an identity matrix, and there are enough correlations among the variables for factor analysis.

The tests indicate that the dataset is appropriate for factor analysis, confirming that the variables associated with the technological aspects of EVM adoption have enough shared variance to justify using this statistical technique.

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.679	33.576	33.576	1.679	33.576	33.576
2	1.063	21.251	54.827	1.063	21.251	54.827
3	.869	17.371	72.198			
4	.743	14.864	87.062			
5	.647	12.938	100.000			

Table 6:Total Variance Explained Test for Technological Impact of EVM Adoption

Table 6 displays the cumulative variance accounted for by the retrieved components using Principal Component Analysis. Initially, this approach evaluated five components. The first component, which has an Eigenvalue of 1.679, explains 33.576% of the overall variation. The second component, which has an Eigenvalue of 1.063, adds an extra 21.251%, leading to a total cumulative variance of 54.827%. Additional components from Component 3 to Component 5 contribute further variability to the model. Nevertheless, it is crucial to acknowledge that the comprehensibility of these elements may decrease as we go down the hierarchy. Specifically, Component 3, which has an Eigenvalue of .869, accounts for 17.371% of the total variance, contributing to a cumulative variance of 72.198%. The subsequent elements exhibit a like pattern, with diminishing contributions to the overall variance.

The study provided five components with initial eigenvalues, but only two were kept due to their eigenvalues exceeding one, as shown in Table 5.37. The initial component accounted for 33.576% of the variation, whereas the subsequent component accounted for an additional 21.251%, resulting in a cumulative total of 54.827% of the explained variance.

Component Matrix		
	Component	
	1	2
EVM could be Hacked	.699	.023
Manipulation of EVM	-.620	-.002
Training of Election Officials	.601	-.028
Vote Counting	-.469	.731
Investment in Resources and Infrastructure	.473	.726
Extraction Method: Principal Component Analysis.		
a. two components extracted.		

Table 7:Component Transformation Matrix of Technological Impact of EVM Adoption

Through Varimax rotation, it was determined that there are two separate dimensions. From Table 7, it is evident that Component 1 (35.784% of variance) had strong associations with the perception of EVM hacking (.699) and EVM manipulation (-

.620), indicating a security-oriented viewpoint that is concerned with vulnerabilities related to hacking and manipulation. Component 2, which accounts for 28.216% of the variation, is defined by strong correlations with Vote Counting (0.731) and Investment in Resources and Infrastructure (0.726).

This indicates a focus on implementation, prioritizing effective vote counting, and appropriate allocation of resources. These findings indicate that while certain persons express apprehensions about the security of EVMs, others prioritize the effective execution of these systems to maximize advantages.

Rotated Component Matrix[a]

	Component	
	1	2
EVM could be Hacked	.699	.026
Manipulation of EVM	-.620	-.005
Training of Election Officials	.601	-.026
Vote Counting	-.473	.729
Investment in Resources and Infrastructure	.470	.728

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. [a]
a. Rotation converged in 3 iterations.

Table 8: Rotated component Matrix of Technological impact of EVM adoption

Using Varimax rotation and Kaiser Normalization, the Principal Factor Analysis identified a two-component structure that accounted for the variance in the analyzed variables, as provided in Table 8. Two dimensions have been identified through Factor Analysis that have the potential to influence EVM adoption. The first dimension is security-centered, characterized by apprehensions of EVM's vulnerability toward hacking and manipulation and the need for sufficient resources and infrastructure building. On the other hand, the second dimension focuses on faster and error-free result calculation along with the proper allocation of resources for infrastructure building. This means some people are concerned about security issues and find their crucial technological impact on EVM adoption. In contrast, other people prefer efficient implementation procedures to ensure EVM's seamless and efficient working. This means that addressing both apprehensions is necessary for the successful adoption of EVM and for fostering public confidence in its adoption.

3.2 Technological Factors Affecting Acceptance of EVM

A semi-open-ended question in the survey was relevant to the technological challenges and factors that can influence the acceptance of EVM. The respondents were allowed to choose one or more options to know their views about the challenges that can affect the successful adoption of EVM.

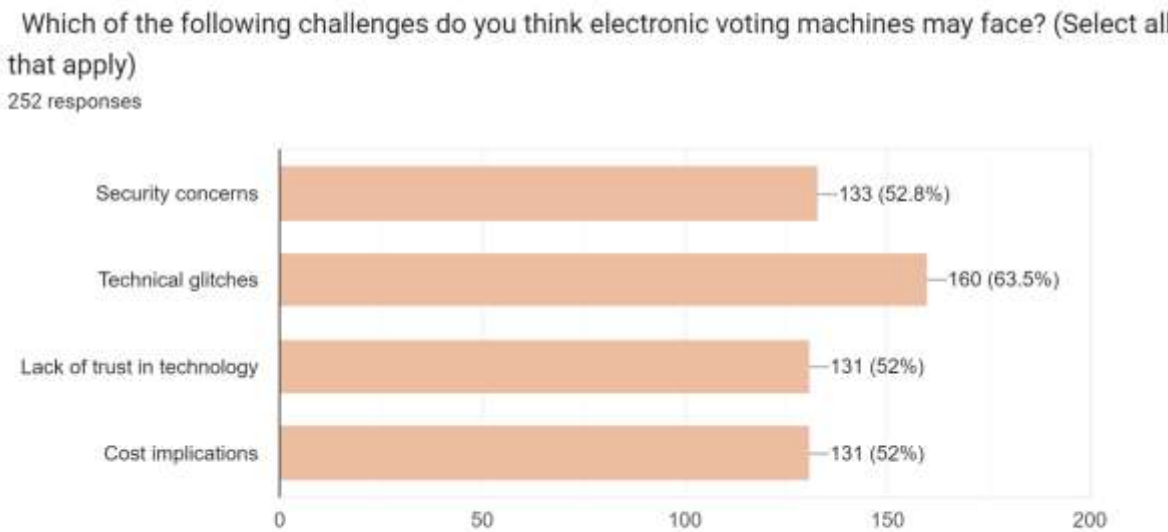

Figure 1:Challenges in the Adoption of EVM

Figure 1 presents the respondents' perspectives regarding the possible obstacles that may arise during the implementation of EVMs.

A majority of respondents (160, 63.5%) consider technical problems to be a noteworthy obstacle. This problem emphasizes the utmost importance of the reliability of EVMs and highlights the necessity for thorough testing and quality assurance procedures both before and during their implementation. This obstacle is acknowledged by 133 respondents (52.8%), showing that somewhat more than half perceive the security of EVMs as a possible concern. The emphasis on security highlights the necessity for solid encryption and protective measures to guarantee voter trust in the election procedure. 52% of people have shown a lack of confidence in technological advancement and emphasized the importance of people's trust as an essential requirement for the smooth implementation of EVM. This requires special measures like mass awareness about comparing traditional voting and EVM to foster public confidence in EVM.

A good number of people (52% of the total) also identified considerable costs to be incurred on procurement and training of EVM as an essential challenge for acceptance of EVM. This requires further research on the cost-benefit analysis of EVM to rationalize the expected expenditure on the adoption of EVM.

To conclude, all of these challenges provide a significant way forward for policymakers to consider these factors while developing and adopting any strategy for the implementation of EVM. In order to adopt EVM successfully, these challenges require redressal in the shape of consensus of all stakeholders, meticulous preparation, and significant public awareness campaigns.

Conclusion

Amidst the transformative impact of technology on our lives, this research expedition on EVMs has shed light on a way to update elections and strengthen democracy, with Pakistan as the primary focus.

To conclude this effort of finding technological implications of EVM in Pakistan, we are at a considerable conclusion that technological advancement and reliability play significant roles in adopting any new technology. This research concluded that despite other factors, technological advancement also significantly impacts EVM's success.

In the first instance, this research unequivocally supports that technological advancement has a good role in determining the success and impact of EVM in elections. The statistical significance of the correlation between EVM and technological advancement highlights the potential for technology to enhance the electoral process's enhancement, accuracy and security, especially during polling. This implies that a rationale exists to explore the possibilities of adopting EVM as a means of voting to bolster the integrity of elections.

The implementation of EVMs in Pakistan has been impacted by two opposing factors that have been analyzed. One aspect represents the security concerns, including significant concerns about hacking and manipulation. Efficiency requires concentrating on prompt and accurate results and strategic allocation of resources. Different challenges have also been highlighted, including technical challenges, machine security, public trust issues, financial constraints for procurement, and allied matters of EVM deployment.

This study also highlights an essential need for a comprehensive cost-benefit analysis to examine the costs and benefits of EVM adoption. Ultimately, citizens' collective confidence and awareness serve as the unifying element. In order to enhance public trust in EVMs, it is imperative to conduct educational and awareness initiatives that efficiently communicate the benefits of EVMs compared to conventional voting systems.

Our analysis of EVMs indicates a positive and encouraging future for Pakistan and the broader domain of democratic processes. EVMs can bring about a future characterized by transparency, efficiency, and reliability in elections. The expedition is replete with obstacles, yet it also offers abundant fulfillment. Pakistan and other nations strive to improve their democratic processes by making them more modern, transparent, and effective.

Recommendations

Based on the analysis of this research, we conclude that Pakistan's electoral landscape has excellent potential to adopt Electronic Voting Machines in the electoral process. However, the following recommendations have been penned down for policymakers and the Election Commission of Pakistan before implementing EVM in the Pakistani electoral process.

5.1 Phased Piloting and Implementation

To implement Electronic Voting using machines in Pakistan, a phased manner plan is required on a pilot basis. The results of these pilots enabled ECP to bolster the creditability and security of EVMs and make them tamper and error-free. It will also provide a roadmap for the complete implementation of EVM if required.

5.2 Secure and User-Friendly EVMs

Safety measures and protocols are required to avoid machine tampering and address technical issues. A consistent improvement, as done by India in machines, will maintain the effectiveness and durability of EVM.

5.3 Enhanced Training and Infrastructure

It is the requirement of the time to invest in HR and resources to initiate comprehensive extensive training for election officials and equip them with the necessary resources and infrastructure to implement EVM.

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