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THE TRIPLE BURDEN: HOW PAPER-BASED SYSTEMS INCREASE COSTS, DELAY APPROVALS AND COMPROMISE DATA ACCURACY IN ELEMENTARY AND SECONDARY EDUCATION OF KHYBER PAKHTUNKHWA

Raja Nabeel Sajid[*1], Dr. Samina Rooh[2], Dr. Javeria Andleeb Qureshi[3], Rehmat Ullah Khan[4]

[*1]*Elementary & Secondary Education, KP*
[2]*Lecturer in Management Sciences University of Buner*
[3]*Assistant Professor, Department of Management Sciences, Hazara University, Mansehra*
[4]*Department of Management Sciences, Hazara University, Mansehra, Pakistan.*

[*1]rajanabeelsajid@outlook.com, [3]javeria@hu.edu.pk, [2]samina.ali.bangash@gmail.com, [4]rehmat@hu.edu.pk

Corresponding Author: *
Raja Nabeel Sajid
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ABSTRACT

This study examines the inefficiencies of paper-based administrative systems in elementary and secondary schools of Khyber Pakhtunkhwa (KP), Pakistan, highlighting three major challenges: increased operational costs, prolonged processing delays, and compromised data accuracy. Despite global advancements in digital governance, KP's education sector continues to rely on outdated manual methods for tasks such as student enrollment, staff transfers, leave approvals, and financial documentation. These processes result in unnecessary expenses, bureaucratic bottlenecks, and frequent errors, ultimately affecting the quality of education service delivery.

Using a quantitative, cross-sectional survey design, data was collected from 320 administrative staff across 80 schools in urban and rural areas. Findings reveal that schools spend an average of PKR 20,300 monthly on paperwork, with critical processes like No Objection Certificates (NOCs) and staff transfers taking up to 28–35 days for approval and sometimes more than that. Additionally, 78% of respondents reported recurring errors in student records, undermining data reliability. While rural schools face more severe delays due to infrastructure limitations, 89% of staff expressed willingness to adopt digital solutions.

The study concludes that transitioning to digital systems is essential for improving efficiency, reducing costs, and ensuring accurate record-keeping. Recommendations include piloting digital interventions in urban schools, enhancing staff digital literacy, and establishing long-term funding mechanisms for sustainable implementation. The research underscores the urgent need for administrative reforms in KP's education sector to align with modern governance standards.

Keywords: *Paper-based systems, administrative inefficiencies, digital transformation, Khyber Pakhtunkhwa, education sector, operational costs, data accuracy.*

INTRODUCTION

1.1 Background of the Study

In the 21st century, digital transformation has revolutionized administrative processes across various sectors, enhancing efficiency, transparency, and decision-making. However, many government institutions, particularly in the education sector of developing regions like Khyber Pakhtunkhwa (KP), Pakistan, still rely heavily on paper-based systems for routine administrative tasks. These tasks include student enrollment records, staff

attendance, financial documentation, transfer orders, leave applications, and No Objection Certificates (NOCs).

The continued dependence on manual paperwork creates a triple burden, 1) It Increases Operational Costs – Printing, storage, and transportation of physical documents incur unnecessary expenses. 2) Delayed Approvals and Processes – Manual verification and hierarchical approvals slow down critical administrative functions and 3) Compromised Data Accuracy – Human errors in record-keeping, duplication, and lost files lead to unreliable data.

Given the growing emphasis on e-governance and smart education systems, there is an urgent need to assess how paper-based workflows hinder efficiency and what digital solutions can be implemented to mitigate these challenges.

This chapter has established the critical challenges posed by paper-based administrative systems in Khyber Pakhtunkhwa's elementary and secondary education sector. The discussion highlighted how manual processes lead to financial inefficiencies, procedural delays, and data inaccuracies, ultimately affecting the overall functionality of schools. By outlining the research objectives and questions, this study aims to systematically investigate these inefficiencies and explore digital solutions that could enhance administrative performance. The significance of this research extends to policymakers, school administrators, and educators who are directly impacted by these bureaucratic hurdles.

The administrative framework of Khyber Pakhtunkhwa's education system remains entrenched in conventional paper-based methodologies, creating substantial operational inefficiencies. Manual processing of critical functions such as student admissions, staff records, and financial documentation results in excessive bureaucratic delays, increased costs, and frequent data discrepancies. This outdated approach significantly hinders the smooth functioning of elementary and secondary schools, where time-sensitive processes like teacher transfers and NOC approvals often face prolonged delays due to physical documentation requirements and hierarchical approval chains.

Contemporary educational systems worldwide have demonstrated remarkable improvements through digital transformation, achieving enhanced efficiency, accuracy, and transparency in administrative operations. Developed nations and progressive regions have successfully implemented digital solutions for student information systems, staff management, and financial operations, yielding measurable benefits in processing speed and data reliability. However, KP's education sector continues to grapple with fundamental challenges including inadequate technological infrastructure, limited digital literacy among administrative staff, and resistance to organizational change, all of which perpetuate reliance on inefficient manual systems.

The recent global shift toward digital governance, accelerated by pandemic-induced disruptions, has highlighted the urgent need for administrative modernization in KP's education sector. While temporary digital solutions were adopted during school closures, the post-pandemic period has seen a regression to traditional paper-based methods, squandering an opportunity for meaningful reform. This study examines the tangible consequences of maintaining outdated administrative practices while exploring feasible digital alternatives that could transform school operations, aligning with the provincial government's growing emphasis on e-governance initiatives in the education domain.

Problem statement

The education system in Khyber Pakhtunkhwa remains burdened by inefficient paper-based administrative processes, leading to significant delays in approvals (NOCs, transfers, leave applications, etc), inflated operational costs (printing, storage, document transportation, mailing), and compromised data accuracy (enrollment records, staff details, financial documentation) (Khan et al., 2021; UNESCO, 2022). These manual systems create bureaucratic bottlenecks that hinder timely decision-making, frustrate educators and staff, and ultimately affect the quality of education service delivery (World Bank, 2020). Despite global advancements in digital governance, KP's schools continue to rely on outdated methods, resulting in lost productivity, financial wastage, and unreliable data for policy formulation (KPEDC Report, 2023). This study investigates how these systemic inefficiencies impact school operations and explores the potential of digital solutions to streamline administrative workflows in KP's elementary and secondary education sector.

Research Objectives

1) To quantify the financial and time costs incurred by KP schools due to reliance on paper-based administrative systems.
2) To identify which specific school processes (NOCs, staff transfers, student admissions, financial reporting) experience the most severe delays and errors.
3) To evaluate how manual record-keeping affects data reliability and its subsequent impact on educational decision-making.
4) To propose feasible digital solutions that could optimize administrative efficiency while considering KP's infrastructure constraints.

Research Questions

1) How do paper-based administrative systems contribute to increased operational costs and processing delays in KP's elementary and secondary schools?
2) Which specific administrative processes (NOC approvals, staff transfers, student admissions, financial reporting) are most affected by inefficiencies in the current manual system?
3) What types of errors and inconsistencies commonly occur in manual record-keeping, and how do they impact the reliability of educational data?
4) What cost-effective digital interventions could significantly reduce processing times, minimize errors, and improve overall administrative efficiency in KP's school system?

Research Hypotheses

1) Schools utilizing paper-based administrative systems will demonstrate significantly higher operational costs and longer processing times compared to partially digitized institutions in KP.
2) NOC approvals and staff transfer processes will show the most severe delays among all administrative functions in KP's manual school systems.
3) Manual record-keeping systems will exhibit at least 30% more data inaccuracies in student enrollment and staff records compared to digital alternatives.
4) Implementation of basic digital tracking systems would reduce administrative approval times by minimum 40% while cutting paperwork costs by half in KP schools.

Significance of the Study

This investigation carries substantial practical importance for KP's education landscape, offering empirical evidence to support digital transformation in school administration. For education policymakers, it provides critical insights into the systemic inefficiencies of current practices and the potential benefits of technological integration. School administrators may utilize the findings to identify priority areas for process optimization, while teachers and staff stand to gain from reduced bureaucratic burdens in their daily operations. Furthermore, the study contributes to the broader academic discourse on educational administration in developing regions, presenting a case study of how strategic digital interventions can address persistent challenges in resource-constrained environments. By quantifying the costs of maintaining status quo and demonstrating the viability of digital solutions, this research aims to inform and accelerate much-needed administrative reforms in KP's elementary and secondary education system.

LITERATURE REVIEW

Existing research highlights a global shift toward digital education administration, with studies demonstrating how technology reduces processing times, minimizes errors, and cuts operational costs. In developed countries, cloud-based school management systems have automated attendance tracking, fee collection, and staff approvals, improving efficiency by over 50% in some cases (Smith & Johnson, 2022). Similar successes in India's "Digital India" school initiatives show that even basic digitization—like online student databases—can significantly reduce paperwork burdens (Kumar & Patel, 2021). However, these systems require stable infrastructure and digital literacy, which remain challenges in many developing regions.

Within Pakistan, studies on Punjab's e-learn pilot program reveal measurable benefits, including faster fund disbursement and more accurate enrollment data (Ahmed et al., 2023). Yet research specific to Khyber Pakhtunkhwa remains limited, with only fragmented reports on individual schools adopting digital tools. A 2023 KP Education Department audit found that manual processes contribute to a 30% loss in administrative productivity, particularly in teacher transfers and NOC approvals (KPEDC, 2023). These findings

align with broader observations that paper-based systems disproportionately burden rural schools, where document transportation between villages and district offices compounds delays (Khan & Yousafzai, 2022).

Critical gaps persist in understanding the financial toll of maintaining manual systems versus implementing digital alternatives in KP's context. While international studies emphasize long-term cost savings from digitization, local research lacks granular data on implementation barriers like electricity access or staff resistance. This study aims to bridge that gap by quantifying both the hidden costs of current practices and the feasibility of scalable solutions tailored to KP's infrastructure constraints. By synthesizing global best practices with on-ground realities, the review underscores the urgency of reforming administrative workflows to match 21st-century educational demands.

Paper-Based Administrative Systems

Traditional paper-based administrative systems in Khyber Pakhtunkhwa's schools rely on physical documentation for student records, staff approvals, and financial reporting, leading to inefficiencies (KPEDC, 2023). These manual processes require extensive paperwork, physical storage, and in-person submissions, making them prone to delays and errors (Khan & Yousafzai, 2022). Studies show that such outdated systems hinder transparency and accountability, particularly in remote areas where document transportation is challenging (UNESCO, 2022).

Operational Costs

The reliance on paper-based systems incurs significant operational expenses, including printing, file storage, and courier services for inter-school document transfers (World Bank, 2020). A KPEDC (2023) audit found that schools spend up to 15% of their administrative budgets on paper-related costs annually. Comparatively, digitized systems in Punjab reduced these expenses by 40%, redirecting funds toward educational resources (Ahmed et al., 2023).

Processing Delays

Manual approval workflows for NOCs, staff transfers, and leave applications often take weeks due to hierarchical verifications and physical document routing (Khan et al., 2021). In KP, teacher transfer requests average 30 days for processing, compared to 5 days in digitized systems (KP Education Report, 2022). Such delays demoralize staff and disrupt school operations (UNESCO, 2021).

Data Accuracy

Paper records are susceptible to entry errors, duplication, and loss, with KP schools reporting a 25% discrepancy rate in enrollment and payroll data (KPEDC, 2023). A World Bank (2020) study linked manual systems to misreported attendance and fund leakage. Digital databases, like those piloted in Punjab, lowered errors to under 5% (Ahmed et al., 2023).

School Type

School type (public/private, urban/rural) moderates the impact of paper systems, as rural public schools face more severe delays due to limited access to district offices (Khan & Yousafzai, 2022). Urban private schools, with better infrastructure, adapt quicker to digital alternatives (KPEDC, 2023).

School Size

Larger schools experience compounded inefficiencies, as manual systems struggle to manage high volumes of student/staff data (Smith & Johnson, 2022). A 2022 study noted that schools with 500+ students waste 20% more time on paperwork than smaller institutions (UNESCO, 2022).

Infrastructure Availability

Limited electricity and internet in rural KP schools hinder digitization, forcing reliance on paper (World Bank, 2020). Only 35% of KP's rural schools have stable power, versus 80% in urban areas (KPEDC, 2023).

Staff Digital Literacy

Low digital skills among administrative staff perpetuate paper dependency. A KPEDC (2023) survey found 60% of school clerks lacked training in basic software, slowing potential transitions.

Proposed Digital Solutions

Cloud-based platforms and mobile apps could automate approvals and data tracking, as demonstrated by Punjab's e-learn system cutting processing times by 70% (Ahmed et al., 2023). Pilot studies suggest even SMS-based systems improve rural school reporting (UNESCO, 2022).

RESEARCH METHODOLOGY & TECHNIQUES

Research Design

This study adopts a quantitative, cross-sectional survey design to examine the inefficiencies of paper-based systems in KP's public schools. The research focuses on four school levels:

1. Primary Schools (Grade Nursery to Grade 05)
2. Middle Schools (Grade 06 to Grade 08)
3. High Schools (Grade 06 to Grade 10)
4. Higher Secondary Schools (Grade 06 to Grade 12)

Data is collected exclusively from teaching and administrative staff to evaluate:

- Operational costs
-Processing delays (NOCs, transfers, leave approvals)
- Data accuracy errors

Sampling Technique

Stratified Random Sampling by:
-School Level (Primary, Middle, High, Higher.Secondary)
- Location (Urban/Rural)
-Districts Covered: Mansehra, Abbottabad, Torghar, Haripur, Battagram.

Sample Size

School Level	Urban Schools	Rural Schools	Total per level
Primary	10	10	20
Middle	10	10	20
High	10	10	20
Higher Secondary	10	10	20
Total	**40**	**40**	**80 Schools**

Respondents

I. Principal/Vice-Principal
II. Teachers
III. Admin Staff (Clerk/Accountant)

Total Respondents: 320 (80 schools × 4 staff)

Data Collection & Tools

1. Structured Questionnaire

Demographic Section (Closed-ended):

1. **Age**
- 20–30 years
- 31–40 years
- 41–50 years
- 51+ years

2. Qualification
- Bachelor's
- Master's
- M.Phil/PhD

3. **Experience**
- <5 years
- 5–10 years
- >10 years

Main Survey Sections (5-point Likert Scale)

I. Operational Costs: "Estimate monthly paperwork expenses (PKR): ___"
II. Processing Delays: "Average days for teacher transfer approval: ___"
III. Data Accuracy: "Rate frequency of student record errors (1=Never, 5=Daily)"

2. Secondary Data

KP Education Department's annual reports on administrative timelines.

Statistical Analysis

1. Descriptive Statistics

Mean/SD for costs, delays, error rates.
Frequency tables for demographics.

2. Inferential Statistics

ANOVA: Compare inefficiencies across school levels.
Independent t-tests: Urban vs. rural differences.
Regression: Predict delays based on school level/experience.
3. Software: SPSS (Version 27)

Validity & Reliability

Pilot Test: 15 respondents (excluded from final sample; Cronbach's $\alpha = 0.82$).
Bias Control: Anonymous surveys, random sampling.

RESEARCH RESULTS

This chapter presents quantitative findings on paper-based administrative inefficiencies in KP's public schools, analyzed through descriptive and inferential statistics. Data was collected from 320 staff members (principals, teachers, admin) across 80 schools (primary to higher secondary).

Table 1: Demographic Profile of Respondents

Variable	Category	Frequency (n=320)	Percentage (%)
School Level	Primary	80	25.0%
	Middle	80	25.0%
	High	80	25.0%
	Higher Secondary	80	25.0%
Location	Urban	160	50.0%
	Rural	160	50.0%
Experience	<5 years	90	28.1%
	5–10 years	110	34.4%
	>10 years	120	37.5%

Explanation: The sample was evenly distributed across school levels and locations. Most respondents (71.9%) had over 5 years of experience, ensuring informed perspectives on administrative processes.

Table 2: Operational Costs (Monthly Averages)

Cost Type	Mean (PKR)	SD	Range (PKR)
Paperwork Expenses	12,500	2,300	8,000–18,000
Printing/Photocopying	7,800	1,950	5,000–12,000
Total	20,300	3,120	13,000–30,000

Explanation: Schools spend an average of PKR 20,300/month on paper-based tasks. Higher secondary schools reported 22% higher costs than primary schools ($p < 0.05$), linked to larger student populations.

Table 3: Processing Delays (in Days)

Process	Mean Delay	SD	ANOVA (p-value)
NOC Approvals	28.5	6.2	0.003*
Staff Transfers	35.2	8.7	0.001*
Leave Applications	14.0	3.5	0.120

Explanation:

- Delays were severe for NOCs (28.5 days) and transfers (35.2 days), with rural schools experiencing 40% longer delays than urban schools (t-test, $p < 0.01$).
- ANOVA confirmed significant differences across school levels ($p < 0.05$), with high schools facing the longest transfer delays.

Table 4: Data Accuracy Issues (Likert Scale: 1=Never, 5=Daily)

Record Type	Mean Score	SD	% Reporting ≥3 (Occasional+)
Student Enrollment	3.8	0.9	78.4%
Staff Attendance	3.2	1.1	65.6%
Financial Discrepancies	2.9	0.8	52.3%

Explanation:
- 78.4% of respondents reported at least occasional errors in student records.
- Principals with >10 years' experience noted 30% fewer errors than novices (p = 0.02), suggesting expertise mitigates inaccuracies.

Table 5: Digital Readiness

Question	Percentage	Urban	Rural
Use digital tools for admin tasks?	18.7%	32.5%	5.0%
Willingness to adopt paperless systems?	89.2%	92.1%	86.3%

Explanation:
- Only 18.7% currently use digital tools frequently, with urban schools 6.5× more likely than rural schools.
- High willingness (89.2%) to adopt digital systems indicates readiness for reform.

Table 6: Regression Assumption Tests (Durbin-Watson & p-values)

Variable Relationship Tested	Durbin-Watson Statistic	p-value	Interpretation
Paperwork Costs → Processing Delays	1.82	0.012*	No autocorrelation (1.5–2.5 range)
Data Errors → Operational Costs	1.93	0.003*	No autocorrelation
School Level → Total Delays	1.67	0.021*	Mild positive autocorrelation

Key:
- Durbin-Watson Range: 0–4 (1.5–2.5 indicates no autocorrelation).
- p-value: $p < 0.05$ confirms statistical significance.

Explanation of Results

1. Durbin-Watson Test:

- Value = 1.82 (Costs vs. Delays): Indicates no autocorrelation in residuals (ideal range: 1.5–2.5), meaning errors in the regression model are independent.
- Value = 1.67 (School Level vs. Delays): Suggests mild positive autocorrelation, possibly due to similar delay patterns within districts.

2.p-values:

- All relationships were statistically significant ($p < 0.05$), confirming:
- Higher paperwork costs predict longer delays ($p = 0.012$).
- Data errors increase operational costs ($p = 0.003$).
- School level (primary/H.Sec) affects total delays ($p = 0.021$).

3. Summary

The model is valid for inference (no major autocorrelation issues).
Significant p-values support hypotheses that paper systems worsen inefficiencies.

Costs: Paper-based systems consume ~PKR 243,600/year per school.

Delays: Critical processes (transfers/NOCs) take 2–5 weeks.

Errors: 65–78% face recurring data inaccuracies.

Digital Gap: Rural schools lack tools but show high adoption willingness.

CONCLUSION & RECOMMENDATIONS

Conclusion

The findings of this study reveal significant inefficiencies in Khyber Pakhtunkhwa's public schools administration due to reliance on paper-based systems. Excessive operational costs, prolonged processing delays, and frequent data inaccuracies were consistently reported across all school levels. Rural institutions faced particularly severe challenges, with administrative processes often taking twice as long as urban schools. These inefficiencies not only strain limited educational budgets but also negatively impact staff morale and the quality of service delivery to students.
Statistical analysis confirmed strong correlations between manual processes and administrative bottlenecks. The Durbin-Watson tests validated the reliability of these findings, showing no significant autocorrelation in the data. Perhaps most encouragingly, the research revealed overwhelming willingness among school staff to

adopt digital solutions, with 89% of respondents expressing readiness for technological upgrades. This presents a valuable opportunity for transformative change in the province's education administration.

These results paint a clear picture: KP's education system cannot achieve modern standards of efficiency and transparency while maintaining paper-dependent workflows. The transition to digital administration is no longer optional but a necessary step to ensure effective resource management and timely service delivery. The current system's shortcomings directly affect educational outcomes, making reform both urgent and achievable given the demonstrated staff openness to change.

Recommendations

Immediate action should begin with targeted pilot programs in urban schools to digitize high-priority processes like NOC approvals and staff transfers. These pilots should utilize simple, accessible technologies such as cloud-based forms and SMS notifications to demonstrate quick wins. Simultaneously, the education department should establish a task force to develop a phased implementation plan for statewide digital transformation, beginning with better-resourced schools and gradually expanding to rural areas.

Capacity building must accompany technological upgrades. The provincial government should mandate digital literacy training for all administrative staff, focusing on practical skills like data entry and basic software use. Partnerships with local universities and tech companies could provide cost-effective training solutions. Additionally, the creation of a dedicated technical support team would ensure schools receive ongoing assistance during and after the transition period.

Long-term success requires sustained commitment and funding. The KP government should allocate specific budget lines for educational technology in annual budgets, prioritizing rural infrastructure development. A monitoring and evaluation framework should track key metrics like processing times and cost savings to demonstrate impact. Public-private partnerships could help develop customized, affordable solutions tailored to KP's unique needs and constraints, ensuring the digital transformation is both comprehensive and sustainable.

Future Research Limitations

While this study provides valuable insights, several limitations warrant consideration. The research focused on only five districts, potentially overlooking unique challenges in more remote areas of KP. The quantitative methodology, while robust, couldn't capture the nuanced human factors behind resistance to change. Future studies should employ mixed methods to explore both statistical patterns and personal experiences. Additionally, the cross-sectional design limits understanding of long-term effects; longitudinal research tracking digital implementation outcomes would be valuable. Infrastructure realities, particularly in off-grid schools, require deeper investigation to develop truly feasible solutions. These limitations highlight important directions for future research to build upon these findings.

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