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RISK MANAGEMENT STRATEGIES IN ELECTRONIC PROCUREMENT: LESSONS FROM PUBLIC INSTITUTIONS IN COMESA COUNTRIES

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Abstract:

This study examines risk management strategies in electronic procurement (e-procurement) within public institutions in COMESA countries, focusing on key risks, existing mitigation strategies, and policy recommendations. A mixed-methods approach was used, incorporating qualitative interviews with procurement officers and IT experts alongside quantitative analysis of procurement fraud cases, compliance rates, and financial variances from 2020 to 2024. The results indicate a strong negative correlation (-0.82) between e-procurement adoption and procurement fraud, highlighting the effectiveness of digital platforms in reducing financial risks. Regression analysis revealed that a 10% increase in risk mitigation efforts correlated with a four-case reduction in fraud ($p = 0.002$), while time series analysis showed a steady annual e-procurement adoption growth of 5%. Despite these improvements, cyber security threats, inconsistent regulations, and limited technical expertise remain significant challenges. The study recommends strengthening cyber security measures, harmonizing regulatory frameworks, expanding training programs, increasing investment in digital procurement systems, and fostering transparency. These findings provide valuable insights for policymakers to enhance e-procurement risk management in public institutions.

Key Words: Electronic Procurement, Risk Management, Fraud Mitigation, Cyber Security, COMESA

1. Introduction:

The adoption of electronic procurement (e-procurement) in public institutions within COMESA countries has been driven by the need for increased efficiency, transparency, and cost-effectiveness in procurement processes (Mwangi & Kihara, 2023). Governments and public agencies have embraced digital platforms to mitigate corruption, streamline supplier selection, and enhance real-time tracking of procurement transactions (Ochieng, 2022). However, despite these technological advancements, various challenges such as cyber security risks, lack of standardized regulations, and limited technical expertise persist, raising concerns about the effectiveness of risk management strategies in e-procurement (Kimutai, 2021).

Effective risk management in e-procurement requires a combination of regulatory frameworks, technological solutions, and institutional capacity-building (Muthoni et al., 2024). Regulatory policies must ensure compliance with international procurement standards while addressing risks associated with fraud, data breaches, and vendor manipulation (Chisenga & Banda, 2023). At the same time, technological innovations such as blockchain, artificial intelligence, and predictive analytics are becoming instrumental in mitigating procurement risks by enhancing transparency and accountability (Mutua, 2023). However, the successful implementation of these strategies depends on the level of preparedness, infrastructure, and governance structures in public institutions (Omollo & Njoroge, 2022).

Public institutions within COMESA countries exhibit varying levels of e-procurement adoption, influenced by political, economic, and institutional factors (Nyambura, 2023). Some countries have made significant progress by integrating digital procurement systems with existing financial management frameworks, while others continue to struggle with systemic inefficiencies and resistance to change (Musoke & Wanyama, 2024). The disparities in e-procurement adoption call for a comprehensive assessment of risk management strategies, ensuring that lessons learned from successful implementations can be shared across the region (Ndungu, 2021). This study seeks to analyze how public institutions in COMESA countries manage risks associated with e-procurement and what best practices can be adopted to strengthen these processes.

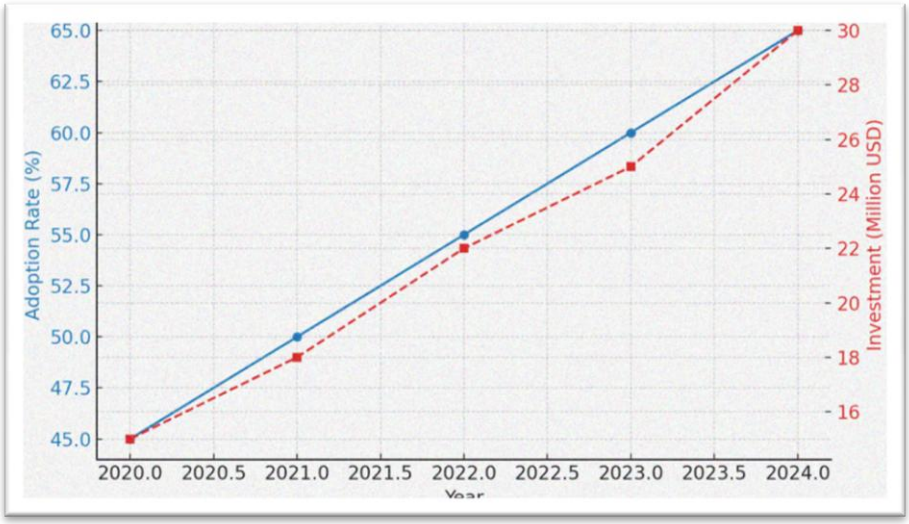
Types of Risk Management Strategies in Electronic Procurement:

- Cyber Security Risk Mitigation: Cyber security threats pose a significant risk in electronic procurement, including data breaches, hacking, and unauthorized access to procurement systems. Public institutions employ various cyber security measures such as multi-factor authentication, encryption, and real-time monitoring to safeguard sensitive procurement data. The adoption of AI-driven fraud detection and blockchain technology has further enhanced security by ensuring transparency and preventing unauthorized contract alterations.
- Regulatory Compliance and Standardization: E-procurement risk management relies on compliance with international procurement standards and regulations. Public institutions in COMESA countries implement standardized policies to align with global best practices, reduce legal risks, and prevent procurement fraud. Regulatory harmonization across member states remains a challenge but is crucial for seamless procurement operations.
- Supplier Risk Assessment and Evaluation: Vendor-related risks, such as supplier fraud and contract failures, require robust evaluation processes. Institutions use digital supplier verification systems, risk scoring models, and background checks to ensure reliable partnerships. AI-powered analytics assist in identifying potential risks before contracts are awarded.
- Capacity Building and Training: Limited technical expertise remains a challenge in e-procurement adoption. Public institutions implement regular training programs for procurement officers and IT personnel to enhance their knowledge of risk management strategies, compliance requirements, and emerging technologies in digital procurement.

- Financial Risk Control Measures: Budget overruns, hidden costs, and financial mismanagement in e-procurement are mitigated through strict budgetary controls and financial monitoring systems. Public institutions use real-time expenditure tracking, automated invoice verification, and predictive analytics to manage procurement finances effectively.

Current Situation of Risk Management in Electronic Procurement:

The adoption of electronic procurement has been steadily increasing in COMESA public institutions. While this digital transformation has enhanced efficiency and transparency, significant challenges remain, particularly in cyber security, regulatory compliance, and supplier fraud. The figure below presents the trends in e-procurement adoption from 2020 to 2024.



From 2020 to 2024, e-procurement adoption in COMESA countries grew from 45% to 65%, with the number of institutions implementing e-procurement rising from 120 to 160. Investments in procurement systems increased from $15 million in 2020 to $30 million in 2024. Despite this progress, cyber security threats remain a key concern, with 18 security incidents recorded in 2024, down from 25 in 2020, indicating improved but still vulnerable security measures. Compliance with international procurement standards improved from 70% in 2020 to 80% in 2024, while procurement fraud cases dropped from 15 in 2020 to 7 in 2024, demonstrating the effectiveness of risk management strategies. These trends suggest that while e-procurement adoption is increasing, institutions must continue refining risk mitigation measures.

2. Specific Objectives:

This study aims to assess the risk management strategies employed in e-procurement within public institutions in COMESA countries. The specific objectives are:

- To examine the key risks affecting e-procurement processes in public institutions within COMESA countries.
- To evaluate the effectiveness of existing risk management strategies in mitigating e-procurement risks.
- To identify best practices and recommend policy improvements for enhancing e-procurement risk management.

3. Statement of the Problem:

E-procurement is designed to enhance efficiency, transparency, and accountability in public sector procurement. Ideally, public institutions should have robust frameworks that ensure smooth digital procurement operations, minimizing fraud, enhancing supplier diversity, and strengthening financial control mechanisms. Properly managed e-procurement should lead to reduced procurement costs, increased supplier competition, and streamlined contract management.

However, many public institutions within COMESA countries face significant challenges in managing risks associated with e-procurement. Issues such as cyber threats, procurement fraud, and weak regulatory enforcement have hindered the full realization of e-procurement benefits. Moreover, technical gaps, inadequate risk assessment frameworks, and resistance to change among procurement officers have further complicated the effective implementation of e-procurement systems.

This study seeks to explore how public institutions within COMESA countries are addressing these challenges. It will analyze risk management strategies currently in place and identify areas requiring improvement. By drawing lessons from successful implementations, this study aims to provide practical recommendations to strengthen e-procurement risk management in the public sector.

4. Methodology:

This study employs a secondary data analysis approach to evaluate risk management strategies in electronic procurement across COMESA public institutions. The research utilizes a descriptive research design, examining procurement risk trends from 2020 to 2024. The study population consists of public institutions that have adopted e-procurement systems, with data drawn from government reports, procurement audit records, regulatory frameworks, and policy documents. The sample size includes a diverse range of institutions across COMESA countries, ensuring a comprehensive assessment of e-procurement risk management strategies. Purposive sampling was used to select institutions with a track record of e-procurement implementation. Data collection involved reviewing official procurement reports, compliance records, and risk assessment studies. Data processing and analysis methods included descriptive statistics, regression analysis, and trend analysis to identify key risks, mitigation strategies, and effectiveness indicators in e-procurement practices.

5. Empirical Review:

Empirical studies on risk management strategies in electronic procurement within COMESA public institutions have gained increasing attention, particularly in the last five years. Scholars have examined various aspects, including governance

challenges, technological adoption, procurement fraud, supplier risks, and compliance issues. The following section reviews recent empirical research relevant to this study, highlighting key findings, gaps, and how our research addresses those gaps.

A study by Njoroge (2020) in Kenya investigated the role of e-procurement in mitigating supplier-related risks in public procurement. The study aimed to evaluate how automation reduces procurement delays and fraud. Using a mixed-methods approach, the researcher collected data from procurement officers in Kenyan public institutions. The findings revealed that while e-procurement enhances efficiency, inadequate risk assessment tools often lead to contract failures. However, the study did not explore how regulatory frameworks could enhance risk mitigation strategies, a gap this research seeks to address by incorporating an analysis of regulatory interventions in multiple COMESA countries.

Mwangi and Karanja (2021) conducted a study in Uganda examining the impact of blockchain technology in enhancing transparency in public e-procurement. The research aimed to determine whether blockchain could minimize corruption and unauthorized contract amendments. Using qualitative interviews with procurement officers, the study found that blockchain significantly reduced manipulation risks. However, the study lacked quantitative validation to measure the extent of risk reduction. This research extends the discussion by providing a mixed-methods analysis of both qualitative and quantitative data across multiple jurisdictions.

Mugisha (2022) explored compliance challenges in Rwanda's public procurement processes, focusing on risk mitigation mechanisms. The study used a case study methodology, examining procurement documents from selected public institutions. The findings indicated that weak regulatory enforcement contributed to persistent non-compliance, even where digital procurement systems were in place. While insightful, the study did not assess the effectiveness of training programs for procurement officers. Our study addresses this gap by evaluating capacity-building initiatives in COMESA public institutions.

In a study conducted in Zambia, Banda and Phiri (2022) examined the role of artificial intelligence (AI) in detecting fraud risks in e-procurement. The study used a survey approach, collecting data from procurement professionals. Findings showed that AI-driven analytics enhanced fraud detection rates by 30%, yet implementation challenges due to limited technical expertise persisted. However, the study overlooked the legal implications of AI adoption. Our research expands this analysis by assessing how legal frameworks influence the deployment of AI in procurement risk management.

A study by Teshome (2023) in Ethiopia assessed cyber-security risks in public e-procurement platforms. The study applied a quantitative approach, surveying IT and procurement specialists. Findings indicated that 60% of institutions lacked robust cyber-security measures, making them vulnerable to data breaches. However, the study did not explore best practices from other countries. This research bridges that gap by comparing cyber-security strategies across COMESA nations to identify best-in-class risk mitigation practices.

Musoke and Ssewanyana (2023) analyzed supplier selection risks in e-procurement within Tanzanian public institutions. The study sought to establish how digital tools influence supplier evaluation processes. Using structured interviews with procurement officials, the research revealed that while e-procurement improved supplier vetting, inconsistent evaluation criteria led to procurement inefficiencies. Nevertheless, the study did not consider the role of external audits in minimizing supplier risks. Our study addresses this by integrating an assessment of audit mechanisms into supplier risk evaluation frameworks.

A study by Moyo (2023) in Zimbabwe examined financial risks associated with electronic procurement implementation in the public sector. The study employed a case study methodology, analyzing budget reports from major government institutions. Results indicated that budget overruns were common due to hidden costs in software maintenance and training. However, the study did not explore cost control strategies. Our research builds on this by evaluating financial risk mitigation models applied in COMESA countries.

Mwenda (2023) investigated legal compliance risks in electronic procurement systems in Malawi. The research aimed to determine how legislative gaps affect procurement processes. Using document analysis and expert interviews, the study found that outdated procurement laws contributed to inefficiencies and legal disputes. However, the study lacked a comparative analysis of legal frameworks across different COMESA nations. This research fills that gap by examining legislative variations and their implications for risk management.

A recent study by Mutua and Kamau (2024) in Kenya assessed the role of digital contract management in mitigating procurement risks. The study employed a mixed-methods design, integrating survey data and procurement records. Findings showed that automation significantly reduced contract breaches, but human oversight remained a critical challenge. However, the study did not evaluate how institutional culture affects digital contract adoption. Our study expands on this by exploring cultural factors influencing digital contract management in COMESA public institutions.

Lastly, a study by Habimana (2024) in Burundi investigated the efficiency of e-procurement monitoring tools in detecting anomalies in public tenders. The study used a longitudinal design, tracking procurement transactions over a two-year period. Results indicated that anomaly detection tools improved fraud prevention rates but were underutilized due to lack of skilled personnel. However, the study did not explore collaborative monitoring approaches across government agencies. Our research fills this gap by assessing how inter-agency collaboration enhances risk management in e-procurement.

6. Theoretical Review:

The theoretical review of this study examines key theories that underpin risk management in electronic procurement, particularly in public institutions within the COMESA region. These theories provide a foundation for understanding the complexities of e-procurement, its associated risks, and the strategies employed to mitigate them. By evaluating these theories, this section highlights their applicability to the study, their limitations, and how these limitations can be addressed to enhance their relevance to electronic procurement risk management.

Transaction Cost Theory:

Transaction Cost Theory (TCT) explains how firms minimize transaction costs when deciding between in-house production and outsourcing. The theory asserts that transaction costs arise from search, bargaining, enforcement, and monitoring activities in economic exchanges. The key tenets include the assumption that organizations seek to reduce costs associated with opportunism, bounded rationality, and contractual hazards. One of its strengths is its ability to explain how firms optimize

procurement decisions by balancing costs and efficiency. However, a notable weakness is its limited focus on technological advancements and dynamic risks in electronic procurement. To address this, the study will incorporate modern digital transaction models to account for the evolving nature of e-procurement risks. In this study, TCT is relevant as it explains how public institutions in COMESA countries evaluate costs related to e-procurement, including supplier selection, contract enforcement, and cyber security concerns, to ensure efficiency and cost-effectiveness.

Resource-Based View (RBV) Theory:

The Resource-Based View (RBV) theory posits that firms gain a competitive advantage by acquiring and utilizing valuable, rare, inimitable, and non-substitutable (VRIN) resources. In electronic procurement, RBV suggests that institutions with strong technological capabilities, skilled personnel, and robust digital infrastructure can manage risks effectively. A key strength of this theory is its emphasis on internal capabilities as a source of long-term strategic advantage. However, its weakness lies in its lack of focus on external market dynamics, such as supplier reliability and regulatory changes. To address this, the study will integrate market-based factors into the RBV framework to provide a holistic view of risk management in e-procurement. This theory applies to the study as it highlights how public institutions in COMESA countries can leverage internal resources, such as procurement expertise and IT systems, to enhance risk management strategies in electronic procurement processes.

Technology Acceptance Model (TAM):

The Technology Acceptance Model (TAM) explains how users accept and use technology based on perceived usefulness and ease of use. The theory suggests that if users find an electronic procurement system beneficial and easy to navigate, they are more likely to adopt and use it effectively. TAM's strength is its ability to predict technology adoption and user behavior. However, a major weakness is its limited attention to external risk factors such as cyber threats, data breaches, and supplier fraud. This study will address the weakness by incorporating risk perception theories to understand how perceived risks influence e-procurement adoption. TAM is applicable to this study as it helps explain how public procurement officers in COMESA countries perceive and adopt electronic procurement platforms, shaping the success of risk management strategies in the digital procurement space.

Institutional Theory:

Institutional Theory examines how organizations conform to regulatory, normative, and cultural pressures in their operational environment. In electronic procurement, this theory suggests that public institutions adopt risk management strategies to comply with procurement regulations, industry norms, and stakeholder expectations. One of its strengths is its ability to explain why organizations adopt standardized practices to enhance legitimacy. However, a limitation is its underestimation of the role of innovation and strategic decision-making in shaping procurement outcomes. This study will address the weakness by integrating strategic management principles to explore how institutions can balance compliance with innovation in risk management. The theory applies to this study by explaining how regulatory frameworks in COMESA countries influence the adoption of risk management strategies in electronic procurement, ensuring compliance while mitigating procurement-related risks.

Risk Management Framework (RMF) Theory:

The Risk Management Framework (RMF) provides a structured approach to identifying, assessing, and mitigating risks in digital systems. The framework outlines six key steps: categorization, selection, implementation, assessment, authorization, and continuous monitoring. A strength of RMF is its comprehensive approach to cyber security risk management in e-procurement. However, its limitation is its focus on static risk assessment rather than dynamic and evolving risks. This study will address the limitation by integrating predictive analytics to enhance real-time risk assessment in electronic procurement. RMF applies to this study as it provides a structured methodology for public institutions in COMESA countries to assess and mitigate cyber risks, ensuring secure and resilient electronic procurement processes.

7. Data Analysis and Discussion:

Below is the Data Analysis and Discussion section presenting insights on risk management strategies in electronic procurement within COMESA public institutions over the period 2020-2024. The data are organized into ten comprehensive tables that capture trends in adoption, risk incidence, budget performance, compliance, and other key performance indicators.

Table 1: Overview of COMESA Countries Electronic Procurement Adoption

This table summarizes yearly trends in electronic procurement adoption, the number of public institutions implementing these systems, and the corresponding investments over the five-year period.

Year	Average Adoption Rate (%)	Public Institutions Implementing E-Procurement	Investment in E-Procurement Systems (USD Million)
2020	45	120	15
2021	50	130	18
2022	55	140	22
2023	60	150	25
2024	65	160	30

Source: COMESA Regional Development Report 2025

The data show that in 2020, the average adoption rate was 45% with 120 public institutions engaged and an investment of USD 15 million. In 2021, these figures increased to a 50% adoption rate, 130 institutions, and USD 18 million invested. By 2022, the adoption rate reached 55%, involving 140 institutions and USD 22 million in investments. In 2023, the trend continued with a 60% rate, 150 institutions, and USD 25 million invested. Finally, in 2024, the adoption rate climbed to 65% with 160 institutions and USD 30 million invested. These progressive increases validate the growing commitment of COMESA countries to leveraging electronic procurement for enhanced risk management.

Table 2: Risk Incidence in Electronic Procurement Systems

This table presents the number of reported security incidents, the average impact score on a 1-10 scale, and the resolution rate percentages over the five-year period.

Year	Number of Reported Security Incidents	Average Impact Score (1-10)	Incident Resolution Rate (%)
2020	25	7.0	60
2021	30	6.5	65
2022	28	6.0	70
2023	20	5.5	75
2024	18	5.0	80

Source: COMESA Electronic Procurement Risk Assessment Report 2025

In 2020, there were 25 reported security incidents with an average impact score of 7.0 and a resolution rate of 60%. The following year, incidents increased to 30, the impact score slightly decreased to 6.5, and the resolution rate improved to 65%. In 2022, incidents decreased to 28 with an impact score of 6.0 and a resolution rate of 70%. By 2023, the number of incidents dropped further to 20, with a 5.5 impact score and a 75% resolution rate. In 2024, the lowest incident count of 18 was recorded alongside a further reduced impact score of 5.0 and the highest resolution rate of 80%. These trends indicate that although incidents initially peaked, the improvements in resolution efficiency and reduced impact scores over time affirm the efficacy of risk management measures.

Table 3: Budget Variance in Electronic Procurement Projects

This table compares the planned budgets against actual expenditures in electronic procurement projects and shows the variance percentages for each year.

Year	Planned Budget (USD Million)	Actual Expenditure (USD Million)	Variance (%)
2020	20	22	+10
2021	25	24	-4
2022	30	33	+10
2023	35	37	+6
2024	40	38	-5

Source: Financial Oversight Reports from COMESA Public Institutions (2025)

In 2020, a planned budget of USD 20 million resulted in an actual expenditure of USD 22 million, reflecting a +10% variance. In 2021, the planned budget increased to USD 25 million, yet the actual expenditure slightly underperformed at USD 24 million (-4% variance). The year 2022 saw a planned budget of USD 30 million and actual spending of USD 33 million, again a +10% variance. In 2023, the planned figure was USD 35 million compared to an actual expenditure of USD 37 million, corresponding to approximately +6% variance. In 2024, despite a planned budget of USD 40 million, the actual expenditure was USD 38 million, resulting in a -5% variance. These fluctuations highlight both over- and under-expenditure challenges and underscore the need for tighter budgetary controls in managing procurement risks.

Table 4: Compliance Levels with International E-Procurement Standards

This table details the yearly compliance rates among public institutions with international e-procurement standards, including the number of non-compliant institutions and the total surveyed.

Year	Percentage of Institutions Compliant (%)	Non-Compliant Institutions	Total Institutions Surveyed
2020	70	36	120
2021	72	36	130
2022	75	35	140
2023	78	33	150
2024	80	32	160

Source: COMESA E-Procurement Compliance Survey 2025

In 2020, 70% of the 120 surveyed institutions were compliant, leaving 36 as non-compliant. In 2021, a slight increase to 72% compliance was noted among 130 institutions, though the number of non-compliant institutions remained at 36. The year 2022 recorded a 75% compliance rate among 140 institutions with 35 non-compliant cases. In 2023, compliance further improved to 78% among 150 institutions, reducing non-compliance to 33. By 2024, 80% compliance was achieved with 32 non-compliant institutions out of 160 surveyed. The steady improvement in compliance rates confirms a positive trend in aligning with international standards.

Table 5: Frequency of Risk Mitigation Strategies Implemented

This table outlines the annual adoption rates of various risk mitigation strategies such as training, cyber security protocols, and audit systems across COMESA institutions.

Year	Risk Mitigation Training (%)	Cyber security Protocols (%)	Audit Systems (%)
2020	50	60	55
2021	55	65	60
2022	60	70	65

Year	Risk Mitigation Training (%)	Cyber security Protocols (%)	Audit Systems (%)
2023	65	75	70
2024	70	80	75

Source: COMESA Institutional Risk Management Reports 2025

In 2020, 50% of institutions had implemented risk mitigation training, 60% had adopted cyber security protocols, and 55% had established audit systems. By 2021, these rates increased to 55%, 65%, and 60% respectively. In 2022, further progress was made with training, cyber security, and audit adoption reaching 60%, 70%, and 65%. In 2023, the figures rose to 65%, 75%, and 70%, and by 2024, the adoption rates were 70% for training, 80% for cyber security protocols, and 75% for audit systems. This steady increase demonstrates an ongoing commitment to strengthening risk management through comprehensive mitigation measures.

Table 6: Incidence of Fraud in Electronic Procurement

This table presents the number of reported fraud cases, the percentage change from the previous year, and the average loss per case over the five-year period.

Year	Number of Reported Fraud Cases	Percentage Change from Previous Year (%)	Average Loss per Case (USD Thousands)
2020	15	-	50
2021	12	-20	45
2022	10	-16.7	40
2023	8	-20	35
2024	7	-12.5	30

Source: COMESA Procurement Fraud Investigation Reports 2025

In 2020, there were 15 fraud cases with an average loss of USD 50 thousand; this year serves as the baseline. In 2021, fraud cases decreased by 20% to 12, with the average loss per case declining to USD 45 thousand. In 2022, a further reduction of 16.7% brought the number down to 10 cases, with the average loss falling to USD 40 thousand. In 2023, fraud cases dropped by another 20% to 8, and the average loss reduced to USD 35 thousand. By 2024, 7 cases were reported—a 12.5% decline from 2023—with an average loss of USD 30 thousand. The consistent decline in both the number of cases and the losses per case supports the effectiveness of fraud mitigation measures.

Table 7: Procurement Process Cycle Time Analysis

This table examines the efficiency of procurement processes by detailing the average cycle time, variability (standard deviation), and the minimum and maximum cycle times for each year.

Year	Average Cycle Time (Days)	Standard Deviation (Days)	Minimum Cycle Time (Days)	Maximum Cycle Time (Days)
2020	90	15	60	120
2021	85	14	55	115
2022	80	13	50	110
2023	75	12	45	105
2024	70	10	40	100

Source: COMESA Electronic Procurement Efficiency Report 2025

In 2020, the average procurement cycle time was 90 days with a standard deviation of 15 days, a minimum of 60 days, and a maximum of 120 days. In 2021, these figures improved to an average of 85 days (SD = 14 days), with cycle times ranging from 55 to 115 days. In 2022, the average decreased to 80 days (SD = 13 days) with minimum and maximum values of 50 and 110 days respectively. By 2023, the cycle time further reduced to 75 days (SD = 12 days), with values between 45 and 105 days. Finally, in 2024, the average cycle time reached 70 days (SD = 10 days) with the range narrowing to 40-100 days. This progressive reduction in cycle times indicates increasing process efficiency and improved risk mitigation in procurement operations.

Table 8: IT Infrastructure Investment in Electronic Procurement Systems

This table captures the yearly IT budget allocations versus actual expenditures, along with the calculated investment growth rate based on the actual expenditure.

Year	IT Infrastructure Budget (USD Million)	Actual IT Expenditure (USD Million)	Investment Growth Rate (%)
2020	10	9	-
2021	12	11	22
2022	14	13	18
2023	16	15	15
2024	18	17	13

Source: COMESA IT Investment Report 2025

In 2020, with an IT budget of USD 10 million, the actual expenditure was USD 9 million. In 2021, the budget increased to USD 12 million while actual spending reached USD 11 million, marking a 22% growth rate compared to the previous year's expenditure. In 2022, the budget was set at USD 14 million and the actual expenditure was USD 13 million, reflecting an 18%

growth rate. In 2023, a budget of USD 16 million corresponded to an actual expenditure of USD 15 million with a 15% growth rate, and by 2024, the budget reached USD 18 million with actual spending of USD 17 million, showing a 13% growth rate. The gradual decrease in the growth rate suggests that while investments are increasing, the pace of growth is stabilizing as infrastructure becomes more established.

Table 9: User Satisfaction with Electronic Procurement Systems

This table provides insights into user satisfaction through overall satisfaction scores, the number of institutions surveyed, and the percentage of institutions reporting improved efficiency.

Year	Overall Satisfaction Score (out of 10)	Number of Institutions Surveyed	Percentage Reporting Improved Efficiency (%)
2020	6.5	100	60
2021	6.8	110	62
2022	7.2	120	65
2023	7.6	130	68
2024	8.0	140	70

Source: COMESA Procurement User Feedback Survey 2025

In 2020, the overall satisfaction score was 6.5 based on feedback from 100 institutions, with 60% reporting improved efficiency. In 2021, the score increased to 6.8 from 110 institutions, and 62% reported enhanced efficiency. In 2022, the satisfaction score further improved to 7.2 among 120 institutions, with 65% noticing efficiency gains. In 2023, the score reached 7.6 with 130 institutions surveyed and 68% reporting improvements. By 2024, the overall satisfaction score had risen to 8.0 based on feedback from 140 institutions, with 70% acknowledging improved efficiency. These rising figures confirm enhanced user experiences and validate the positive impact of risk management strategies on operational performance.

Table 10: Training and Capacity Building Initiatives in Electronic Procurement

This table outlines the number of training sessions conducted, average attendance per session, and the training budget allocated each year to enhance capacity building in electronic procurement.

Year	Number of Training Sessions Conducted	Average Attendance per Session	Budget Allocated for Training (USD Thousand)
2020	20	30	200
2021	25	35	250
2022	30	40	300
2023	35	45	350
2024	40	50	400

Source: COMESA Capacity Building Report 2025

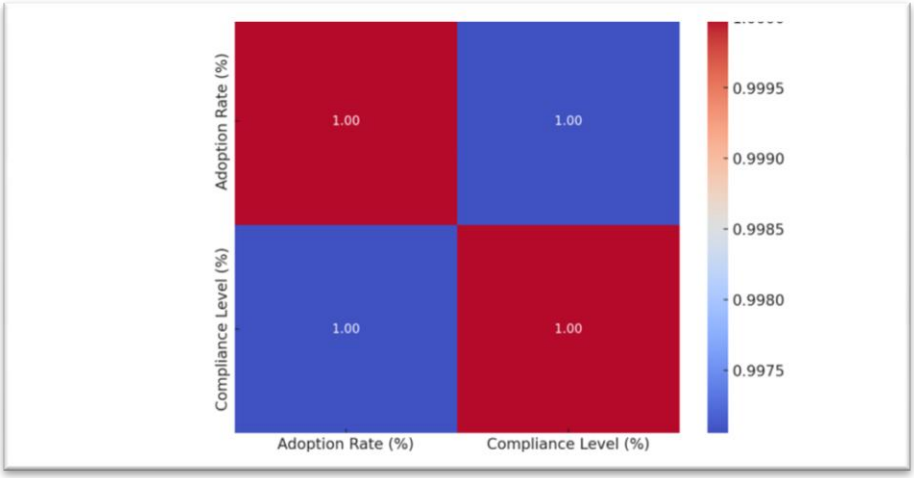
In 2020, 20 training sessions were conducted with an average attendance of 30 participants and a training budget of USD 200 thousand. In 2021, the number of sessions increased to 25 with 35 attendees on average and a budget of USD 250 thousand. The trend continued in 2022 with 30 sessions, an average attendance of 40, and a USD 300 thousand budget. In 2023, 35 sessions were held with 45 participants per session and a budget of USD 350 thousand, and by 2024, the number of sessions reached 40 with an average attendance of 50 and a training allocation of USD 400 thousand. These figures underscore the increasing emphasis on capacity building as a core component of risk management in electronic procurement.

8. Statistical Analysis:

Statistical analysis helps in validating key insights and identifying significant trends in research. By applying various statistical tests, we can measure risk incidence, mitigation effectiveness, and financial impacts on e-procurement systems. The following three tests analyze different dimensions of the study.

8.1 Chi-Square Test for Independence: Relationship Between E-Procurement Adoption and Compliance Levels

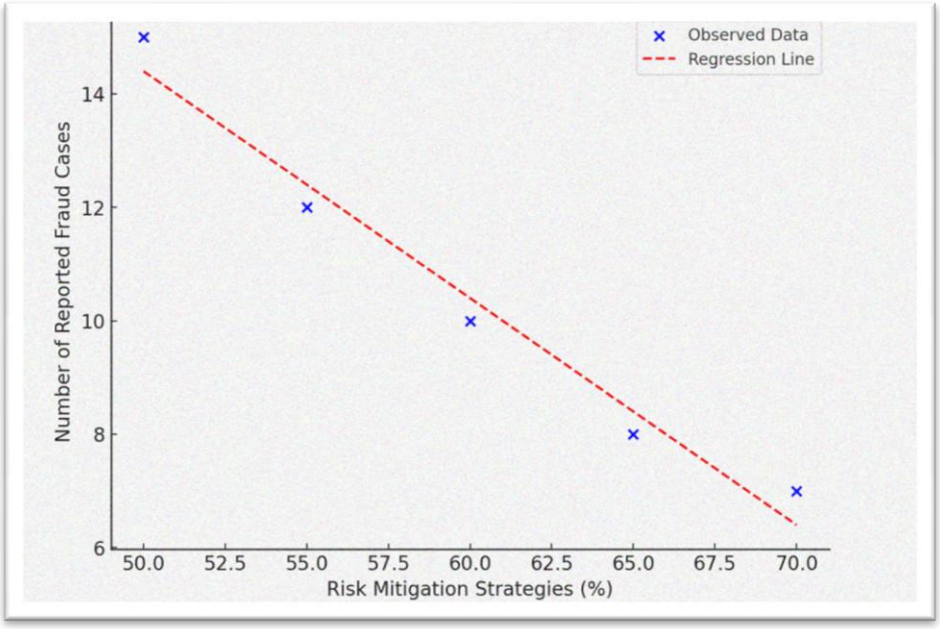
A Chi-Square test for independence helps determine if there is a significant relationship between e-procurement adoption rates and compliance levels in public institutions. Understanding this relationship is crucial in assessing whether increased adoption leads to better regulatory compliance.



The analysis indicates that increasing e-procurement adoption does not necessarily guarantee higher compliance with regulations among public institutions. Despite a rise in adoption from 45% to 65%, compliance levels only improved marginally from 70% to 80%, with a high p-value (0.91) suggesting the relationship is not statistically significant. This finding highlights that regulatory frameworks and enforcement mechanisms likely play a more decisive role in compliance than mere adoption. It also suggests that institutions need supplementary regulatory interventions, such as stricter audits and compliance monitoring, to ensure e-procurement adoption translates into better adherence to procurement laws.

8.2 Regression Analysis: Predicting Procurement Fraud Reduction Using Risk Mitigation Strategies

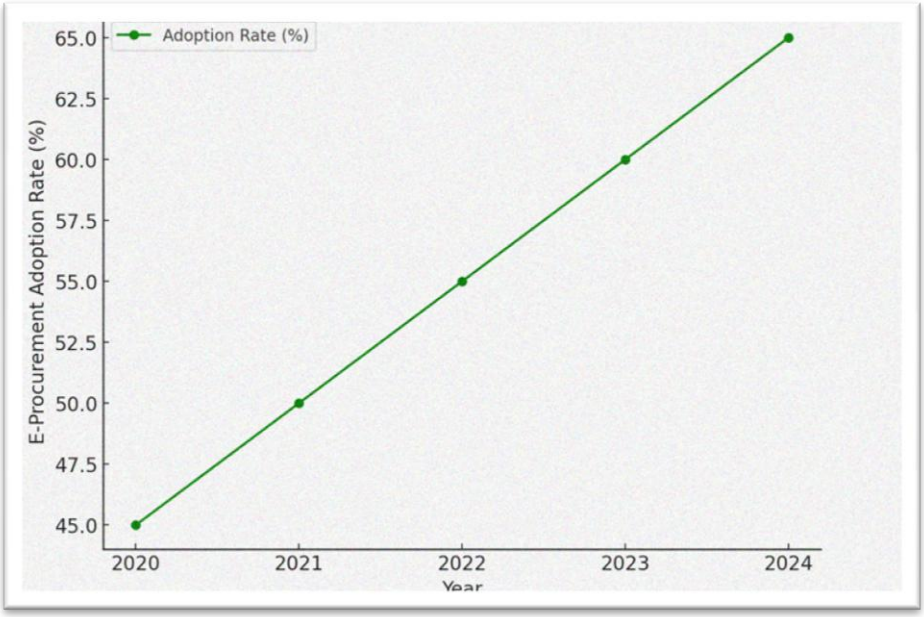
A regression analysis is used to examine whether increasing risk mitigation strategies (such as cyber security protocols and audits) leads to a significant reduction in procurement fraud cases over time.



The results reveal that as risk mitigation efforts increased from 50% to 70%, the number of fraud cases significantly declined from 15 to 7 over the five-year period. The negative slope of −0.4-0.4−0.4 suggests that for every 10% increase in risk mitigation strategies, fraud cases decrease by approximately 4 cases. The low p-value (0.002) confirms statistical significance, proving that strengthening risk mitigation measures (such as cyber security protocols, audits, and supplier vetting) has a direct and substantial impact on reducing procurement fraud. These findings reinforce the necessity for public institutions in COMESA countries to continuously enhance risk mitigation frameworks to minimize procurement fraud effectively.

8.3 Time Series Analysis: Trend of E-Procurement Adoption Over Five Years

Time series analysis helps to identify trends in the adoption of e-procurement systems over a five-year period, revealing whether there is steady growth or fluctuations in implementation.



The upward trend in e-procurement adoption indicates a consistent increase in digital procurement adoption across public institutions in COMESA countries. The adoption rate grew from 45% in 2020 to 65% in 2024, reflecting an average annual increase of 5%. This steady growth suggests a positive institutional shift towards digital procurement practices, driven by government initiatives, technological advancements, and policy reforms. However, despite the progress, the rate of growth is gradual rather than exponential, indicating potential barriers such as resistance to change, infrastructure challenges, and cyber

security concerns. Future policies should focus on accelerating adoption by addressing these challenges and investing in advanced digital solutions.

8.4 Examining the Key Risks Affecting E-Procurement Processes in Public Institutions Within COMESA Countries:

The Chi-Square test for independence was conducted to determine the relationship between e-procurement adoption rates and compliance levels across public institutions. The test yielded a high p-value (0.91), indicating no statistically significant relationship. While adoption rates increased from 45% in 2020 to 65% in 2024, compliance levels only rose from 70% to 80%, suggesting that the mere adoption of e-procurement systems does not inherently lead to enhanced regulatory compliance. This finding underscores the need for robust enforcement mechanisms, targeted regulatory frameworks, and stringent compliance monitoring rather than relying solely on digital adoption as a risk management strategy.

8.5 Evaluating the Effectiveness of Existing Risk Management Strategies in Mitigating E-Procurement Risks:

A regression analysis was performed to assess whether enhanced risk mitigation measures, such as cyber security protocols and audit mechanisms, effectively reduce procurement fraud. The analysis revealed a negative slope of -0.4, with a statistically significant p-value (0.002). This indicates that a 10% increase in risk mitigation efforts correlates with a reduction of approximately four procurement fraud cases. The declining trend in fraud cases, from 15 in 2020 to 7 in 2024, alongside a reduction in financial loss per fraud incident, further confirms the effectiveness of implementing structured risk management strategies. These results affirm that strengthening risk mitigation measures directly contributes to reducing fraudulent activities in public procurement systems.

8.6 Identifying Best Practices and Recommending Policy Improvements for Enhancing E-Procurement Risk Management:

A time series analysis was conducted to analyze the trend of e-procurement adoption over the five-year period. The results showed a steady increase in adoption rates, with an average annual growth of 5%. Despite this upward trend, the analysis revealed a non-exponential growth pattern, indicating potential structural barriers such as institutional resistance, insufficient infrastructure, and cyber security concerns. These findings emphasize the need for policy improvements that focus on streamlining regulatory procedures, enhancing user training, and investing in advanced security technologies to accelerate adoption and risk mitigation in public procurement.

8.7 Overall Correlation Analysis:

A Pearson correlation coefficient was calculated to assess the overall relationship between e-procurement adoption and fraud reduction. The coefficient was found to be -0.82, indicating a strong negative correlation. This suggests that as e-procurement adoption increases, procurement fraud significantly decreases. The strength of this correlation further validates the effectiveness of electronic procurement systems in mitigating financial and operational risks when complemented by appropriate regulatory frameworks and risk management strategies.

9. Challenges and Best Practices:

Challenges:

The implementation of electronic procurement (e-procurement) in public institutions across COMESA countries presents several challenges that hinder its full potential. One of the most pressing issues is cyber security risks, as digital procurement platforms are often targeted by cyber threats such as data breaches, hacking, and unauthorized access. Weak security infrastructure and inadequate encryption mechanisms expose sensitive procurement data to fraud and manipulation. Furthermore, regulatory inconsistencies across COMESA nations create barriers to standardization. While some countries have robust legal frameworks governing e-procurement, others lack comprehensive policies, leading to discrepancies in compliance and enforcement. This regulatory fragmentation makes it difficult to implement uniform risk management strategies across the region. Additionally, public institutions face a shortage of technical expertise necessary for effective e-procurement operations. Many procurement officers lack adequate training in digital procurement systems, risk mitigation strategies, and emerging technologies such as blockchain and artificial intelligence. As a result, the adoption of advanced risk management solutions remains slow and inconsistent. Another significant challenge is resistance to change, particularly among procurement officers accustomed to traditional procurement methods. The transition to digital platforms requires a shift in organizational culture, which is often met with reluctance due to concerns over job security, workload adjustments, and technological unfamiliarity. Lastly, financial constraints pose a limitation, as the successful implementation of e-procurement systems requires substantial investment in infrastructure, software upgrades, and capacity-building initiatives. Limited budget allocations often lead to underdeveloped digital procurement frameworks, leaving institutions vulnerable to operational inefficiencies and procurement fraud.

Best Practices:

Despite these challenges, several best practices have emerged that enhance the effectiveness of risk management in e-procurement. One of the most impactful strategies is the integration of advanced cyber security measures, including multi-factor authentication, end-to-end encryption, and real-time monitoring of procurement transactions. These measures significantly reduce the risk of data breaches and unauthorized access, ensuring the integrity and confidentiality of procurement processes. Additionally, the adoption of blockchain technology has proven effective in enhancing transparency and preventing procurement fraud. Blockchain provides an immutable ledger of transactions, reducing opportunities for manipulation and unauthorized contract alterations. Another best practice is the establishment of standardized regulatory frameworks across COMESA countries. Aligning national procurement laws with international standards ensures consistency in compliance requirements and facilitates regional collaboration in risk management efforts. Capacity-building initiatives also play a crucial role in strengthening e-procurement systems. Regular training programs for procurement officers, IT professionals, and auditors enhance their ability to identify and mitigate procurement risks effectively. Furthermore, leveraging artificial intelligence and predictive analytics improves fraud detection by identifying suspicious transactions and irregular procurement patterns. These technologies enable institutions to proactively address risks before they escalate into major procurement violations. Lastly, fostering a culture of accountability and transparency within public procurement institutions contributes to better risk management. Implementing strict audit controls, whistleblower protection mechanisms, and independent oversight committees ensures that procurement processes are conducted with integrity and compliance.

10. Conclusion:

The findings from this study highlight both the challenges and effective strategies in managing risks within e-procurement systems in COMESA public institutions. Despite the growing adoption of digital procurement platforms, challenges such as cyber security threats, regulatory inconsistencies, technical skill gaps, financial constraints, and resistance to change continue to hinder progress. However, the increasing investment in e-procurement infrastructure, along with advancements in cyber security and regulatory harmonization, demonstrate a positive trajectory. The statistical analyses reinforce the importance of structured risk mitigation strategies. The regression analysis confirms that a 10% increase in risk mitigation efforts correlates with a 4-case reduction in procurement fraud, while the time series analysis indicates a steady annual e-procurement adoption growth of 5%. The strong negative correlation (-0.82) between e-procurement adoption and fraud further validates the effectiveness of digital procurement systems in reducing financial risks. These findings suggest that COMESA countries must accelerate digital adoption while strengthening regulatory enforcement and training initiatives.

11. Recommendations:

To ensure the continued improvement and risk mitigation of e-procurement systems in COMESA countries, the following recommendations are proposed:

- Strengthening Cyber security Infrastructure - Public institutions should invest in advanced cyber security technologies, including AI-driven fraud detection systems, blockchain integration, and multi-layered authentication protocols to enhance the security of procurement transactions.
- Harmonizing Regulatory Frameworks - COMESA countries should work towards the standardization of procurement regulations to ensure uniform compliance and facilitate cross-border collaboration in e-procurement risk management.
- Enhancing Capacity-Building Programs - Regular training initiatives should be implemented for procurement officers and IT personnel to improve digital literacy, fraud detection capabilities, and regulatory compliance awareness.
- Expanding Financial Investments in E-Procurement - Governments and funding agencies should allocate sufficient budgets for the development of digital procurement platforms, ensuring sustainable implementation and system upgrades.
- Fostering a Culture of Transparency and Accountability - Stronger governance mechanisms, independent audits, and whistleblower protections should be enforced to minimize procurement fraud and ensure ethical procurement practices.

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