Design and Development of an Automated Internal Audit Management System for Federal Polytechnics in North-East Nigeria: A Case Study of Federal Polytechnic Bauchi

[1]Auwal Ahmad, [2] Rilwan Ali Zira, [3]Idrissa Djibo, [4]Yakubu Nuhu Danjuma [5]Abubakar S. Hamza, [6]Yamusa Idris Adamu, [7]Alhaji Kawugana
[1,2,3,4,5]ICT Directorate, Federal Polytechnic
Bauchi, Bauchi State, Nigeria
[6] Networking and Cloud Computing Department
Federal Polytechnic Bauchi, Bauchi State, Nigeria.
[7]Bursary Department, Federal Polytechnic Bauchi,
Bauchi State, Nigeria.
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Abstract
Internal audit is responsible for checking financial transactions, examining internal controls, confirming compliance with approved procedures, safeguarding institutional resources and reporting weaknesses to management. In Federal Polytechnics, these duties involve large volumes of payment records, revenue transactions, payroll information, procurement documents, stores records and financial reports. When audit work depends heavily on separate files and manual records, the retrieval of evidence, review of transactions and follow-up of audit observations can be slow and difficult to track. This study presents the design and development of an Automated Internal Audit Management System for Federal Polytechnics in North-East Nigeria, using Federal Polytechnic Bauchi as the case institution. The proposed system brings audit planning, voucher examination, revenue and expenditure review, payroll and procurement checks, stores and asset verification, bank-reconciliation review, working papers, audit queries, recommendation follow-up and reporting into one controlled environment. The study uses a design-oriented case-study approach and user acceptance testing. The institutional UAT dataset contains 120 responses to 20 five-point Likert-scale items measuring perceived usefulness, perceived ease of use, security readiness and system use/acceptance. Data screening identified 12 missing item responses and three uniform response patterns; the three affected cases were excluded, leaving 117 responses for inferential analysis. The four measures showed good internal consistency, with Cronbach's alpha ranging from .829 to .895. Perceived ease of use ($\beta = .514$, $p < .001$) and security readiness ($\beta = .431$, $p < .001$) were significant predictors of system use/acceptance, while perceived usefulness was positive but did not reach the .05 level ($\beta = .124$, $p = .052$). The regression model explained 59.8% of the variation in system use/acceptance. The findings show that ease of operation and confidence in the controls surrounding the system are important considerations for staff using an automated audit system. The study provides a practical basis for strengthening audit records, transaction review and follow-up within Federal Polytechnics.

Keywords: *internal audit; automated audit system; Federal Polytechnics; user acceptance testing; internal control; audit trail; financial audit; Nigeria*

I. Introduction

Internal audit has an important place in the management of public tertiary institutions. Its work is concerned with checking transactions, reviewing controls, confirming compliance with financial rules, protecting institutional resources and drawing management's attention to weaknesses that require correction. The Federal Government Financial Regulations describe internal audit as a managerial control for examining the effectiveness of internal controls and for auditing accounts, revenue, expenditure, assets and stores. The Federal Ministry of Education also identifies pre-audit of payments and receipts, review of internal controls, compliance checks, safeguarding of assets, examination of accounting information, value-for-money work, investigation of irregularities and reporting to management among the functions of internal audit. In a Federal Polytechnic, these responsibilities cut across several departments and records. An audit officer may need to examine payment vouchers, student revenue records, payroll information, procurement documents, stores records, bank statements, asset registers and financial reports. The quality of audit work therefore depends partly on how quickly relevant records can be obtained and how clearly transactions and decisions can be followed from their origin to their final approval or settlement.

Many audit activities still depend on paper files, spreadsheets and records kept in separate locations. Such arrangements can make it difficult to trace an earlier transaction, monitor outstanding audit queries, confirm whether management has acted on a recommendation or obtain a complete history of changes made to a record. The problem becomes more serious when the volume of transactions increases and several officers are involved in reviewing and approving the same transaction. This study addresses the problem through the design and development of an Automated Internal Audit Management System for Federal Polytechnics in North-East Nigeria, using Federal Polytechnic Bauchi as the case institution. The proposed system is intended to support, rather than replace, the professional judgement of audit officers. It provides a structured means of recording audit work, reviewing transactions, preserving evidence, issuing queries, monitoring responses and preparing reports.

Problem Statement

The main problem addressed in this study is the difficulty of maintaining timely, complete and traceable audit records when audit activities are handled through disconnected manual and electronic records. In such circumstances, an audit officer may spend considerable time locating documents, comparing records, checking approvals and determining the status of earlier observations. The absence of a common audit record can also make it difficult for management to see unresolved issues and the actions taken in response to them. An integrated audit system is therefore required to improve the organisation and traceability of audit work while retaining the necessary controls over confidential financial information.

Research Gap

Studies on information and communication technology in Nigerian tertiary institutions have reported improvements in financial administration and record keeping, but there is less published work on a dedicated automated audit platform designed around the day-to-day responsibilities of internal audit in Federal Polytechnics in the North-East. The present study addresses this gap by developing an audit system around transaction review, evidence management, audit observations, management responses and follow-up, and by examining its acceptance among institutional users.

Aim and Objectives

The aim of the study is to design and develop an Automated Internal Audit Management System for Federal Polytechnics in North-East Nigeria, using Federal Polytechnic Bauchi as

the case institution. The objectives are to: (1) examine the requirements of existing audit procedures; (2) identify difficulties affecting audit work; (3) determine the functional and non-functional requirements of the proposed system; (4) design the system structure, database and user interface; (5) provide functions for audit planning, transaction examination, evidence recording, queries, recommendations and reporting; (6) provide controlled user access, audit trails and data-protection measures; (7) evaluate user acceptance of the system; and (8) develop a framework that can guide similar institutions.

Research Questions

RQ1: What functional and non-functional requirements should guide an automated audit system for Federal Polytechnics? RQ2: What are users' perceptions of the system's usefulness, ease of use and security readiness? RQ3: To what extent do perceived usefulness, perceived ease of use and security readiness predict system use/acceptance?

Hypotheses

H1: Perceived usefulness positively predicts system use/acceptance. H2: Perceived ease of use positively predicts system use/acceptance. H3: Security readiness positively predicts system use/acceptance.

II. Related Works

Internal Audit in Public Tertiary Institutions

The internal audit function in public institutions is intended to provide management with assurance that financial and administrative activities are properly controlled. The Federal Government Financial Regulations require internal audit to examine accounting records and the systems and procedures in operation, identify weaknesses and report irregularities. In education institutions, internal audit also covers payments and receipts, stores, assets, compliance with financial rules, value-for-money considerations and investigations. These responsibilities provide the basis for the functions included in the proposed system.

Audit Records and Control

Audit work depends on reliable evidence. A useful audit record should show the transaction or activity examined, the documents considered, the officer responsible, the audit observation, the response received and the action taken. A system that keeps these elements together can make follow-up easier and reduce dependence on separate paper files. However, electronic records also require proper access controls, user identification, backups and a clear record of changes.

Information Systems in Higher Education

Research on higher-education administration shows that the value of institutional information systems depends on how well technology, work procedures and users fit together. Fernández et al. (2023) and Farias-Gaytan et al. (2023) note that changes in higher education involve organisational processes as well as technology. For internal audit, this means that a system should be built around actual audit duties and reporting requirements rather than simply converting existing paper forms into electronic screens.

System Development and Evaluation

Hevner et al. (2004) explain that design-science research is suitable when a study develops and evaluates an information-system artefact. The present work follows this approach by identifying the audit problem, specifying requirements, designing the system, developing its functions and assessing user acceptance. Runeson and Höst (2009) also emphasise the

importance of clearly describing the case, evidence and procedures in software-related case studies.

User Acceptance

Davis (1989) identified perceived usefulness and perceived ease of use as important factors in acceptance of information systems. In the present study, security readiness is included because audit records contain financial, personnel and institutional information. The resulting model is limited to the four constructs measured by the UAT instrument and is used to examine acceptance of the proposed audit system.

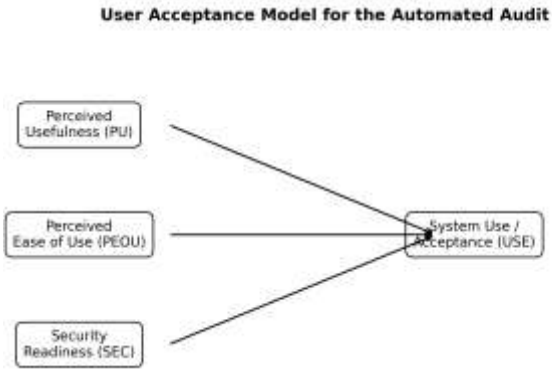

Fig. 1. User acceptance model for the Automated Internal Audit Management System.

III. Methodology

Research Design

The study uses a design-oriented case-study approach. Federal Polytechnic Bauchi serves as the institutional case. The development process covers requirements identification, analysis of existing procedures, system design, database design, development, integration, testing and user acceptance testing. The empirical component focuses on users' assessment of the completed functions available for evaluation.

System Functions

The proposed Automated Internal Audit Management System contains functions for audit planning and scheduling, risk and control assessment, audit engagement records, pre-payment and voucher review, revenue examination, expenditure examination, payroll review, procurement review, stores and asset verification, bank-reconciliation review, audit working papers, supporting evidence, audit observations, audit queries, management responses, recommendation tracking and audit reports. User accounts are controlled according to assigned responsibilities, while important activities are recorded in an audit trail.

Security and Access Control

Because audit work involves confidential records, the system provides user authentication, role-based access, controlled privileges, transaction history and audit logging. These controls are intended to ensure that an officer can access only the functions appropriate to the assigned responsibility and that important activities can be traced to the user who performed them.

UAT Instrument and Data

The UAT instrument contains 20 five-point Likert-scale items, with five items each for perceived usefulness, perceived ease of use, security readiness and system use/acceptance. The institutional dataset contains 120 responses. The responses were examined before statistical analysis to identify missing entries, uniform response patterns and unusually extreme construct scores.

Data Quality and Analysis

Twelve missing item responses were identified among the 600 possible item responses, representing 2.0% item-level missingness. Three respondents selected one response category across all 20 items and were excluded as uniform response cases. No respondent had a construct score beyond ±3 standard deviations and therefore no additional case was removed as an outlier. Construct scores were calculated from the valid available items. Reliability was examined using Cronbach's alpha; Pearson correlation was used to assess relationships among constructs; and multiple linear regression was used to determine the separate contributions of PU, PEOU and SEC to USE. The significance level was set at .05.

IV. Results

Data Screening

Of the 120 institutional UAT responses, 12 item-level entries were missing. The missing entries represented 2.0% of all item responses. Three respondents showed the same answer for every item and were excluded from inferential analysis. The final analytical sample was therefore 117 respondents.

Check	Finding	Decision
Initial responses	120	Screened
Missing item responses	12 of 600 (2.0%)	Available valid items used
Uniform response cases	3 (2.5%)	Excluded
Extreme construct scores	None beyond ±3 SD	No deletion
Final analytical sample	117	Inferential analysis

Table 1. Data-quality screening results.

Descriptive and Reliability Results

Perceived usefulness had a mean of 2.99 (SD = 0.70); perceived ease of use had a mean of 2.93 (SD = 0.74); security readiness had a mean of 3.00 (SD = 0.79); and system use/acceptance had a mean of 2.92 (SD = 0.84). The reliability coefficients ranged from 0.829 to 0.895, indicating that the items within each measure were sufficiently consistent for the analysis.

Measure	N	Mean	SD	α
PU	117	2.99	0.70	0.829
PEOU	117	2.93	0.74	0.861
SEC	117	3.00	0.79	0.895
USE	117	2.92	0.84	0.892

Table 2. Descriptive statistics and internal consistency.

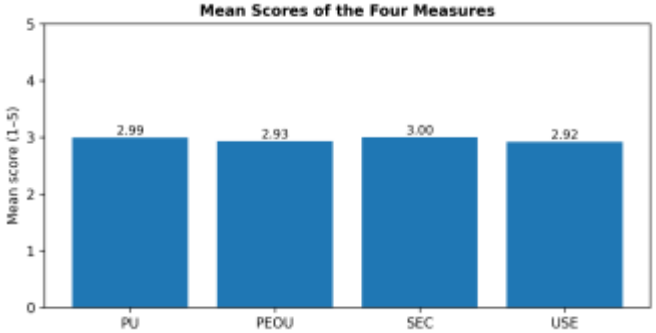

Fig. 2. Mean scores of the four measures.

Correlation Results

System use/acceptance was positively related to perceived usefulness (r = 0.365), perceived ease of use (r = 0.614) and security readiness (r = 0.549). The relationship between perceived ease of use and system use/acceptance was the strongest of the three.

	PU	PEOU	SEC	USE
PU	1.000	0.239	0.273	0.365
PEOU	0.239	1.000	0.163	0.614
SEC	0.273	0.163	1.000	0.549
USE	0.365	0.614	0.549	1.000

Table 3. Pearson correlation matrix.

Regression Results

The regression model was statistically significant, $F(3, 113) = 55.979$, $p < .001$. It explained 59.8% of the variation in system use/acceptance ($R^2 = 0.598$; adjusted $R^2 = 0.587$). Perceived ease of use was a significant positive predictor ($B = 0.584$, $\beta = 0.514$, $p < .001$), as was security readiness ($B = 0.457$, $\beta = 0.431$, $p < .001$). Perceived usefulness was positive but did not reach the .05 level ($B = 0.149$, $\beta = 0.124$, $p = 0.052$).

Predictor	B	SE	β	t	p
PU	0.149	0.076	0.124	1.963	0.052
PEOU	0.584	0.070	0.514	8.318	< .001
SEC	0.457	0.066	0.431	6.917	< .001

Table 4. Multiple regression results.

Model statistic	Value
R	0.773
R^2	0.598
Adjusted R^2	0.587
F(3,113)	55.979
Model p	< .001
N	117

Table 5. Overall regression model.

Hypothesis Testing

H1: Perceived usefulness positively predicts system use/acceptance. $\beta = 0.124$, $p = 0.052$; not supported at $\alpha = .05$.

H2: Perceived ease of use positively predicts system use/acceptance. $\beta = 0.514$, $p < .001$; supported.

H3: Security readiness positively predicts system use/acceptance. $\beta = 0.431$, $p < .001$; supported.

Hypothesis	B	p	Decision
H1	0.124	0.052	Not supported
H2	0.514	< .001	Supported
H3	0.431	< .001	Supported

Table 6. Hypothesis testing.

V. Discussion

The results show that perceived ease of use has the strongest relationship with acceptance of the automated audit system when the three explanatory variables are considered together. This finding is understandable in an audit setting because officers must move through several activities, including locating transactions, examining supporting records, recording

observations and checking the status of earlier recommendations. A system that is difficult to navigate may add to the work rather than reduce it. The result supports the view that ease of use is an important consideration when introducing information systems into established administrative procedures. Security readiness was also a significant predictor of system use/acceptance. This is particularly relevant to internal audit because audit officers work with financial records, payroll information, procurement documents, management reports and other confidential materials. Users are more likely to rely on the system when access is controlled and activities can be traced. The inclusion of authentication, user privileges, transaction history and audit logs are therefore important to the practical operation of the system. Perceived usefulness was positively related to system use/acceptance but was marginal in the regression model. This result should not be taken to mean that usefulness has no value. Rather, after ease of use and security readiness were considered, usefulness made a smaller independent contribution in this sample. It is possible that users first need to feel comfortable with the system and confident in its controls before the wider benefits of the system become more apparent. The findings are consistent with the established view that internal audit requires reliable records, effective controls and timely reporting. They also support the need for an audit system that is closely connected to actual work procedures. The proposed system therefore focuses on the practical sequence of audit work: planning, examination, evidence, observation, query, response, recommendation and follow-up.

VI. Proposed Automated Audit Unit

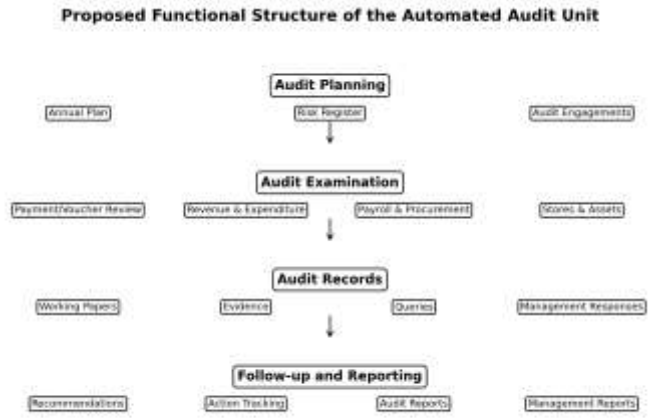

Fig. 3. Proposed functional structure of the Automated Internal Audit Management System.

The proposed system follows the normal sequence of audit work. Audit planning establishes the work to be undertaken and the areas of risk or concern. Audit examination then provides access to the relevant transaction and supporting records. Working papers and evidence preserve what was examined and what was found. Queries and management responses provide a formal record of issues raised and explanations received. Finally, recommendations and follow-up records allow the Audit Unit and Management to determine whether agreed actions have been completed.

VII. Contribution to Knowledge

The study contributes a practical system design for internal audit in Federal Polytechnics, with particular attention to the procedures followed in a public tertiary institution. It brings together audit planning, transaction examination, evidence, queries, recommendations and follow-up in a single structure. It also demonstrates a way of evaluating users' acceptance of such a system using measurable perceptions of usefulness, ease of use, security readiness and system use.

VIII. Practical Implications

Management should treat the proposed system as part of the institution's control arrangements. The Internal Audit Unit should retain responsibility for professional judgement, audit conclusions and reporting, while the system provides the records and controls needed to support that work. Access should be assigned according to responsibility, audit records should be protected from unauthorised alteration, and management responses should be recorded and followed up. Training should be provided before full implementation, particularly for staff who have previously relied on paper files or separate spreadsheets. The institution should also establish clear procedures for electronic audit evidence, retention of records, backup, confidentiality and recovery. Where possible, the audit system should obtain relevant information from financial and administrative systems without allowing audit officers or system administrators to alter the underlying transaction records without proper authority.

IX. Limitations

The study is based on one Federal Polytechnic and therefore the findings should not automatically be assumed to apply to every Polytechnic in Nigeria. The acceptance analysis is also based on users' perceptions and does not by itself measure changes in audit completion time, number of outstanding queries, value of recovered funds, frequency of control exceptions or the rate at which recommendations are implemented. These measures should be examined in a subsequent operational evaluation.

X. Recommendations

- Federal Polytechnics should establish clear procedures for electronic audit working papers and evidence.
- User access should be based on assigned responsibilities, with regular review of active accounts and privileges.
- Audit queries, management responses and agreed corrective actions should be recorded and monitored through the system.
- Audit trails should be protected so that important audit activities and changes to records remain traceable.
- Training and practical support should accompany implementation.
- Future evaluations should include objective measures such as audit-cycle time, evidence-retrieval time, outstanding queries, control exceptions and recommendation closure rates.
- Other Federal Polytechnics in the North-East should be included in later evaluations to determine whether the system is suitable across different institutional settings.

XI. Conclusion

This study developed an Automated Internal Audit Management System for Federal Polytechnics in North-East Nigeria, using Federal Polytechnic Bauchi as the case institution. The proposed system organises audit planning, transaction examination, evidence, queries, management responses, recommendations and reporting within a controlled environment. The institutional UAT results show that perceived ease of use and security readiness are significant predictors of system use/acceptance, while perceived usefulness is positive but does not reach the conventional significance level in the regression model. The findings indicate that a useful audit system must be straightforward to operate and must provide users with confidence that sensitive records and audit activities are properly controlled. The proposed design provides a practical foundation for improving the organisation, traceability and follow-up of internal audit work in Federal Polytechnics.

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