

A Multi-Tiered Cloud-Based Framework for Automated Quality Documentation Management in Higher Education

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ABSTRACT

The systematic management of quality assurance documentation is a cornerstone of institutional accreditation. This paper presents an integrated automated framework developed for Northern Border University (NBU) using Microsoft Excel 365 and OneDrive. The system manages the full lifecycle of 13 core quality tasks—including Program Reports, Course Portfolios, and Program Learning Outcome Assessment Reports—across 10 colleges and 56 academic programs (39 Bachelor's and 17 Master's). The framework employs a three-tier governance architecture that synchronizes workflows across the Academic Program, College Quality Unit, and University Deanship using low-code cloud automation. Results from university-wide deployment show that the institutional compliance ratio improved from a baseline of 0.49 to 0.96. The implementation achieved a 75% reduction in administrative man-hours, saving over 500 hours per cycle, whereas the average delay for critical submissions such as the Program Report was reduced from 18 days to just 4 days. Furthermore, 100% verification of Department and College Council minutes was achieved, demonstrating a scalable and platform-agnostic model for sustainable institutional governance.

Keywords-quality management; academic accreditation; Microsoft 365 integration; automated dashboard; higher education governance; Northern Border University (NBU)

I. INTRODUCTION

The pursuit of academic excellence in higher education is increasingly dependent on robust quality assurance frameworks that ensure institutional accountability and continuous improvement, particularly in the Saudi context [1]. In the Kingdom of Saudi Arabia, the National Center for Academic Accreditation and Evaluation (NCAAA) has established rigorous standards requiring institutions to document the full lifecycle of academic activities, from course delivery to program-level strategic planning [2]. However, the management of this documentation—specifically the Program Report, Course Reports, and governing body minutes—remains a significant administrative challenge for large-scale universities. The digitization of quality assurance has moved beyond simple archiving toward integrated management systems, as automation is now recognized as a primary driver for institutional efficiency. For instance, authors in [3] demonstrated that Microsoft Excel-based frameworks

significantly streamline the assessment of Course Learning Outcomes (CLOs) and Program Learning Outcomes (PLOs), reducing manual error while maintaining high data accuracy. Despite these advancements, many institutions still struggle with "information silos," where data exist but are not accessible for real-time oversight, a challenge systematically reviewed in digital transformation literature [4]. Email-based submissions and decentralized folders often cause version control conflicts and obscure the audit trail, a challenge extensively documented in recent accreditation literature [5].

The complexity of university governance requires systems capable of managing diverse documentation types while ensuring transparency. Authors in [6] proposed a multi-criteria decision-making approach to enhance accreditation, emphasizing the need to minimize "rejection returns" through better initial document modeling. This aligns with authors in [7], who showed that academic accreditation mediates the link between quality management initiatives and institutional

performance, underscoring the need for documented, auditable decision pathways. Furthermore, integrated Content Management Systems (CMS) have been shown to improve user satisfaction by providing online access, streamlined workflows, and transparent feedback [8]. A critical requirement for accreditation is "closing the loop," where assessment results lead to documented improvements sanctioned by official councils, supported by structured learning outcome models [9]. Existing Learning Management Systems (LMS) often lack the administrative depth and feedback-literacy infrastructure required to track the movement of a Program Report through various levels of approval [10]. There is a documented need for "decentralized input and centralized oversight" models that allow programs to upload data while enabling deans to monitor institutional compliance in real-time, a requirement supported by cross-cultural studies on cloud adoption factors in higher education [11]. Cloud-native tools like Microsoft Excel 365 and OneDrive offer a cost-effective solution for this, providing a "single source of truth" and enabling real-time collaboration that was previously impossible with static spreadsheets, as demonstrated in recent studies on enterprise cloud productivity adoption [12]. Transitioning from fragmented manual documentation to integrated cloud systems is a key element of digital leadership, enabling institutions to overcome administrative resistance and foster a culture of excellence [13]. Automating Key Performance Indicator (KPI) measurement further supports sustainable accreditation, ensuring that quality metrics are not only accurate but also consistently available for longitudinal analysis [14].

This paper addresses these identified gaps by presenting a multi-tiered framework developed for Northern Border University (NBU). Unlike previous models that focus solely on pedagogical outcomes, this system automates the administrative lifecycle of quality documentation across three levels: the Academic Program, the College Quality Unit, and the University Deanship. The primary objectives of this study are to (1) design an integrated, governance-aware dashboard using Microsoft Excel 365 that standardizes Program Report submissions across all departments, (2) implement automated verification of Department and College Council minutes through mandatory metadata fields, and (3) evaluate the framework's impact on institutional compliance rates and feedback-loop efficiency. In the context of this study, an administrative 'cycle' is defined as one full academic year, representing the complete duration from the initiation of course reporting to the final institutional audit.

II. METHODOLOGY AND SYSTEM DESIGN

The proposed framework is engineered to synchronize multi-level academic governance through cloud-native architecture. By leveraging Microsoft Excel 365 and OneDrive, the system provides a dynamic environment for data entry, technical auditing, and institutional oversight.

A. Tier 1: The Academic Program Dashboard (Operational Layer)

Tier 1 is the operational core. It provides the primary interface for Program Quality Coordinators to manage the thirteen mandatory quality tasks. This dashboard transitions

away from traditional, static record-keeping by implementing a multidimensional tracking architecture that monitors document progression through five distinct administrative stages: evidence availability, technical review, internal committee feedback, program response, and final governance approval. Central to this tier is the integration of standardized metadata, which align every quality task with a rigid institutional timeline. For instance, tasks such as Program Specifications are mapped to specific delivery dates (e.g., Week 2 of the first semester), allowing the system to automatically flag temporal variances. This operational rigor is visually supported by an iconography-based analytics system. High-visibility status indicators—utilizing a traffic-light color convention—provide immediate insight into the health of the program; green markers denote full completion, whereas yellow and red indicators highlight tasks that are in progress or overdue, respectively.

Beyond simple tracking, as shown in Figure 1, the dashboard embeds a "closed-loop" feedback mechanism directly into the workflow. Each task includes dedicated fields for the Internal Review Committee to provide status updates and link formal Review Reports. This necessitates a documented "Program Response," ensuring that qualitative feedback leads to measurable action before a document is finalized. This technical audit trail is concluded through a dual-level governance verification module, which tracks formal approvals from both the Department and College Councils. By requiring the entry of specific council minute references and dates, the system ensures that the evidence is not only physically available in the cloud but has also undergone the mandatory legal and academic scrutiny required for national accreditation.

B. Tier 2: The College Quality Unit Dashboard (Technical Audit Layer)

The second tier of the framework functions as a technical gatekeeper, shifting the focus from data entry to rigorous verification. Managed by the College Development and Quality Unit (CDQU), this dashboard aggregates the thirteen mandatory tasks from all constituent programs to conduct a multi-stage technical audit. The system utilizes a specialized "Review Status" logic—depicted in the audit workflow of Figure 2—categorizing document readiness into stages such as "Under Review," "Approved," or "Needs Revision."

A critical governance requirement handled at this tier is the authentication of institutional approvals. The dashboard monitors the Council Approval Status across two distinct levels: the Department Council and the College Council. By requiring specific minute references for each task, the system prevents the escalation of non-sanctioned evidence. As illustrated in the feedback loop in Figure 2, the dashboard monitors the "Program Response Status," ensuring that any "Needs Revision" flag results in updated evidence before college-level certification.

C. Tier 3: The University Deanship Dashboard (Strategic Oversight Layer)

The final tier is managed by the Deanship of Development and Quality (DDQ) and represents the strategic summit of the

framework. This tier is responsible for the aggregate monitoring of all 56 Bachelor's and Master's programs across the university's ten colleges. As illustrated in Figure 3, the Deanship utilizes a high-level institutional monitoring interface equipped with advanced Slicers. These allow decision-makers to filter the university's quality health by academic year, specific college clusters, or individual program levels, transforming raw documentation data into a dynamic "Quality Heatmap."

A critical technical feature of this tier is the automated "Check Availability" engine, which validates the contents of the OneDrive repositories generated by the Office Scripts. By providing a macro-view of the 13 mandatory tasks across the entire institution, the DDQ can identify systemic gaps. Furthermore, as shown in Figure 4, the dashboard includes a dedicated module for Accreditation Readiness and Final

Governance. This specific view tracks the status of the "Permanent Higher Committee for Quality" approval.

In this final interface (see Figure 4), the system calculates an overall completion ratio of 0.307 during mid-cycle monitoring—reflecting partial completion in accordance with the academic calendar—as compared to the end-of-cycle institutional average of 0.96. This metric is derived from the total number of "Completed Tasks" and "Approved Tasks" across all 56 academic programs. The tier effectively closes the loop of the institutional quality cycle by ensuring that a Program Report and its associated evidence are not deemed valid until the DDQ verifies that all prior stages—including internal technical reviews and mandatory approvals from Department and College Councils—have been fully completed and formally sanctioned by the university's highest quality authority.

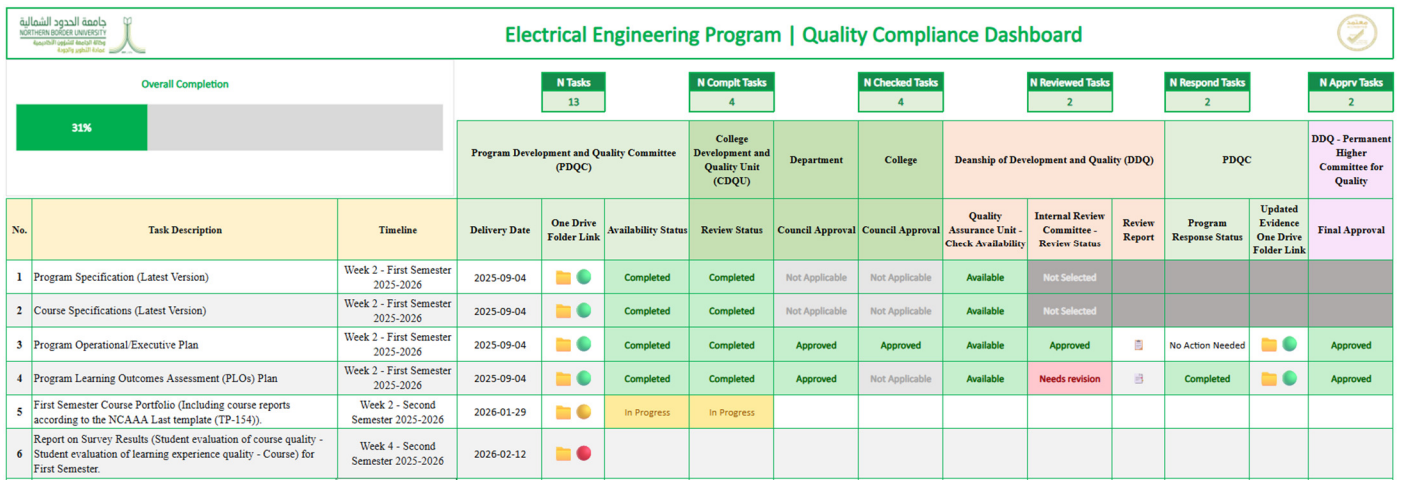


Fig. 1. Program level dashboard.

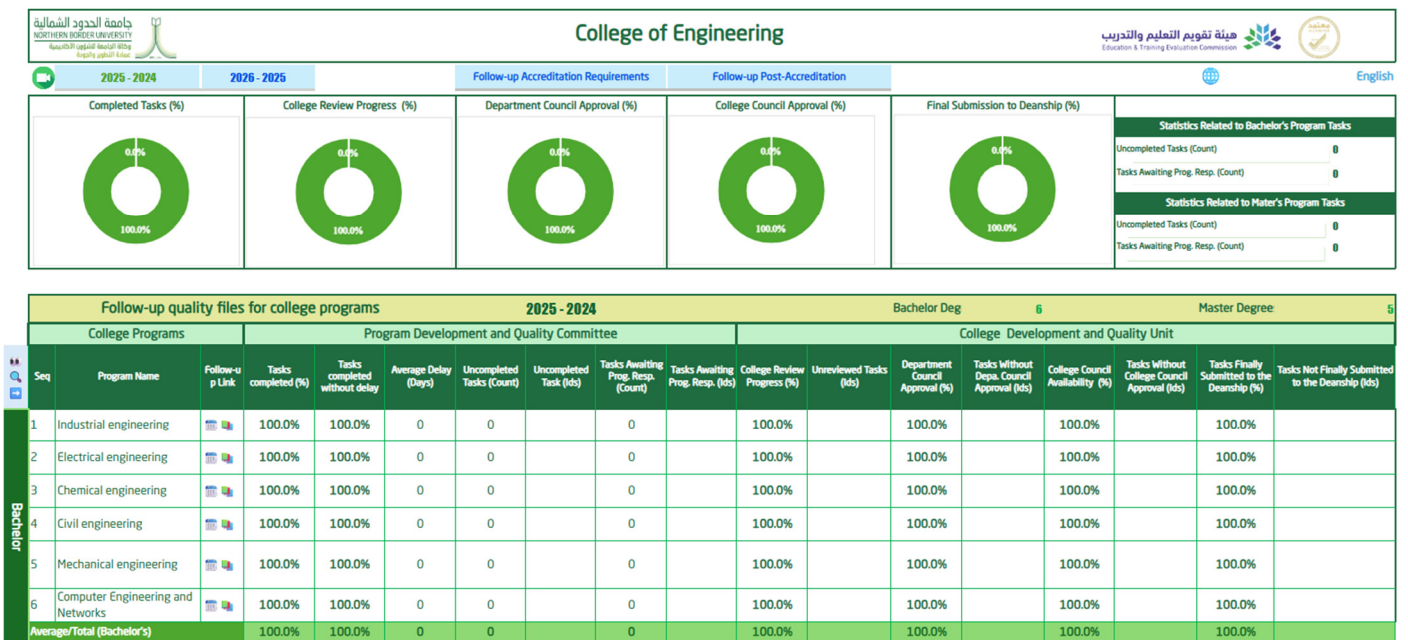


Fig. 2. College-level dashboard.

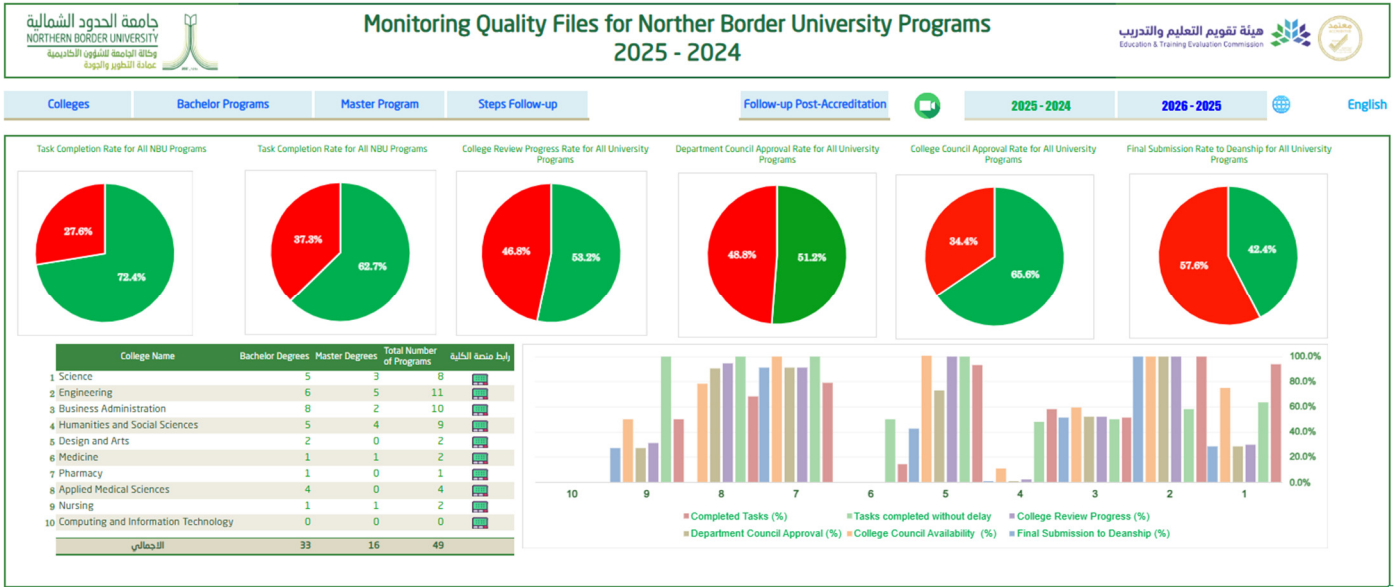


Fig. 3. Strategic oversight dashboard showing real-time compliance heatmap across colleges.

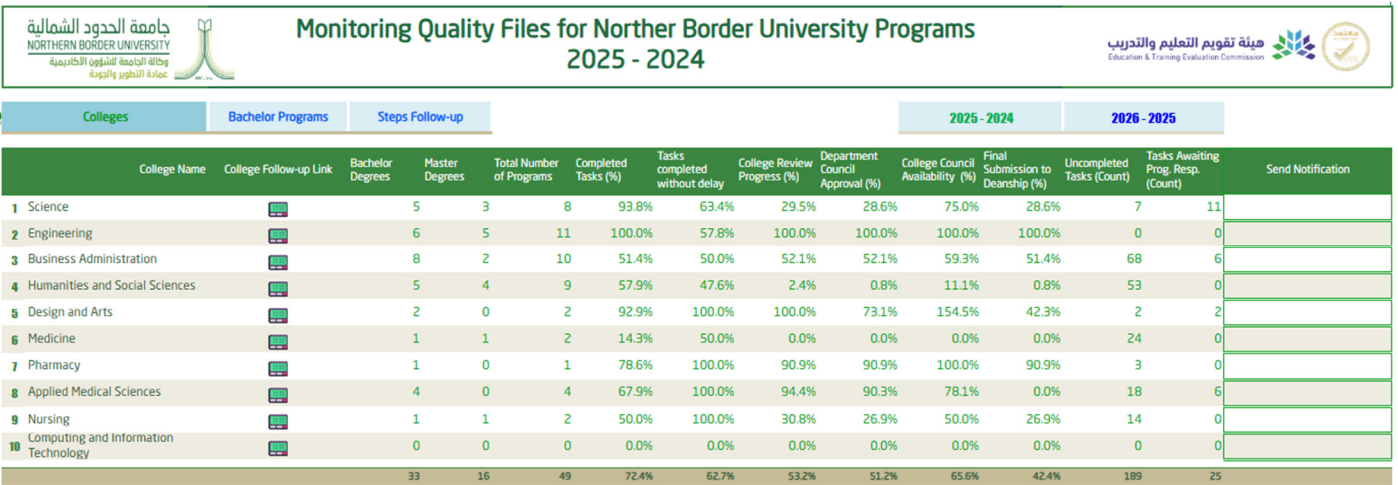


Fig. 4. NBU institutional quality dashboard: aggregated compliance metrics and accreditation gatekeeping view.

D. Technical Design and Functional Implementation

The operational efficacy of the framework is rooted in a sophisticated computational architecture within Microsoft Excel 365, designed to automate data relationships, ensure version control, and provide real-time reporting metrics across the university's 56 programs.

1) Automated Evidence Connectivity

To facilitate seamless external auditing, the system utilizes the HYPERLINK function to bridge the Excel front end with the OneDrive back end. By programmatically connecting the "Evidence Link" cells to specific cloud file paths, the system eliminates manual document retrieval. This ensures that reviewers are always presented with the most current version of a document, effectively mitigating the risks associated with decentralized file storage.

2) Quantitative Compliance Modeling

The framework quantifies institutional progress through a numerical compliance score (C_r), ranging from 0.0 to 1.0. This metric is derived by evaluating the completion status of the 13 mandatory tasks. Mathematically, the compliance ratio is defined as:

$$C_r = \frac{\sum_{i=1}^N S_i}{N} \tag{1}$$

where:

- C_r is the compliance ratio,
- S_i is the status of document i (1 for completed, 0 for not), and
- N is the total number of required documents (13).

In the Excel implementation, this is executed via a SUMIFS logic that aggregates tasks marked as "Completed" and divides

them by the total count of mandatory requirements, enabling the real-time tracking of the 1.0 completion rates observed in the institutional results.

3) Temporal Variance Analysis

Adherence to the academic calendar is monitored through a "Delivery Time Difference" calculation. The system compares a static Planned_Deadline (e.g., Week 2 of Semester 1) against a dynamic Actual_Entry_Date. Using logical IF statements, the dashboard flags late submissions by calculating the day-count variance. This allows the DDQ to identify systemic delays in the document lifecycle and intervene during the early stages of the academic year.

4) Automated Data Pipelines and Multi-Tier Cloud Synchronization

The technical rigor of the framework lies in its automated data pipeline, which addresses the challenge of real-time synchronization across 56 independent program workbooks. By utilizing Power Query as a middleware for "Get & Transform" operations, the system maintains live, low-latency connections with cloud-linked reference structures. This ensures data atomicity—where a single status update performed by a Program Coordinator propagates across all oversight tiers to the Central University Dashboard (as illustrated in the multi-tiered architecture and functional workflows in Figures 1–4) without manual intervention. By employing a source-referencing mechanism (Link to Source), the framework maintains a single source of truth, creating a unified and transparent institutional dataset that eliminates the version control conflicts typical of decentralized systems.

5) Workflow Automation via Office Scripts and Power Automate

The scalability of the framework is governed by a robust automation layer designed to manage a high-volume data architecture. To meet NCAA requirements for "closing the loop," the system manages 1,456 dedicated OneDrive folders annually (calculated as 56 programs × 13 tasks × 2 stages: Initial Evidence and Post-Revision Evidence). This ensures a rigorous audit trail where the initial submission is preserved alongside the corrected version resulting from the technical review process.

a) Batch Program Initialization and Template Cloning

To ensure scalability, the system utilizes a Batch Cloning Script, as shown in Figure 5. Rather than manual duplication, this script iterates through a centralized array containing the names of all 56 academic programs. It programmatically clones the "Program Quality Template," creating a standardized environment across the university in a single execution. This ensures that every program, regardless of its college or discipline, operates within the same institutional quality logic.

b) Academic Year Transition and Dynamic Timeline Updates

At the commencement of a new academic cycle (e.g., the transition to 2026–2027), the framework executes a Lifecycle Management Script. This automation performs three critical functions:

- **Worksheet generation:** Creates a new "Academic Year" sheet within every program's workbook.
- **Timeline calibration:** Injects the updated institutional calendar (e.g., Week 2 – First Semester 2026) into the new sheet.
- **Repository expansion:** Triggers a cloud flow to generate 26 new folders per program (13 for initial evidence and 13 for evidence after revision).

```
function main(workbook: ExcelScript.Workbook, programList: string[]) {
    let p = workbook.getWorksheet("Prg_Template");
    programList.forEach((prgName) => {
        let newSheet = p.copy(ExcelScript.WorksheetPositionType.after, p);
        newSheet.setName(prgName);
        newSheet.getRange("B2").setValue(prgName);
        .....
        // Lock administrative metadata and deadlines
        newProg.getProtection().unprotect();
        newProg.getRange("D2:F14").getProtection().setLocked(false);
        .....
        newProg.getProtection().protect();
    });
}
```

Fig. 5. Script 1 – Batch template cloning for university-wide programs.

c) Integrated Evidence Repository and Hyperlink Mapping

The connectivity between the dashboard and the 1,456 folders is managed through a four-step automated sequence using Power Automate. This ensures that the two-stage evidence trail (Initial vs. Post-Revision) is perfectly mapped to the corresponding cells in the Excel dashboard, as shown in Figure 6:

- **Trigger:** An Office Script collects program metadata and the current Academic Year ID.
- **Dual-folder creation (Power Automate):** The flow executes a nested loop to create two subfolders for each of the 13 tasks: [Task_ID]_Initial and [Task_ID]_Revised.
- **Permission and URL retrieval:** The flow creates secure "Edit" sharing links for all 26 folders and captures their unique URLs.
- **Bulk injection:** These URLs are returned to the Excel dashboard, where the script populates the "OneDrive Folder Link" and "Updated Evidence Link" columns using the HYPERLINK formula.

6) Data Privacy and Access Control

The framework ensures institutional data integrity through a hierarchical permission model native to Microsoft 365. Access is restricted via Role-Based Access Control (RBAC), where Program Coordinators possess "Edit" rights only for their

specific folders, whereas the College Quality and Development Units and the DDQ maintain "Read-Only" or "Full Oversight" permissions depending on the audit stage. All document transitions and modifications are logged within the OneDrive version history, providing a tamper-proof audit trail that satisfies national data governance standards.

```
function main(workbook: ExcelScript.Workbook,
    initialUrls: string[], revisedUrls: string[]) {
    let sheet = workbook.getActiveWorksheet();

    for (let i = 0; i < 13; i++) {
        let row = i + 2;
        // Map initial submission folders
        sheet.getRange(`F${row}`).setFormula(
            `=HYPERLINK("${initialUrls[i]}", "📁 Initial");`
        );
        // Map post-revision folders (The "Closing the Loop" evidence)
        sheet.getRange(`O${row}`).setFormula(
            `=HYPERLINK("${revisedUrls[i]}", "📁 Revised");`
        );
    }
}
```

Fig. 6. Script 2 – Dual-stage hyperlink injection (initial & revised).

III. CASE STUDY AND RESULTS

The multi-tiered dashboard framework was implemented institution-wide at NBU over two consecutive academic cycles (2023–2025). The deployment replaced fragmented, email-based documentation practices with a unified cloud infrastructure built on Microsoft Excel 365 and OneDrive. This section presents the implementation scope, quantitative compliance outcomes, timeline adherence metrics, and feedback-loop efficiency gains observed during the transition.

A. Implementation Scope and Clustering

The system was scaled to manage 56 academic programs (39 Bachelor's and 17 Master's) across 10 colleges. To balance operational autonomy with centralized oversight, colleges were grouped into three administrative clusters based on disciplinary alignment and governance similarity:

- Engineering & technology cluster: Engineering, computing, and information technology.
- Medical & health sciences cluster: Medicine, pharmacy, applied medical sciences, nursing.
- Humanities, business & arts cluster: Business administration, humanities and social sciences, design and arts, science.

This clustering preserved departmental privacy while enabling cross-college benchmarking and resource allocation by the DDQ.

B. Quantitative Compliance Analysis

Prior to implementation, quality documentation was managed through decentralized folders and manual tracking, resulting in an institutional baseline compliance ratio of 0.49. Following deployment, real-time compliance monitoring became possible via the automated dashboard. As shown in Table I, all clusters demonstrated significant improvement:

- The engineering & technology cluster achieved near-complete compliance (0.99).
- The humanities, business & arts cluster, which had the lowest initial performance (0.44), showed the highest relative gain (+113%).
- The institutional average rose to 0.96, reflecting a 96% improvement in documentation readiness.

TABLE I. UNIVERSITY-WIDE DOCUMENT COMPLIANCE RATES (PRE VS. POST IMPLEMENTATION)

Cluster	Programs (B/M)	Baseline compliance	Final compliance	Improv. (%)
Engineering & technology	13	0.50	0.99	+98
Medical & health sciences	12	0.58	0.96	+65
Humanities, business & arts	31	0.44	0.94	+113
Institutional total	56	Avg: 0.49	Avg: 0.96	+96

Note: B/M = Bachelor's/Master's programs.

Notably, the system also supports mid-cycle monitoring. During the 2024–2025 academic year, the overall completion ratio was recorded at 0.307, accurately reflecting that foundational tasks (e.g., Program Specifications) were complete, whereas longitudinal deliverables (e.g., Program Reports) remained in progress per the academic calendar. This demonstrates the system's ability to provide context-aware compliance snapshots, not just end-state metrics.

C. Performance against the Mandatory 13-Task Timeline

The framework enforced a strict institutional calendar, automating the "Delivery Time Difference" for 13 specific milestones. As detailed in Table II, the visibility provided by the University Deanship dashboard significantly reduced administrative latency. The average delay for the Program Report, which is the most critical document for accreditation, was reduced from 18 days to 4 days, marking a 77% increase in temporal efficiency.

TABLE II. VARIANCE TRACKING FOR MANDATORY QUALITY TASKS

No.	Task description	Target deadline	Avg. delay (manual)	Avg. delay (dashboard)
1	Program Specification	Week 2 – Sem 1 23/24	+10 days	+1 day
5	Course Portfolios (Sem 1)	Week 2 – Sem 2 23/24	+15 days	+3 days
10	Program Report	Week 2 – Sem 1 24/25	+18 days	+4 days
13	KPI-P Report	Week 2 – Sem 1 24/25	+22 days	+5 days

As shown in Table II, the automated alerts and visibility at the University Deanship level reduced the average delay for the Program Report by over 77%.

D. Efficiency of the Feedback Loop (Closing the Loop)

A core innovation is the enforced closed-loop feedback mechanism. Unlike legacy systems where recommendations often went unaddressed, the dashboard mandates program-level responses before cycle closure.

Key outcomes include:

- Feedback response rate: Increased from 35% to 100%.
- Revision quality: College-level technical review reduced errors in final Program Reports by 60%.
- Audit efficiency: OneDrive hyperlinks cut average audit time per program by 45%, eliminating email-based file requests.

Together, these results confirm that automation not only improves speed but also strengthens accountability, traceability, and governance integrity—critical pillars of NCAAA accreditation.

E. Administrative Efficiency and Man-Hour Savings

Beyond reducing delays, the framework significantly optimized human capital. To provide a factual foundation for these improvements, a time-motion analysis was conducted to compare the manual baseline against the automated framework. The values represented in Table III are calculated as the institutional average across the 56 academic programs involved in the study.

TABLE III. QUANTITATIVE TIME-MOTION ANALYSIS OF ADMINISTRATIVE SAVINGS PER CYCLE

Documentation activity	Manual/email process (avg. h/prog)	Dashboard framework (avg. h/prog)	Time saved (h)	Efficiency gain (%)
Folder setup & template initialization	3.5	0.5	3.0	86
Document tracking & email follow-ups	4.0	1.0	3.0	75
Internal technical review & feedback	2.5	1.0	1.5	60
Verification of council minute metadata	2.0	0.5	1.5	75
Total per academic program	12.0	3.0	9.0	75
Institutional total (56 programs)	672.0	168.0	504.0	75

As shown in Table III, the transition to the automated dashboard resulted in an average saving of 9 hours per program. When aggregated across the institution, this represents a total saving of 504 man-hours per cycle. This data-driven foundation confirms that the framework successfully reallocates human capital from clerical logistics to qualitative academic development.

IV. COMPARATIVE ANALYSIS AND DISCUSSION

This section compares the proposed framework against conventional approaches—manual/email-based systems and standard LMS platforms—in terms of governance depth, automation, and cost. Building upon the computational assessment frameworks proposed by authors in [3] and the accreditation decision-modeling established in [6], this system automates the administrative lifecycle through verified council approvals and real-time compliance tracking.

A. Functional Comparison with Existing Approaches

Most higher education institutions continue to rely on either decentralized manual processes (e.g., shared drives, email submissions) or pedagogically oriented LMS platforms such as Blackboard or Moodle. While these tools support course delivery and student assessment, they lack the administrative scaffolding required for multi-tier accreditation governance.

As demonstrated in Table IV, this functional comparison demonstrates that the framework uniquely satisfies NCAAA's dual requirements of governance traceability and process automation—a combination not achievable through legacy or general-purpose systems.

TABLE IV. FUNCTIONAL COMPARISON OF QUALITY MANAGEMENT APPROACHES

Feature	Manual/email methods	Standard LMS (Blackboard/Moodle)	Proposed multi-tier dashboard
Real-time oversight	None (static)	Limited to course level	Institutional (program to deanship)
Evidence validation	Manual check	None	Automated via council minute links
Feedback loop	Fragmented	None	Integrated "response to revision"
Data integrity	High error risk	Moderate	High (standardized dropdowns)
Implementation cost	Low	High (licensing)	Low (existing MS 365 license)

B. Scalability, Sustainability, and Transferability

A key strength of the design is its zero-additional-cost sustainability. Since NBU already holds a Microsoft 365 institutional license, deployment required no new procurement—only process re-engineering and light scripting. The architecture scales linearly: adding new programs only requires executing the batch initialization script (Script 1), whereas Power Query-based synchronization ensures the central dashboard remains responsive even as data volume grows.

Critically, the framework is transferable to other institutions facing similar accreditation pressures. The core logic—three-tier oversight, two-stage evidence retention, and automated compliance scoring—is independent of NBU-specific terminology. The system is adaptable to other institutions; for instance, the DDQ module can be renamed to suit local terminology within the Gulf Cooperation Council region or beyond.

Moreover, the system's ability to maintain a 0.96 institutional compliance rate across disciplines—from engineering to humanities—confirms its adaptability to heterogeneous academic cultures within a single governance model.

While Power Query is highly robust, maintaining links across 56 cloud-hosted workbooks requires strict data hygiene. To ensure reliability, the framework utilizes a "Centralized Path Parameter". If a folder structure changes, the administrator updates a single cell in the master sheet, and all 56 queries automatically recalibrate. This prevents the large-file latency and refresh errors common in decentralized cloud-linked spreadsheets.

While this implementation utilizes Microsoft 365, its architectural principles are platform-agnostic. The three-tier oversight and "Dual-Stage Evidence Retention" logic can be replicated in environments like Google Workspace using Google Sheets and Apps Script. The metadata-enforced verification remains the primary governance driver, regardless of whether the underlying automation is executed via Office Scripts or alternative low-code scripting languages.

V. CONCLUSION

This paper presented a multi-tiered, cloud-based framework for automating quality documentation management across 56 academic programs at Northern Border University (NBU) using native Microsoft 365 tools. The proposed system increased institutional compliance from 0.49 to 0.96, reduced submission delays by up to 77%, and achieved 100% feedback-loop closure by enforcing verified Department and College Council approvals. Critically, the framework achieved a 75% reduction in administrative man-hours, saving over 500 hours per academic cycle across the institution. Unlike costly enterprise platforms, this low-code solution leverages existing institutional licenses and digital literacy, enabling rapid adoption and sustainable operation. Its modular architecture—integrating program execution, college-level auditing, and university-level oversight—is platform-agnostic and readily transferable to other cloud environments, such as Google Workspace, operating under similar accreditation regimes.

Future work will explore integration with national education portals and the use of predictive analytics to forecast compliance risks before deadlines. The current implementation already offers a robust model for transforming quality assurance into an integrated, transparent, and governance-embedded process.

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