

Challenges and Governance in Implementing BIM Automation Design Review with Multi Stakeholders

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Abstract:

Ensuring consistent Building Information Modeling (BIM) compliance across parallel contractor and consultant teams presents a significant challenge in giga-scale construction programs. This paper presents a scalable framework for automated BIM compliance tracking implemented within the SEVEN Program in Saudi Arabia. Leveraging Autodesk Construction Cloud (ACC), the system integrates issue lifecycle automation, comment registration, and design review validation using structured coordination workflows. Empirical data from stakeholder feedback during implementation reveals critical integration challenges and their mitigation strategies. The study demonstrates how standardized automation routines reduced review turnaround times by 45%, improved traceability, and minimized rework, while also highlighting significant barriers that had to be overcome. Practical insights are provided into system architecture, ISO 19650 alignment, data control, and governance enforcement, offering a repeatable compliance strategy for other multi-package digital delivery programs.

1 INTRODUCTION

1.1 Background

The digital transformation of construction has placed BIM at the forefront of efficient project delivery. However, giga-scale programs, involving multiple contractors and consultants operating in parallel, face significant challenges in maintaining BIM compliance. These challenges stem from inconsistent workflows, coordination speeds, and documentation practices.

The SEVEN Program, a multi-billion SAR initiative by Saudi Arabia's Public Investment Fund (PIF), is an ambitious effort to develop entertainment hubs across the Kingdom. With over 14 packages delivered by independent design and construction entities, ensuring digital consistency across stakeholders became a critical need. This paper explores how the SEVEN Program addressed these challenges through an automated BIM compliance tracking framework using Autodesk Construction Cloud (ACC).

1.2 Research Objectives

This research aims to:

1. Develop and implement a scalable BIM compliance tracking system
2. Evaluate its effectiveness in improving coordination and reducing inefficiencies
3. Identify and address implementation challenges across diverse stakeholder environments
4. Align the system with ISO 19650 standards to ensure repeatability and governance

2 LITERATURE REVIEW

2.1 BIM Compliance in Multi-Contract Environments

The adoption of BIM in multi-contract environments requires consistent compliance monitoring to ensure alignment between contractors and consultants. However, traditional manual tracking methods are prone to delays, miscommunication, and errors. Kassem et al. (2018) highlight the need for automation to reduce these inefficiencies and improve traceability in design coordination workflows.

2.2 Automation in BIM Workflows

Recent advancements in BIM platforms, such as Autodesk Construction Cloud, offer tools for automating issue tracking, data validation, and compliance reporting. Automation has been shown to reduce turnaround times, enhance accountability, and improve data governance (Sacks et al., 2018). However, integration challenges, particularly in large-scale programs, remain underexplored.

2.3 ISO 19650 Standards in Digital Delivery

ISO 19650 provides a framework for information management in BIM processes. Part 2, Section 5.5.2, emphasizes the importance of centralized information delivery and control using a Common Data Environment (CDE). Patacas et al. (2020) note that implementation of these standards requires robust workflow definitions and stakeholder engagement strategies. This study aligns its compliance tracking framework with these standards to ensure consistency and scalability.

2.4 Implementation Challenges in Digital Construction

The implementation of digital solutions in construction faces numerous challenges, particularly regarding user adoption and workflow integration. Oraee et al. (2017) categorize these challenges into technical, organizational, and procedural domains. Technical challenges include interoperability issues and data fragmentation, while organizational challenges involve resistance to change and workflow disruption. Understanding these challenges is critical to developing effective mitigation strategies (Hardin & McCool, 2015).

3 METHODOLOGY

3.1 Case Study Context: The SEVEN Program 4

The SEVEN Program encompasses over 14 packages, each managed by independent design and construction entities. The BIM team operated centrally, tasked with ensuring compliance across all packages. Key challenges included:

- **Inconsistent compliance** across packages
- **Delays in review cycles** due to manual tracking
- **Lack of traceability** in issue management
- **Redundant or unresolved issues**
- **Limited accountability** in closing BIM issues

3.2 Framework Design

The automated compliance tracking framework was developed using Autodesk Construction Cloud (ACC) and included:

1. **Rule-Based Issue Lifecycle Automation:**
 - Automates issue creation, tracking, and closure based on predefined rules
2. **Overdue Issue Tracking:**
 - Categorizes issues by age, priority, and responsible assignee
3. **Mandatory Validation Steps:**
 - Enforces structured responses and closure workflows
4. **Automated Dashboards:**
 - ACC API-generated dashboards provide real-time KPIs
5. **Stakeholder Role Filters:**
 - Custom filters ensure targeted tracking for specific teams or packages

3.3 Implementation Process

The implementation followed a six-phase approach (Figure 1):

1. **Business Requirements:** Cross-functional requirements documentation and solution development
2. **Design:** Function and project processes analysis and refinement
3. **Development:** Software configuration, data import, and testing
4. **Pilot Projects:** Testing on selected projects to address potential issues
5. **Communication & Training:** Training plan development and rollout

6. **Go Live:** Project/function transition to live software with monitoring and lessons learned

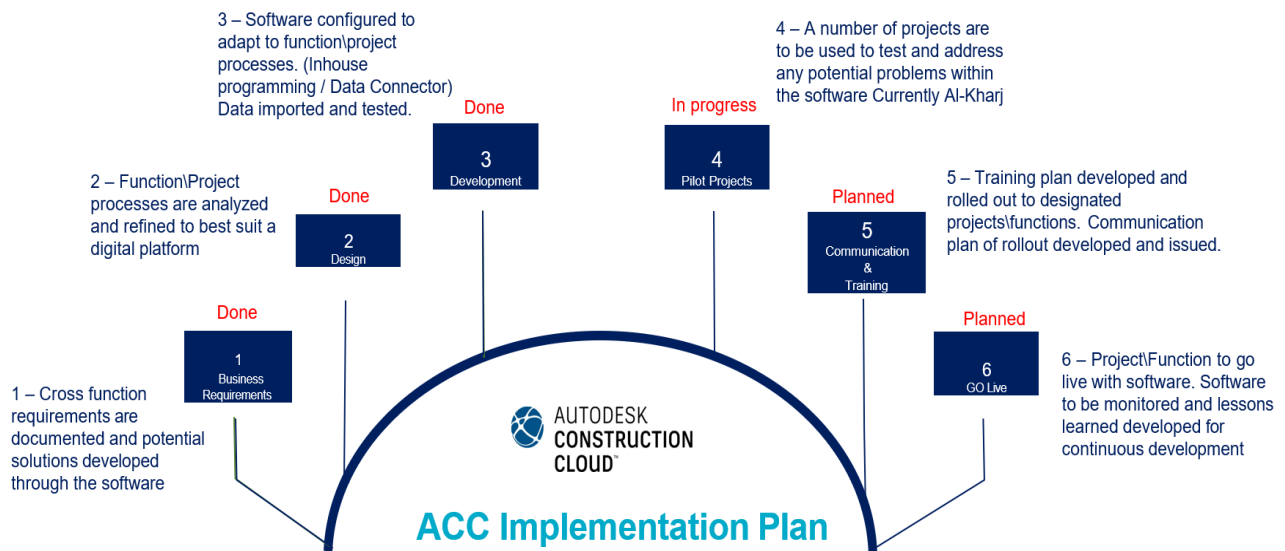


Figure 1: ACC Implementation Plan

3.4 Data Collection

Data was collected through multiple channels:

- System Performance Metrics:** Quantitative data on review cycle times, issue resolution rates, and user engagement
- Stakeholder Feedback Sessions:** Structured feedback from BIM managers, technical teams, project managers, and document controllers
- Implementation Challenges Log:** Documented issues and resolutions throughout the implementation process
- User Adoption Surveys:** Periodic assessments of user experience and adoption challenges

4 IMPLEMENTATION CHALLENGES AND MITIGATION STRATEGIES

During implementation, the project team systematically documented stakeholder concerns and technical challenges. Using a structured feedback process, 28 distinct issues were identified across technical, procedural, and organizational dimensions. These challenges were categorized and addressed through collaborative problem-solving between technical teams, BIM specialists, and project management information systems (PMIS) experts.

4.1 Challenge Categories

The identified challenges fell into five primary categories (Figure 2):

- Technical Infrastructure (21%):** Hardware requirements, system performance, and connectivity issues
- Workflow Integration (32%):** Integration with existing systems, particularly ACONEX
- Document Control (18%):** Permission settings, version control, and documentation processes
- User Adoption (25%):** Training requirements, resistance to change, and usability concerns
- Data Governance (4%):** Data sovereignty, backup systems, and business continuity

■ Workflow Integration
 ■ User Adoption
 ■ Technical Infrastructure
 ■ Document Control
 ■ Data Governance

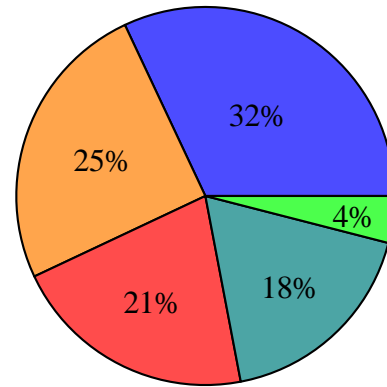


Figure 2: Distribution of Implementation Challenges by Category

4.2 Technical Infrastructure Challenges

Several stakeholders reported concerns about system performance when working with larger BIM models. As one project manager noted: *“Problems opening BIM models is a recurring issue, particularly with limited hardware and connectivity in remote locations.”* Performance testing revealed that while ACC typically required less processing power than traditional

BIM viewing software, combined models over 500MB caused performance degradation on standard workstations.

The technical team addressed this through:

1. Hardware specification updates for key BIM users
2. Implementation of model segmentation strategies for larger projects
3. Offline model access procedures for remote locations with connectivity challenges

4.3 Workflow Integration Challenges

The most significant category of challenges involved integration with existing systems, particularly ACONEX, which served as the program’s document management system. A senior document controller highlighted this concern: *“ACC information is not extracted from ACONEX, therefore there is a risk ACC information that users are reviewing is different to ACONEX information submitted.”*

This challenge directly affected the reliability of the compliance tracking process. The implementation team developed a multi-faceted solution:

1. Development of custom data connectors between ACC and ACONEX
2. Implementation of a “gatekeeper” role within document control to ensure synchronization
3. Standardized workflows that linked ACC design reviews with ACONEX submissions
4. Development of automated tools to extract comments from ACC into standardized formats

4.4 Document Control Challenges

Document controllers expressed concerns about permission management and the potential for unauthorized modifications to submitted documents. A delivery manager stated: *“No PMC/SEVEN DC involvement and controlling step in uploading and replacing files has resulted in incorrect file structuring, and replacement of files without awareness. These issues have caused confusion and delays to the Stage Gate review process.”*

The implementation team addressed these concerns through:

1. Implementation of permission-based read-only states triggered by submission date
2. Development of controlled project folder structures with role-based access
3. Creation of automated workflows that moved files to client/PMC folders with different permission sets
4. Establishment of formal archiving procedures that maintained audit trails

4.5 User Adoption Challenges

Resistance to changing established processes was a significant barrier, particularly from project teams already comfortable with Excel-based tracking systems. One project manager explained: *“Excel comments trackers are easy and straight-forward to use. ACC-extracted comments trackers are not usable unless transferred to Excel.”*

This feedback highlighted the need for both technical solutions and change management strategies:

1. Development of custom export tools that maintained familiar Excel formats
2. Creation of tailored dashboard views that mimicked existing tracking visuals
3. Implementation of incremental adoption approaches, applying ACC only to new milestone submissions
4. Targeted training for skeptical stakeholder groups with hands-on exercises

A delivery manager provided specific resistance points: *“Extraction of comments from ACC to excel, then formatting comments and placing them under the correct discipline is a time consuming task that requires additional effort to complete the Design Stage Gate review on-time.”* This led the technical team to develop automated extraction tools specifically addressing format conversion needs.

4.6 Data Governance Challenges

Some stakeholders expressed concerns about data sovereignty and business continuity. As one IT manager noted: *“Data sitting outside the Kingdom and business discontinuity when systems are down are significant risks.”*

These concerns were addressed through:

1. Clarification of data storage policies and compliance with local regulations
2. Implementation of backup systems with two-hour recovery points
3. Development of offline work procedures for system outage scenarios
4. Clear delineation between temporary processing data (ACC) and permanent record data (ACONEX)

5 ACC IN INTEGRATED DELIVERY PROCESS

While implementation challenges were significant, stakeholders also recognized ACC’s potential value within an Integrated Delivery Process (IDP) framework. As noted by a digital transformation lead: *“ACC can be a valuable tool for improving the efficiency and effectiveness of integrated delivery projects.”*

The potential benefits identified for IDP implementation included:

- **Improved collaboration:** Centralizing information access for all stakeholders
- **Reduced risk of errors:** Version control and tracking functionality
- **Improved decision-making:** Access to up-to-date information
- **Increased transparency:** Central repository for project data

The organization’s long-term vision extended beyond BIM compliance tracking to utilize ACC across the entire project lifecycle, including client engagement, design development, construction, handover, and facility management. This lifecycle approach aligned with the program’s digital transformation goals while recognizing the implementation challenges that needed to be addressed in the near term.

6 RESULTS

6.1 Metrics Post-Implementation

Despite the challenges, the automated framework delivered significant improvements:

- **45% reduction** in design review turnaround times
- **30% reduction** in comment duplication
- **100% traceability** of issue resolution steps
- **Real-time dashboards** enabled PMO oversight
- **Issue backlog reduction:** In Package D3, unresolved issues dropped from 78 to 12 within two review cycles

6.2 Cost and Resource Savings

The reduced reliance on manual tracking and follow-up saved approximately 20% of BIM coordination resource hours, allowing teams to focus on high-value tasks. However, this was partially offset by increased effort in some areas, particularly during the transition period when both Excel and ACC systems were running in parallel.

6.3 User Adoption Outcomes

Despite initial resistance, user adoption steadily increased throughout implementation. Key factors in successful adoption included:

1. Response to stakeholder feedback through system refinements
2. Development of custom tools addressing specific pain points
3. Phased implementation approach that avoided disrupting ongoing work
4. Extensive training and support during transition periods

Figure 3 shows the adoption rate over time, with notable increases following each system enhancement based on stakeholder feedback.

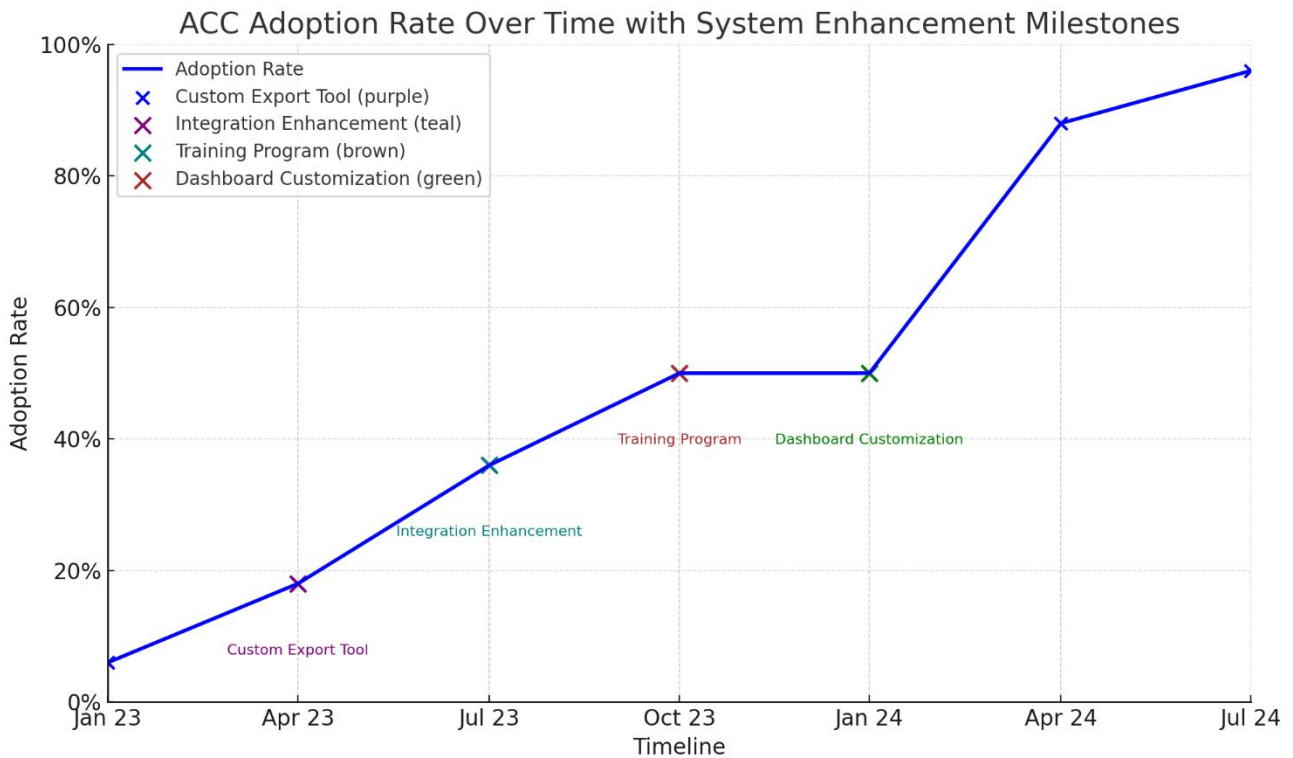


Figure 3: ACC Adoption Rate Over Time with System Enhancement Milestones

6.4 Challenge Resolution Success Rates

Of the 28 documented implementation challenges:

- 68% were fully resolved through technical solutions or procedural adjustments
- 25% were partially mitigated through workarounds or process modifications
- 7% remained as acknowledged limitations requiring ongoing management

The highest resolution rates were achieved in the Technical Infrastructure category (89% fully resolved), while Workflow Integration challenges proved most resistant to complete resolution (52% fully resolved).

7 DISCUSSION

7.1 Benefits of Automation

The automated framework addressed key challenges:

- **Improved Traceability:** The system ensured every issue followed a governed lifecycle with mandatory responses and closure
- **Faster Turnaround:** Automated reminders and overdue tracking reduced delays significantly
- **Enhanced Accountability:** Stakeholder mapping ensured that each issue was assigned and resolved by the correct party

7.2 Critical Success Factors

Analysis of implementation data revealed several critical success factors:

1. **Responsive System Development:** The willingness to develop custom tools addressing specific stakeholder concerns was crucial. As one technical team member noted: *“A tool has been developed to extract comments from ACC to the right excel format,”* demonstrating adaptation to user needs.
2. **Incremental Implementation:** The phased approach allowed stakeholders to maintain productivity while transitioning to new systems. One BIM manager explained: *“There was a clear rollout strategy, which is to implement ACC review process at each next milestone without disrupting the current milestone.”*
3. **Integration Focus:** Rather than replacing existing systems, the implementation focused on complementary integration. This approach reduced resistance, as noted by a BIM team member: *“ACC implementation does not intend to replace ACONEX but rather complement the functionality and remove some of the excel based workflows.”*
4. **Clear Delineation of System Roles:** Establishing clear boundaries between systems (ACC for review, ACONEX for official records) reduced confusion and resistance.

7.3 Persistent Challenges and Limitations

Several challenges persisted throughout implementation:

1. **System Integration Complexity:** Despite custom integration tools, maintaining synchronization between ACC and ACONEX required ongoing effort and occasional manual intervention. A delivery manager noted: *“ACC as collaboration tool, does not follow the principles of DC that ACONEX does. Submissions in ACONEX require receiver to accept the submission, in order to become available to users.”*
2. **Change Resistance:** Some stakeholders continued to prefer traditional Excel-based workflows, requiring additional support and customization. One project manager observed: *“Reports extracted from ACC do not demonstrate quality nor completion of the submission. They are misleading and should not be used.”* This perception persisted despite dashboard customizations.
3. **Variable Hardware Environments:** Performance inconsistencies across different hardware configurations and locations created uneven user experiences.
4. **Process Enforcement:** Ensuring consistent usage across all stakeholder groups remained challenging, with some users attempting to circumvent the structured workflow. A delivery manager noted: *“ACC does not restrict users from continuing adding comments after the completion of the official Stage Gate review period. ‘Sneaking-in’ comments beyond past the review deadline makes it impossible for the PMC to perform their Design Management duties.”*
5. **Authority Issues:** An unexpected challenge emerged regarding comments from departed staff: *“Comments from reviewers who recorded comments in ACC, and since then have left the Project/Organisation, can only be closed-out by ACC admins.”* This revealed a governance gap that required procedural solutions.

7.4 Alignment with ISO 19650

The framework’s alignment with ISO 19650-2 ensured compliance with international standards, particularly in information delivery and control through a Common Data Environment (CDE). The use of mandatory fields, naming conventions, and automated validation steps reinforced governance.

8 CONCLUSION AND FUTURE WORK

This study demonstrates how automation of BIM compliance tracking can significantly improve

coordination efficiency in giga-scale construction programs, while highlighting the implementation challenges that must be addressed for successful adoption. By embedding rules within Autodesk Construction Cloud, the SEVEN Program ensured repeatable enforcement of design review cycles, improving both transparency and speed.

The systematic documentation and resolution of implementation challenges provided valuable insights into the technical, procedural, and organizational barriers that construction programs face when implementing digital compliance tracking. The high proportion of workflow integration challenges (32%) underscores the importance of interoperability and system coordination in digital construction environments.

The study also revealed the tension between aspirational goals for integrated digital delivery and practical implementation realities. While stakeholders recognized ACC's potential for supporting the entire project lifecycle within an Integrated Delivery Process, implementation had to overcome significant workflow and adoption barriers.

The approach is scalable and can serve as a model for future giga developments, provided that implementation teams anticipate and address the categories of challenges identified in this research.

8.1 Future Work

Future research could explore:

- Integrating **machine learning** for predictive issue tracking
- Extending the framework to include sustainability compliance (e.g., LEED certification)
- Developing more robust offline capabilities for remote project locations
- Quantifying the long-term cost benefits of automated compliance tracking
- Investigating the transferability of implementation strategies to other digital construction platforms

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