

THE IMPACT OF LACK OF INFORMATION TRACEABILITY ON CONSTRUCTION PROJECT MANAGEMENT

Alina Ioana EDU-NEAGA¹

¹National University of Science and Technology POLITEHNICA Bucharest, 313 Splaiul Independenței, București, Romania,
ORCID No. 0009-0008-4208-7753, edualina@outlook.com

ABSTRACT: The execution of construction projects depends essentially on the effective management and validation of information across multiple disciplines involved. Despite the increasingly frequent use of digital tools, numerous construction projects continue to face fragmented documentation and limited information traceability, which can negatively affect performance during the execution phase. This paper analyzes the impact of the lack of information traceability on the execution of construction projects, with an emphasis on schedule compliance, cost control, execution quality and decision-making processes. The study is based on a qualitative approach, grounded in professional practice in the construction and installations field, within the context of the Romanian market. The analysis highlights that traceability deficiencies are not merely technical issues, but also organizational and managerial challenges, which lead to reactive execution control and the recurring occurrence of nonconformities. The results contribute to construction management practice by emphasizing the importance of integrated information traceability for improving execution performance in complex projects.

KEYWORDS: information traceability; construction project execution; quality management; documentation control; digitalization in construction; BIM

DOI 10.56082/annalsarscieco.2026.3.73

1. INTRODUCTION

Execution represents one of the most critical phases of construction projects, having a direct impact on schedule compliance, cost control and quality performance.

During this stage a significant volume of information is generated and managed, including technical documentation, design revisions, quality procedures, nonconformities, requests for information, and operational decisions. Ensuring information traceability throughout execution thus becomes an essential factor influencing the overall performance of the project [8].

In the context of construction project management, information traceability refers to the ability to track the relationship between initial requirements, approved technical documentation, execution activities, and verification and control processes.

The lack of coherent traceability frequently leads to difficulties in identifying the correct document versions, delays in decision-making, execution errors and the repeated occurrence of nonconformities [4]. These problems are amplified in complex projects, characterized by the involvement of multiple stakeholders and frequent design and execution changes [5].

On the Romanian construction market, traceability challenges are amplified by fragmented digital practices and reliance on traditional documentation management methods, such as e-mail exchanges, local file storage and non-integrated registers.

This situation affects civil, industrial and infrastructure projects, where the lack of a unified approach to information tracking limits effective execution control.

Practical experience gathered in construction and installation works indicates that the lack of documentation traceability generates chains of errors reflected in execution delays, rework, and difficulties in demonstrating conformity at handover stages. When approved documentation, on-site execution and quality control processes are not clearly correlated, execution management becomes predominantly reactive, based on corrective actions, to the detriment of preventive control.

The purpose of this paper is to analyze the impact of the lack of information traceability on the execution of construction projects, by correlating practical observations with the specialized literature.

The paper highlights the effects of traceability deficiencies on execution duration, costs and quality performance, and discusses the potential role of digital processes in improving execution control within the specific context of the Romanian market.

2. LITERATURE REVIEW – INFORMATION TRACEABILITY AND DIGITALIZATION IN CONSTRUCTION EXECUTION

2.1 Information Traceability in Construction Project Management

The specialized literature identifies information traceability as an essential control mechanism in complex construction projects, particularly during the execution phase [8].

In construction project management, traceability is frequently associated with the ability to monitor information flows between requirements, technical documentation, execution activities and verification processes.

Previous studies indicate that insufficient traceability leads to difficulties in managing changes, loss of control over document versions, and an increase in execution errors, thereby affecting project performance.

The literature on traceability highlights that it is not limited to technical documentation, but also includes information management, decision documentation, quality control processes and communication among the parties involved [9,10,11].

In the absence of effective traceability mechanisms, organizations tend to adopt reactive approaches, focused on correcting errors after they occur, instead of systematic prevention through structured control.

2.2 Traceability within Quality Management Systems

Within quality management systems, traceability is recognized as a fundamental principle for ensuring conformity and demonstrating compliance with specified requirements. Standards such as ISO 9001 emphasize the importance of document control, records management, and alignment between requirements, processes and results [3].

However, the literature highlights a significant gap between the formal requirements of quality standards and their practical implementation during the execution phase of construction projects.

Empirical studies show that quality-related processes are frequently treated as administrative activities separate from execution management. This separation limits their effectiveness and reduces their real contribution to execution control [4].

The lack of traceability between quality documentation, execution activities and on-site inspections hinders the identification of the root causes of nonconformities and often leads to their recurrence throughout the project life cycle.

Professional quality guidelines, such as those published by the American Society for Quality (ASQ), emphasize

that a well-structured traceability program supports the rapid identification of nonconformity sources, facilitates corrective actions, and reduces the organization's exposure to risks associated with the product or the executed work [1].

2.3 The Role of Digitalization in Supporting Traceability

Recent literature identifies digitalization as an essential factor in improving information traceability in construction projects. Digital tools, such as document management systems (DMS), collaborative platforms, BIM-based solutions and digital applications for quality monitoring, offer opportunities for integrating information and establishing coherent data flows throughout execution [6,7].

Research shows that the use of digital tools can reduce information loss, improve version control and increase transparency in decision-making processes. However, several studies emphasize that the mere adoption of digital tools does not automatically lead to improved traceability [2].

In the absence of their integration into existing management and quality processes, digital solutions may remain isolated systems, with limited impact on execution performance.

2.4 Gaps and Limitations in Existing Studies

Although the importance of traceability and digitalization in construction projects is widely recognized, much of the existing literature focuses either on technological aspects or on general theoretical frameworks.

There is limited research that explicitly analyses the impact of the lack of traceability on the execution performance of construction projects, particularly within specific market contexts.

In the case of the Romanian construction industry, studies addressing the integrated relationship between traceability, quality management and digital processes during the execution phase are scarce.

This gap justifies the need for applied research, based on real project environments, that identifies the practical implications of traceability deficiencies and the potential of digital processes to support execution management [8].

3. PRACTICAL CONTEXT AND RESEARCH APPROACH

This study is set within the context of complex construction projects, characterized by the involvement of multiple stakeholders, a high volume of technical documentation, and frequent changes throughout execution. The analyzed context includes

civil, industrial and installation projects within the Romanian construction market.

In such projects, the execution phase requires the simultaneous coordination of multiple disciplines, and mechanical installations, and specialized construction activities.

Each discipline generates specific documentation and requires continuous approval, verification and update processes.

Under these conditions, information traceability becomes a critical element for maintaining coherence between approved documentation, execution activities and quality control processes.

3.1 Characteristics of the Operational Environment

In current practice, documentation management and quality-related processes in the analyzed projects are largely supported by fragmented tools, such as document exchanges via e-mail, local file storage and non-integrated registers.

Although dedicated digital tools, such as document management platforms or digital reporting applications, are sometimes used, they are implemented partially and without clear integration into execution management workflows.

This fragmented approach generates difficulties in tracking document versions, a weak alignment between approved changes and on-site execution, and delays in transmitting information to relevant parties. These challenges are particularly visible in installation works, where frequent design changes and strong interdependencies between disciplines significantly increase the risk of carrying out work based on outdated or inconsistent information.

3.2 Traceability within Execution and Quality Processes

Quality assurance processes in the analyzed projects are generally structured in accordance with the formal requirements of quality management systems, including quality procedures, inspection and testing plans, nonconformity reports and handover documentation. However, in practice, the traceability between these quality records and the actual execution activities is often incomplete.

The lack of a clear correlation between quality requirements, approved technical documentation and on-site execution hinders the rapid identification of the root causes of nonconformities and the demonstration of conformity at handover stages [3,4].

Consequently, quality control frequently becomes a retrospective activity, focused on corrective actions,

rather than representing an integrated and preventive component of execution management.

Document management systems, nonconformity reporting applications and BIM-based solutions are often used in isolation, without being connected within a coherent information flow.

This lack of integration reduces the capacity of digital tools to provide a reliable and up-to-date picture of the execution status and quality conformity [2].

In the absence of clearly defined processes, digitalization risks remaining an administrative support function, rather than becoming a real mechanism supporting execution management decisions.

3.3 Research Approach

The paper adopts a qualitative approach, based on professional practice accumulated in construction and installation projects.

The analysis is grounded in the systematic observation of recurring execution problems related to information management, documentation control and quality processes across different project types.

Rather than relying on quantitative data sets, the study seeks to identify patterns, cause-effect relationships and practical implications associated with the lack of information traceability.

This approach is suitable for exploring complex managerial and organizational phenomena, which are difficult to capture through exclusively quantitative methods, particularly in real project environments characterized by uncertainty and frequent change.

4. IMPACT OF THE LACK OF INFORMATION TRACEABILITY ON CONSTRUCTION EXECUTION

4.1 Impact on Execution Duration

The lack of information traceability during the execution phase has a direct impact on the work schedule.

When technical documentation is not managed within a coherent and transparent system, delays frequently occur due to difficulties in identifying the approved document versions, the need to reconfirm information, and the repetition of decision-making processes.

In practice, these situations lead to interruptions in on-site activities, waiting periods for clarifications, and disruptions to the workflow.

In installation projects, where changes are frequent and interdependencies between disciplines are significant, the lack of traceability generates cumulative delays. Seemingly minor activities, such as clarifying a technical solution or approving a design revision, can produce significant effects on the

execution schedule when information is not easily accessible or correlated with execution activities.

4.2 Impact on Project Costs

Traceability deficiencies directly influence project costs through an increase in the volume of rework, additional material consumption, and extended labor effort required to correct execution errors. Carrying out work based on incomplete or outdated information frequently leads to nonconforming activities that require subsequent corrective interventions.

When approved documentation, managerial decisions and executed works are not clearly correlated, the costs associated with nonconformities become difficult to estimate and control. In addition, the lack of traceability complicates the allocation of responsibilities and the justification of costs, increasing the likelihood of contractual disputes and tensions among the parties involved [4].

4.3 Impact on Execution Quality

Execution quality is strongly influenced by the ability to maintain traceability between project requirements, quality procedures and on-site activities [3].

When these links are incomplete or absent, quality control becomes predominantly reactive, focusing on identifying nonconformities after they occur, rather than preventing them through systematic control.

In the analyzed projects, the lack of traceability leads to difficulties in demonstrating conformity at handover stages and contributes to the recurrence of similar errors throughout execution.

In installation works, where quality requirements are particularly strict, such deficiencies can affect not only formal conformity but also the long-term performance and reliability of the completed constructions.

4.4 Impact on the Decision-Making Process and Coordination

Another significant effect of the lack of traceability is its negative influence on decision-making processes during execution.

Project managers and quality officers are often forced to make decisions based on incomplete or difficult-to-verify information, increasing the risk of errors and suboptimal solutions.

The absence of a clear and reliable picture of the execution status and quality conformity also hinders

coordination between disciplines and among the parties involved in the project.

Without integrated digital tools to support traceability, communication frequently relies on informal channels, which increases the risk of misinterpretation and loss of critical information [8].

4.5 The Potential Role of Digitalization in Reducing the Negative Impact

The analysis of current practice indicates that digital tools can play an essential role in reducing the negative impact associated with the lack of information traceability, provided they are integrated within a clear execution management framework. Document management systems, collaborative platforms and digital applications for quality reporting can support the systematic correlation between requirements, documentation and execution activities, increasing transparency and control.

However, the effectiveness of digitalization depends on the alignment between technological solutions and organizational processes, as well as on the active involvement of stakeholders.

In the absence of this alignment, digital tools risk remaining administrative support systems, with limited influence on execution performance and decision-making processes [2].

5. CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

This paper analyzed the impact of the lack of information traceability on the execution of construction projects, based on practical insights from construction and installation projects carried out on the Romanian market.

The analysis demonstrates that traceability deficiencies represent a critical factor influencing execution performance, with direct effects on schedule compliance, cost control, execution quality and decision-making processes.

The results indicate that the effects of the lack of traceability go beyond the technical or administrative dimension and reflect deeper organizational and managerial challenges.

Fragmented information management, the use of non-integrated tools, and the lack of alignment between approved documentation, on-site execution and quality control processes contribute to a predominantly reactive approach to execution

management, oriented toward corrective actions to the detriment of preventive control.

The study also highlights the potential role of digitalization in supporting information traceability and improving execution control.

Digital tools can enable more structured information flows, improved document version control, and increased transparency among the parties involved. However, the results confirm that digitalization alone does not guarantee improved performance unless it is effectively integrated into execution and quality management processes.

Within the context of the Romanian construction industry, the conclusions emphasize the need for an integrated approach that aligns execution management, quality processes and digital tools. Such an approach can contribute to reducing execution errors, improving operational efficiency, and strengthening quality assurance, particularly in complex projects within the installations and infrastructure sectors.

Future research may focus on developing and validating integrated execution management frameworks that explicitly include traceability mechanisms supported by digital processes. Additionally, comparative studies between projects with different levels of digital maturity could provide further insights into the relationship between traceability, digitalization and execution performance across diverse organizational contexts. (Table 1,2 and 3)

Table 1. Comparative table: ISO 9001:2015 vs support provided by current digital tools in construction execution

ISO 9001:2015	What the Requirement Entails	Support Provided by Current Digital Tools
Control of Documents	<i>Maintaining correct, approved and accessible document versions</i>	<i>DMS and BIM platforms offer version control, but effectiveness depends on their integration into the execution workflow</i>
Retention records	<i>Documented evidence of conformity, traceable over time</i>	<i>BIM-based solutions can connect the model to execution, but partial adoption limits full traceability</i>

Control of nonconformities	<i>Identification, documentation and corrective action</i>	<i>Digital reporting application facilitate recording, but root-cause analysis remains frequently manual</i>
Decision making and coordination	<i>Incomplete or difficult to verify information, informal communication</i>	<i>Suboptimal decisions, risk of misinterpretation</i>

Source of requirements: ISO 9001:2015 [3] (Section 2.2); correlation with digital practice: author’s synthesis based on the literature cited in Section 2.3 [6,7]

Table 2. Information traceability chain in construction project execution

Initial requirements	→	Approved technical documentation	→	On site execution	→	Quality Control Verification
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Note: *A break in traceability at any of these links shifts execution management from structured, preventive control toward reactive control based on subsequent corrective actions*

Table 3. Reactive versus Preventive Execution Control

Reactive control (dominant pattern)	Preventive Control (recommended)
Execution proceeds on unverified information	Requirements ↔ Documentation ↔ Execution – continuously correlated
Nonconformity is discovered on site	Verification occurs before and during execution
Corrective action is taken after the fact	Deviations are caught before they affect execution
Error recurs on similar activities	Root cause is addressed, preventing recurrence

Note: *author’s conceptual synthesis, based on the reactive/preventive contrast discussed throughout Sections 1, 2.2, 3.2 and 4.3*

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