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ENHANCING REQUEST FOR INFORMATION (RFI) PROCESS IN CONSTRUCTION THROUGH DIGITALIZATION AND AUTOMATION

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ABSTRACT: The Request for Information (RFI) process is a fundamental component of construction project management, enabling the resolution of ambiguities, clarification of contract obligations, and coordination among stakeholders. Despite its critical role, the RFI process remains fragmented, inefficient, and prone to delays due to decentralized documentation, inconsistent workflows, and a lack of standardized procedures. These inefficiencies contribute to project delays, cost overruns, and increased risks of disputes. This study examines the limitations of the existing RFI process and explores how digitalization and automation can enhance efficiency, accuracy, and transparency. By reviewing ontological models and analyzing reported process deviations, this research identifies common bottlenecks and their root causes. The study investigates the potential of digital transformation tools – including Natural Language Processing (NLP), process mining, and AI-driven decision support systems – to automate and optimize RFI workflows. These technologies offer solutions for structured data management, real-time tracking, and predictive analytics to streamline RFI submission, review, and response processes. Additionally, a SWOT analysis framework evaluates the strengths, weaknesses, opportunities, and threats associated with AI integration in RFI management, providing a structured approach for industry adoption. The findings highlight the need for a balanced implementation of AI and human oversight to mitigate risks while maximizing efficiency gains. This study contributes to the ongoing discourse on digital transformation in construction by proposing a roadmap for RFI process improvement, emphasizing the role of automation in reducing inefficiencies and enhancing project communication.

1. INTRODUCTION AND BACKGROUND

The Request for Information (RFI) process is a critical component of construction project management, facilitating the resolution of design ambiguities, clarifying contractual obligations, and ensuring smooth project execution. RFIs serve as a formal mechanism to request clarification, seek new details, and address construction document and workflow discrepancies. The RFI process is intertwined with several administrative processes, including change management, claims, and litigation, making its efficiency and accuracy crucial to project success.

At the highest level, the RFI process is structured into four key stages, i.e., (i) *Initiation*; (ii) *Verification*; (iii) *Response*; and (iv) *Clarification & Closeout.* Through an extensive literature review on RFI process, a high-level relationships among these statges and key roles controlling them have been illustrated in Figure 1. The 'Initiator' typically starts the process by filing a request for information. However, RFI process acts in a cyclic than linear manner, which ends with the Initiator receiving the clarified response from the

‘Consolidator’ and can lead to new RFIs being initiated if further clarifications or follow-up requests are needed. Between the two, there are the ‘Coordinator’, and ‘Responder’, as will be explained later in section 2.2. This continuous cycle ensures an iterative flow of information, improving communication and decision-making efficienc

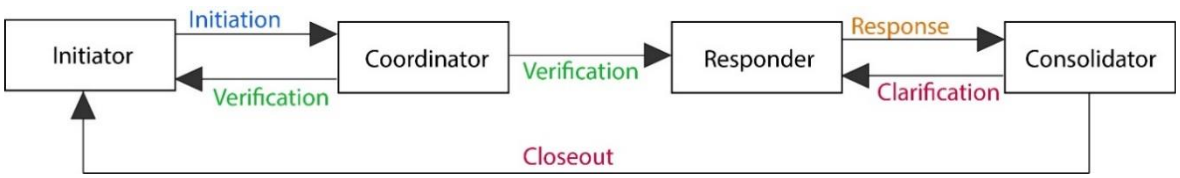

Figure 1: Conceptualization of the RFI process along with key stages and controlling roles

Despite its significance, the RFI process in construction remains fragmented, inefficient, and prone to delays. The lack of a standardized framework results in decentralized documentation, prolonged response times, and disputes that escalate into costly claims. The inefficiencies in RFIs stem from poor document management, unclear contract specifications, and communication bottlenecks among stakeholders. These issues contribute to project delays, cost overruns, and compromised decision-making.

This paper aims to analyze the limitations of the current RFI process and explore the role of digitalization and automation in addressing these shortcomings. The study reviews existing models, identifies process bottlenecks, and examines innovative technologies such as natural language processing (NLP), process mining, and artificial intelligence (AI)-driven solutions to optimize RFIs. A SWOT analysis framework is introduced to evaluate the opportunities and challenges associated with automating the RFI process, ultimately proposing a roadmap for its improvement in the construction industry.

2. MODELING RFI IN CONSTRUCTION – PREVIOUS WORKS

Ontological models have been widely used in construction informatics to formalize domain knowledge, enabling structured data representation, interoperability, and process automation. An ontological model for the RFI process aims to define the fundamental concepts, relationships, and workflows involved, ensuring better integration with digital tools and project management systems. The purpose of ontological models is to cover the most fundamental and core concepts of a domain (El-Gohary & El-Diraby, 2010a) as well as to fill the void of having a formally developed process and to be modified and extended for local processes (El-Gohary & El-Diraby, 2010b). One notable ontological model of RFI is developed by (Golzarpoor, 2017) through utilizing the Industry Foundation Process (IFP) which is illustrated in Figure 2. IFP is a process modelling system which integrates the core process from best known practices into a workflow management system for better transparency and interoperability. Figure 2 depicts the developed high level RFI process with a total of 18 steps where the blue highlighted steps indicate the core subprocesses in the RFI process (Golzarpoor, 2017). The process starts with initiating the RFI by the initiator. After verifying for accuracy and completeness, the coordinator assigns specific participants. If any clarification is required the RFI is sent back to the initiator for clarification, otherwise the RFI is forwarded to the responder for receiving the required response. After approval by the Consolidator the response is issued back to the initiator. Finally, all stakeholders are informed and the RFI process concludes with the acknowledgement from the initiator (Golzarpoor, 2017).

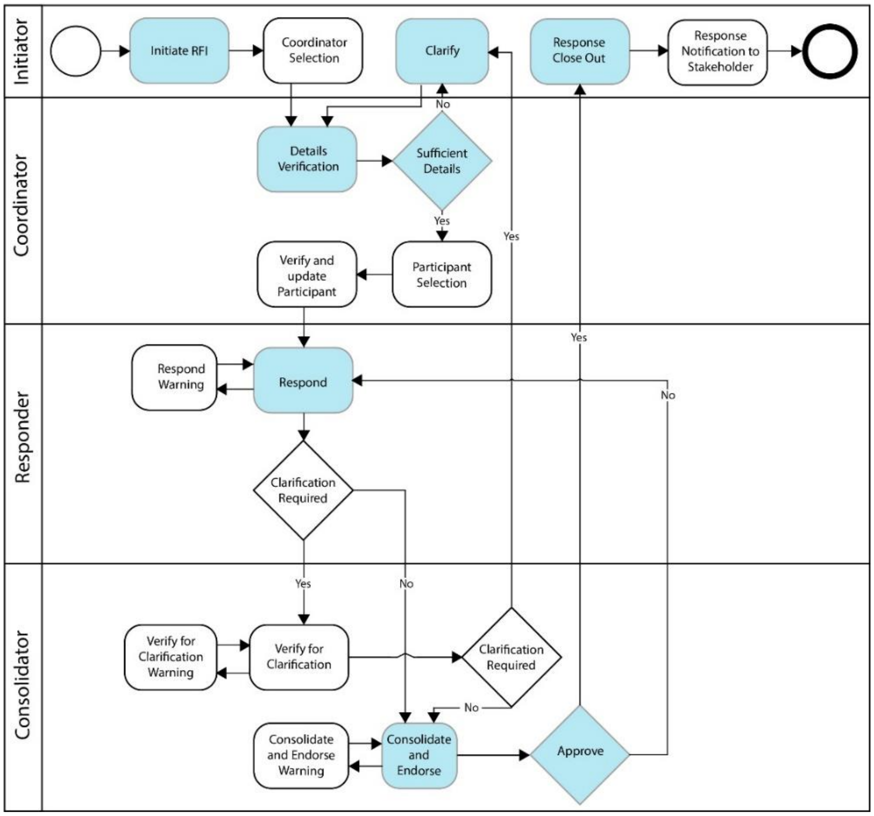

Figure 2: High level RFI process – adapted from (Golzarpoor, 2017)

In addition to defining the sequence of steps, this model identifies four primary roles within the RFI lifecycle, i.e., *Initiator, Coordinator, Responder,* and *Consolidator*. Processes and subprocesses are composed of a set of stages that combine the overall process life cycle (El-Gohary & El-Diraby, 2010a). While ontological models (such as the IFP – Figure 2) aim to showcase the best practice (or an 'as planned' process); in action, deviations happen from such ideal models.

2.1. As-Planned vs As-happened RFI

An "as-planned" process illustrates the expected workflow of a specific process whereas the "as-is" or "as happened" reflects all changes that occur while/after the real-life implementation (Becker, Kugeler, & Rosemann, 2003). Although the "as planned" RFI process is meant to have all the core subprocess and elements and is designed in a structured format for efficient and secure flow of information among various actors; the implementation usually deviates from the plan. RFI process can often deviate due to time constraints, project complexities, communication efficiencies, and stakeholders' preferences (Aibinu, Carter, Francis, & Vaz-Serra, 2019). Different RFI process structures have been identified in the previous literature which highly deviates from on another depending on the specific needs of the project. For instance, Afzal, Wong, and Ahmadian Fard Fini (2024) illustrated RFI being initiated and responded via two specific roles, referred to as 'Requester' and 'Responder'. Mohamed, Tilley, and Tucker (1999) depicted the RFI process being held by several stakeholders including 'site clerk' and 'contract administrator' for better quality control of the process. In a different study, Chin and Russell (2008) presented an improved electronic RFI model depicting a linear flow of information within all the stakeholders, whereas the RFIs are queued and reviewed in parallel; which is in contrast with other works such as (Papajohn, Alleman, Asmar, and Molenaar (2018) which depicted RFIs being reviewed independently. Leung, Chan, and Issa (2003) presented a circular web-based RFI process whereas instead of being a linear relationship among the actors in the RFIs, they contribute to a centralized web systems which enables concurrent response from the responding parties. Apart from these, large number of construction managers still depend on informal communication with their project counterparts which leads to undocumented decisions and miscommunications (Shohet & Frydman, 2003). These discrepancies between the *as-planned* and *as-happened* processes can lead to inefficiencies, risks in decision making, and challenges in effectively tracking project changes.

2.2. Roles and Actors in the RFI Process

Details of the RFI process (both as-planned and as-happened) may differ based on the project specifications (such as the delivery method, governance, project requirements, etc.) One common difference in different project is the stakeholder(s) responsible for taking different roles in the process. Since this paper focuses on the opportunities (and shortcomings) of the technology to support different stakeholders in the RFI process; it would be beneficial to distinguish between the "roles" and "actors" in different project scenarios. Through an extensive analysis of the literature consisting of 57 articles including (Afzal et al., 2024; Alves, Pestana, Gilbert, & Hamzeh, 2016; Chin & Russell, 2008; Leung et al., 2003; Mohamed et al., 1999)(details of which are published elsewhere), we created an actor-role mapping, illustrated in form of a Sankey diagram in Figure 3 relation within the individual roles in the RFI process.

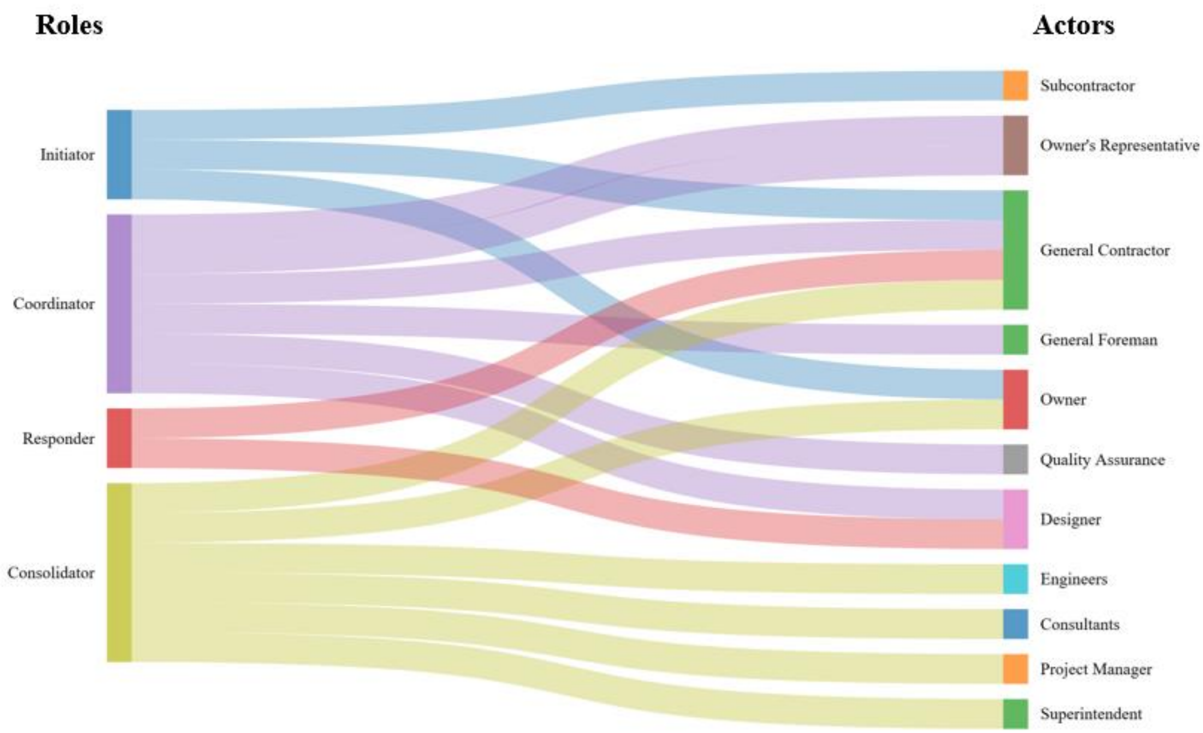

Figure 3: Different Roles and actors (from the project stakeholders) playing those roles in the RFI process

The '*Initiator*' is responsible for generating RFIs, typically when some clarification regarding project specifications, documentation inconsistencies, etc. is required. While in typical construction projects, subcontractors are the ones playing this role; in some circumstances, owners or the general contractor (GC) may also request clarifications, e.g. to ensure the project's alignment with its strategic goals (Leung et al., 2003). Several stakeholders can presume the role of '*Coordinator*' depending on the requirement of the project. In some instances, owner's representatives or a third-party quality assurance agent is responsible for playing the role of coordinator to ensure seamless transition of RFIs from the initiator to responder (Alves et al., 2016), (Mohamed et al., 1999). The '*Responder*' is in the possession of the requested information and/or has the authority to make the clarifications necessary. Although typically designers are to be the responding party, sometimes this role is bestowed to the GC (Afzal et al., 2024). This process ensures the mitigation of RFI abuse and facilitates the resolution process. Afterwards, the responder is responsible for addressing RFIs by providing accurate information and ensuring clarification of the query. Finally, the '*Consolidator*' ensures that RFI responses are properly documented, reviewed, and integrated into project workflows. Typically, engineers or the consultant are stakeholders who take this role and verify the provided response against the project requirements (Alves et al., 2016).

As seen in this analysis, while it is not uncommon for different stakeholders to take various roles in the RFI process, depending on the project specifications, the GC is identified in all four types of the key roles. Therefore, the focus of our study has been on how to support the GC (and other forms of contractors) through the technology adoption, to better manage the RFI process.

3. CHALLENGES OF THE RFI PROCESS

Several factors contribute to inefficiencies of the RFI process that stem from inefficiencies in document management and workflow structures, which impact project efficiency, cost, and schedule. In this section, after a brief review on such factors and the underlying causes, we briefly address some possible technologies that can help bridge the gap towards an effective and efficient RFI process.

3.1. The key challenges and their root causes

One of the primary causes of these limitations is poor documentation, where errors, omissions, and conflicting design details necessitate frequent RFIs, leading to rework and project delays (Fokwa Soh, Barbeau, Doré, & Forgues, 2020; Philips-Ryder, Zuo, & Jin, 2013). Past research has shown that documentation errors can account for up to 22% of rework costs in construction projects (Philips-Ryder et al., 2013). Additionally, contract documents' ambiguity and unclear specifications lead to frequent requests for clarification, further burdening the RFI process (Chan, Nik-Bakht, & Han, 2021; Fokwa Soh et al., 2020). The issue is exacerbated by fragmentation and poor coordination between project stakeholders, which results in repeated RFIs addressing the same issue due to a lack of streamlined communication (Bhat, 2017; Fokwa Soh et al., 2020). Another issue identified is the ineffective information dissemination, where critical documents fail to reach the right stakeholders at the right time, leading to miscommunication, rework, and project delays (Antony Chettupuzha & Haas, 2016). The same study highlights that poorly structured document management systems contribute significantly to these inefficiencies, as traditional EDMS (Electronic Document Management Systems) fail to provide contextual information about documents within a workflow. Similarly, the study by (Yilmaz & Ergen, 2024) highlights the unstructured nature of RFI documents; the lack of structured data makes it difficult for project managers to extract meaningful insights, leading to delays in identifying and resolving project issues. Additionally, the study by (Antony Chettupuzha & Haas, 2016) emphasizes that incorrect document versions being referenced can lead to significant disruptions, particularly in the construction phase, where an outdated drawing or specification can result in costly delays and rework (Antony Chettupuzha & Haas, 2016). This challenge is compounded by the lack of real-time tracking mechanisms, which makes it difficult to ensure that all project participants are working with the most updated information.

Another major shortcoming is the excessive volume of RFIs, which can slow down decision-making and overwhelm design professionals, increasing administrative inefficiencies. Some studies suggest that contractors sometimes misuse RFIs for claims preparation, artificially inflating the number of RFIs to create documentation for potential disputes (Hughes, Wells, Nutter, & Zack, 2013). Furthermore, long response times to RFIs significantly hinder project progress, with studies estimating that project schedules can be delayed by 10% or more due to slow RFI resolution (Aibinu, Carter, Francis, & Vaz-Serra, 2020; Sandoval, Bernardo, Dionisio, & Aquino, 2023). The reliance on manual RFI management further aggravates these issues, as traditional RFI processes require extensive human intervention, leading to increased processing time and human errors (Alves et al., 2016; Bhat, 2017; Nistala, Rajbhoj, Kulkarni, Noronha, & Joshi, 2024; Yilmaz & Ergen, 2024). Therefore, the absence of standardized formats and knowledge validation processes further exacerbates the problem, leading to redundant work and discrepancies. Another limitation is the inconsistencies in terminology – such as variations in naming conventions and abbreviations – which further complicate RFI classification and retrieval (Yilmaz & Ergen, 2024). Moreover, large and complex projects, in particular, experience longer RFI turnaround times compared to smaller projects (Aibinu et al., 2020; Nistala et al., 2024). One major issue is the dependency on subject matter experts (SMEs) to answer RFIs, which creates bottlenecks when dealing with high volumes of requests. The lack of a centralized knowledge repository results in information being scattered across multiple documents, making it difficult to retrieve accurate and up-to-date responses efficiently (Nistala et al., 2024). Finally, the inadequate stakeholder engagement in the design phase contributes to the problem, as contractors often identify issues too late in the process, resulting in a flood of RFIs during construction (Fokwa Soh et al., 2020).

3.2. Tools to mitigate process-related RFI problems

To address these limitations, various mitigation strategies have been proposed in the literature. One widely recognized approach is the implementation of BIM (Building Information Modeling), which helps reduce RFIs (count and impact) by improving design accuracy, ensuring better coordination, and facilitating early issue detection (Alves et al., 2016; Fokwa Soh et al., 2020; Sandoval et al., 2023). Furthermore, object-oriented System Information Models (SIMs) have been suggested to enhance the EDMS by introducing document clarity, particularly in engineering-intensive projects, and hence reducing RFIs related to redundant or contradictory information (Love, Zhou, Sing, & Kim, 2014). Additionally, other Information and Communication Technologies (ICTs), including cloud-based platforms such as Procore ("PROCORE,") and Aconex ("Aconex Construction Management from Oracle,"), have been used to enhance RFI tracking, facilitate real-time collaboration, and shorten response times (Bhat, 2017; Sandoval et al., 2023).

Further advancements in automation have introduced Natural Language Processing (NLP) and text mining techniques, which enable the automated classification and analysis of RFIs, reducing manual processing time and allowing project teams to proactively identify recurring issues (Aibinu et al., 2020; Bhat, 2017). Machine learning and AI-based recommender systems have also been explored to predict RFI occurrences based on historical data, providing project managers with early warnings and suggested solutions (Aibinu et al., 2020; Antony Chettupuzha & Haas, 2016; Nistala et al., 2024; Sandoval et al., 2023; Yilmaz & Ergen, 2024). Additionally, lean construction principles have been adopted to improve document quality and eliminate unnecessary RFIs by fostering better communication between project teams and streamlining document management (Alves et al., 2016). The adoption of web-based document management systems (Philips-Ryder et al., 2013), the metadata-based document classification, and EPPM (Enterprise Project Portfolio Management) systems (Antony Chettupuzha & Haas, 2016; Yilmaz & Ergen, 2024) can help subcontractors and other stakeholders manage RFIs more efficiently by ensuring accurate, real-time access to construction documentation and assigning criticality scores to documents, ensuring that high-priority information receives immediate attention.

Besides an efficient management of the information and documents, other innovative strategies are addressed in the literature to support the RFI challenges. Blockchain-based record-keeping systems are suggested to improve transparency and trust in the RFI process by ensuring all queries and responses are immutably stored and traceable, thereby reducing disputes (Torkanfar, Rezazadeh Azar, & McCabe, 2023) . Additionally, benchmarking and alert systems have been proposed to proactively monitor RFIs, allowing project teams to track response times and flag excessive or redundant requests (Hughes et al., 2013). Process improvement initiatives, such as standardizing RFI submission protocols, integrating AI-driven decision-support systems, and utilizing data-driven dashboards for RFI analytics, have also been suggested to further optimize the process (Bhat, 2017; Hanna, Tadt, & Whited, 2012). These strategies, when implemented effectively, can significantly reduce RFI volume, improve response efficiency, and enhance overall project performance. Finally, (Yilmaz & Ergen, 2024) propose the use of advanced text clustering and visualization techniques to improve RFI analysis. The study evaluates different clustering methods, including Latent Dirichlet Allocation (LDA), Non-negative Matrix Factorization (NMF), and K-means, to determine the most effective technique for categorizing RFI topics. The findings indicate that LDA provides the most accurate clustering results, allowing project managers to extract hidden patterns and identify common sources of RFIs. These techniques collectively enhance RFI processing, ensuring more effective decision-making and reducing project delays.

In the following, we take a deeper focus on these technologies, and study them under two streams of ‘digitalization’ and ‘process automation’. By looking at the best practices and state-of-the-art technologies in other industries (who outperform the construction industry in terms of managing administrative processes) we will then identify the strengths/opportunities as well as the weaknesses/threats of these technologies, when introduced into the RFI process in construction.

4. DIGITAL TRANSFORMATION AS A KEY SOLUTION TO RFI CHALLENGES

Digital transformation in terms of digitization of data collection; digitalization through data analytics; and consequently, automation and decision support (Nik-Bakht & Zayed, 2023) is perceived to be a solution to several inefficiencies, misalignments, and productivity losses in the construction industry. In order to develop a clearer understanding of the opportunities set forward by these technologies, as well as to realize some of their limitations, in this section we look at the adoption of these technologies in some other domains, including healthcare and financial services, as well as within the construction industry to support processes other than RFI. Administrative processes in various domains, such as healthcare, finance, and public administration, are being considered, and the key technologies contributing to resolve issues such as inefficiencies, high manual workloads, and repetitive tasks in those domains will be reviewed. The emphasis here is on recent advancements in artificial intelligence (AI), data science, and process automation to streamline/optimize workflows, support decision-making, and enhance process efficiency.

4.1. Digitalization: from data to knowledge

A prerequisite to taking advantage of AI is collecting and structuring data in a digital format. Adding enough context to the data, to elevate it into information, and eventually analyzing data over time to extract the knowledge are the next steps. RFI process typically involves unstructured data in the form of text, drawings, and/or digital models. Through effective dataset processing, traditional unstructured documents can be converted into formats that are easier to analyze and share. A metadata-based collaboration enhances teamwork and information sharing by structuring, managing and interlinking resources through metadata. These systems have been developed to extract information from web documents, recognizing it into a unified web page to streamline data exchange and enable quick and efficient information retrieval (Leung et al., 2003). This method not only improves the accessibility and accuracy of the information but also reduces the time and cost for project teams in information retrieval and integration. Data understanding is essential before extracting any analytics. Besides visualization and explanatory data analysis (EDA), methods such as frequency analysis and correlation testing were used in the literature for analyzing large RFO datasets. A good example includes collected public project data from various US state transportation departments (DOT), including 6,230 pre-bid RFI data from 612 projects. Next, data preparation (cleaning and labelling) will be necessary. For text data, this takes the general steps of removing special characters, stop-word filtering, and stemming, in order to use it for training and predicting machine learning models, as done by the past studies, on large RFI datasets (Panahi, Kivlin, & Louis, 2023; Zhu, Mao, & Ahmad, 2007)

Besides the structured data, certain methods are proposed in the literature to handle unstructured RFI data. Example includes the view-based approach by (Mao, Zhu, & Ahmad, 2007) to process unstructured content in construction documents through metadata models. Natural language processing (NLP) technology is also used in pre-processing, e.g., to classify pre-bid RFI datasets and identify high-impact RFIs that may have a significant impact on bid documents (Afzal, Wong, & Fini, 2023). In addition, a study by Zhu et al. (2007) used text mining and visualization technology to analyze RFI document datasets and revealed common problem topics in construction projects.

In several application domains, the information fusion integrates data from multiple heterogeneous sources to provide comprehensive insights and improve administrative workflows. In healthcare, e.g., AI-driven information fusion has optimized electronic health records management by merging patient history, laboratory results, and clinical notes into a unified framework, enabling better resource allocation and reducing administrative burden (Mohsen, Ali, El Hajj, & Shah, 2022). In the financial sector, multi-source data fusion has been instrumental in credit risk assessment, combining transactional history, social media activity, and demographic data to improve loan approval processes and reduce manual interventions (Alamsyah, Hafidh, & Mulya, 2025).

Knowledge representation techniques, including ontology engineering and knowledge graphs, enable the structuring and retrieval of domain-specific knowledge in administrative processes. In healthcare administration, knowledge graphs have been used to model regulatory compliance and automate decision-making in patient data processing, reducing manual verification efforts and improving efficiency (Murali, Gopakumar, Viswanathan, & Nedungadi, 2023). In financial services, ontologies have facilitated fraud detection by linking transaction patterns with historical fraud cases, enhancing regulatory compliance checks and accelerating decision-making processes (Abrouk, Chergui, & Ahaggach, 2023).

4.2. Text Mining and NLP for automated content analysis

Text mining and NLP technologies have significantly improved administrative efficiency by automating document processing, sentiment analysis, and customer interaction (among other applications). In healthcare, NLP-driven systems extract structured data from unstructured clinical notes, streamlining patient records management and reducing administrative workload (Gautam, 2024). In legal and financial services, NLP-powered contract analysis tools automate document review and compliance checking, reducing manual processing time by up to 70% (L. Martin, Whitehouse, Yiu, Catterson, & Perera, 2024). Additionally, chatbots powered by NLP have been deployed in customer service, handling inquiries related to insurance claims, tax filings, and loan applications, minimizing human interventions while maintaining high service quality (Singh, 2021). The construction domain has also found several applications for NLP in context analysis. These technologies help extract valuable information from large amounts of unstructured text data to help project teams better understand and manage the complex issues in projects.

For example, Panahi et al. (2023) proposed a framework combining NLP and generative AI to extract text and symbol information from drawings. In that study, generative AI was used to summarize the results and provide support for design review. This method helps reduce the number of RFIs in construction projects and lower the likelihood of change orders and rework (Panahi et al., 2023). Another study used NLP technology to preprocess and transform pre-bid RFIs and then applied machine learning classifiers to automatically identify high-impact RFIs. This method helps identify key issues in bid documents in advance, thereby improving the quality of bid documents and reducing changes and disputes in the construction phase (Afzal et al., 2023). In another study, Zhu et al. (2007) adopted text mining and topic modeling through Latent Dirichlet Allocation (LDA) on RFI documents, to reveal common shortcomings leading to RFIs in construction projects (Zhu et al., 2007).

4.3. Process Mining to automate process discovery, analysis, and improvement

Dataset processing and text mining play a crucial role in improving the efficiency of understanding RFI content. Turning unstructured documents into structured formats then allows better data analysis and retrieval. Furthermore, machine learning techniques can be applied over such structure datasets to predict RFI trends and optimize procurement options. When it comes to the analysis of RFI ‘process’, however, these methods cannot be as effective. Understanding the issues, shortcomings, and inefficiencies in as-happened end-to-end RFI processes requires adopting a particular branch of data science, called ‘process mining’, and a specific data format, referred to as ‘event logs.

Process mining techniques extract knowledge from event logs to analyze and improve workflow efficiency. While the applications of process mining in construction have been limited (Martinez Lagunas & Nik-Bakht, 2024) it has found broad applications in business processes management within several other domains. In the coating and paint sector, among several other industries, process mining has been used to optimize the ‘purchase-to-pay’ process, identifying bottlenecks and enhancing cost effectiveness and efficiency (Bahaweres, Amna, & Nurnaningsih, 2022). In the insurance industry, process mining has facilitated the automation of insurance claim processing, improved compliance monitoring and reducing approval times (Smith, 2025). These techniques have also improved university administration by identifying inefficiencies in student enrollment and grading processes, leading to automated interventions and better service delivery (Loder, 2024).

In the AEC (Architecture, Engineering, Construction) industry, the lack of event logs (which are typically taken from ERP systems in other industries) has considerably limited the applications of process mining. Nevertheless, Process mining has been successfully used for different processes including building permit (N. Martin et al., 2015) design management (Zhang & Ashuri, 2018), (Kouhestani & Nik-Bakht, 2020) and change order management (Lagunas & Nik-Bakht, 2024) RFI can also take advantage of process mining to identify and remove process bottlenecks, understand the social network of actors working together on RFI processing, and optimize the RFI processing time (among others). The key to activate such potentials is using digitalization to extract event logs from various executions of RFIs.

4.4. Optimization and process improvement

Optimization algorithms play a crucial role in enhancing administrative processes by improving scheduling, resource allocation, and decision-making. In healthcare administration, optimization techniques have been applied to patient appointment scheduling, reducing wait times and maximizing resource utilization in hospitals (Ala, Alsaadi, Ahmadi, & Mirjalili, 2021). In logistics and supply chain management, combinatorial optimization algorithms enhance inventory control and automate order fulfillment, reducing manual tracking efforts and operational costs (Cui & Li, 2023).

5. A SWOT PLATFORM FOR RFI PROCESS IMPROVEMENT

As explained, the RFI process in construction, while being an essential mechanism for clarifying specificationsand resolving uncertainties-, is frequently undermined by errors and omissions in design documents, vague specifications and inconsistent or outdated RFI content. These content-related issues obstruct clarity, delay responses, and increase the risk of miscommunication. Integrating AI technologies into construction workflows offers a strategic solution to these challenges. AI tools can automatically detect inconsistencies in design documentation, enforce standardized terminology, and verify document versioning, thereby improving the accuracy, traceability, and reliability of RFI content. Additionally, AI-driven systems enhance decision-making and bolster legal defensibility through automated data capture and structured analysis—an increasingly vital function in arbitration and litigation contexts (Yi & Luo, 2024).

For process-related issues, manual workflows, fragmented documentation, extended response times, and the absence of standardized validation mechanisms continue to impair efficiency. AI-powered automation can streamline the entire RFI lifecycle—from submission and routing to classification and resolution—by enabling real-time tracking, automated notifications, and intelligent categorization. Leveraging large datasets, AI systems can support predictive analytics that identify recurring patterns and forecast potential delays, thus minimizing human error and accelerating response times (Yi & Luo, 2024). Furthermore, integration with centralized, cloud-based platforms reduces the risk of referencing outdated information and enhances process reliability through synchronized version control and consistent documentation practices.

Despite these advantages, AI implementation in RFI management presents notable challenges. Significant investments are required in infrastructure, software, and workforce training, especially for small and medium-sized enterprises. Transitioning from manual to digital workflows introduces operational complexity, necessitating structured change management strategies (Yi & Luo, 2024). Resistance to AI adoption may also stem from concerns about job displacement (Rame et al., 2024), loss of decision-making autonomy, or distrust in opaque algorithms. Overdependence on AI-generated outputs without human oversight can lead to misjudgments, particularly in context-specific scenarios requiring expert interpretation. Lack of explainability or poor calibration further exacerbates the risk of misapplication, potentially compromising project outcomes (Yi & Luo, 2024). Thus, maintaining human oversight remains essential for fostering accountability and trust in multi-stakeholder environments (Wang et al., 2024).

Explainability is a critical enabler of successful AI adoption. In human–AI collaboration, Explainable AI (XAI) builds user trust by providing transparent, interpretable rationales behind its recommendations. This is especially important in RFI contexts, where contractual and regulatory nuances often necessitate human validation. When AI systems offer context-aware, justifiable outputs, users are more likely to accept and apply their insights (Wang et al., 2024). Balancing AI autonomy with user control ensures more effective collaboration between humans and machines.

While this study focuses on RFI-specific challenges, AI's potential extends to broader construction objectives such as sustainability and resource optimization under Industry 5.0 (Glazkova et al., 2024). Predictive analytics can help streamline RFI processes to avoid unnecessary delays, optimize labor and materials, and reduce waste. However, large-scale AI adoption raises critical concerns around data privacy, GDPR compliance (Hjerppe et al., 2019), and ethical risks, including the misuse of employee monitoring data (Rame et al., 2024). Though these fall outside the primary scope of this paper, they remain essential considerations for organizations implementing AI at scale.

Ultimately, the long-term effectiveness of AI in construction—and specifically in RFI and administrative workflows—hinges on workforce buy-in and behavioral adaptation. Despite promising early results, future success will depend on comprehensive user training, intuitive system interfaces, and the perceived reliability of AI tools (Wang et al., 2024). Without these elements, even the most advanced systems risk underperformance or rejection by end users.
Integrating these aspects, through a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis approach, can provide construction companies with a structured framework for evaluating the positive and negative impacts of automation and digitalization on their RFI process. The framework, presented in Figure 4, is the result of a synthesis of key insights from multiple studies, including Yi & Luo (2024), Wang et al. (2024), Rame et al. (2024), and Glazkova et al. (2024).This tool can also help AEC companies to better evaluate the company's maturity level, advantages, and needs for adopting AI (in terms of digitalization and automation) within their practices.

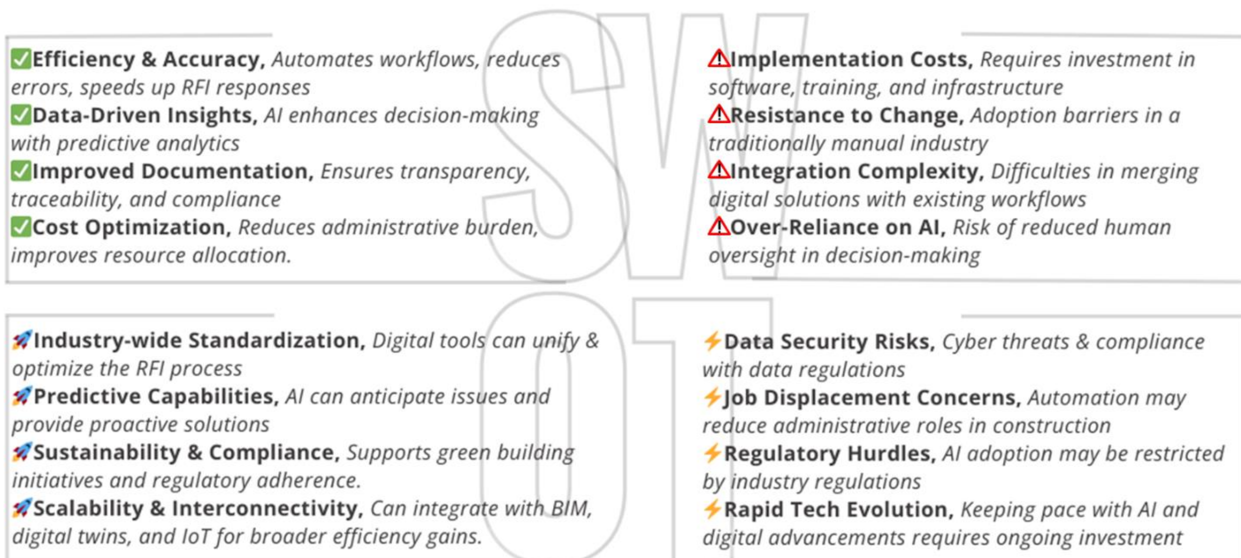

Figure 4: Adopting automation and digitalization to support RFI process, a SWOT view

CONCLUDING REMARKS

The RFI process in construction is a crucial administrative function that suffers from inefficiencies due to poor document management, communication bottlenecks, and manual workflows. Digitalization and automation offer transformative potential to address these challenges. By leveraging AI technologies such as machine learning, NLP, and process mining, the construction industry can streamline RFIs, improve response times, and streamline claim and litigation processes. The integration of AI into the construction RFI process has the potential to significantly enhance cost estimation, human–AI collaboration, and sustainability initiatives. However, challenges such as investment costs, regulatory compliance, and the need for a balanced approach to human–AI integration must be carefully managed. A strategic adoption framework that combines AI-driven automation with human expertise will be essential in maximizing AI's benefits while ensuring transparency, reliability, and ethical implementation within the construction industry. The structured SWOT analysis presented by this paper highlights the benefits and challenges of automation, providing insights into its practical implementation. While high initial investments and resistance to change pose barriers, the long-term advantages of standardization, predictive analytics, and AI-driven optimization make digital transformation a viable solution for the future of RFIs in construction. Further research should focus on refining these technologies, integrating them with existing project management systems, and establishing industry-wide standards for RFI processing.

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