**Harnessing Large Language Models for Social Media Insights in Construction Management**

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**Abstract**

The construction industry faces persistent challenges in workforce development, documentation inefficiencies, safety compliance, and the integration of emerging technologies. This study explores how artificial intelligence (AI), specifically natural language processing (NLP), thematic analysis, and sentiment analysis, can be applied to unstructured social media data to reveal industry trends and support informed decision-making. Using 464 Reddit posts, including their comments, from the subreddit r/Construction collected from January 2025, the research identifies seven major discussion themes, including material sourcing, workplace culture, and project coordination. These AI-derived patterns were compared and contextualized using semi-structured interviews with construction professionals, offering insight into daily workflows, frustrations, and opportunities for AI implementation in practice. The mixed-methods approach revealed strong alignment between social media discourse and practitioner experience, particularly around procedural bottlenecks, burnout, and the need for better documentation and estimation tools. While Reddit users frequently discussed AI in speculative or humorous tones, interviewees described targeted applications for AI in specification searches, compliance management, and summarization of construction documents. By combining large-scale NLP with grounded qualitative insight, the study demonstrates a scalable framework for leveraging digital discourse to address real-world construction management challenges. This research highlights AI’s potential not as a replacement for human expertise, but as a complementary tool that enhances operational efficiency and supports knowledge sharing across the industry.

**1. Introduction**

The construction industry is undergoing a transformative era fueled by digital innovation and the advancement of data-driven decision-making tools. Among the emerging technologies reshaping the field, artificial intelligence (AI) stands out as a powerful instrument for analyzing vast and unstructured data sources (Abioye et al., 2021) (*OpenAI*, n.d.). Simultaneously, social media platforms such as Reddit have become dynamic, real-time collections of industry-related discussions, offering valuable insight into the challenges and innovations professionals encounter daily (Azhar & Abeln, 2014; Iqbal et al., 2021).

The construction industry faces a range of persistent challenges, including labor shortages, the integration of new technologies, and growing demands for improved workplace safety. To address these issues effectively, it is essential to harness new sources of data that provide real-time, diverse perspectives. Social media, with its informal exchange of information provides real-world views of the industry. However, the vast and unstructured nature of social media data often makes it difficult to process and analyze efficiently (Gisselbrecht et al., 2015).

Reddit is a social media platform organized into topic-specific communities called subreddits, where users share content and engage in discussions (Reddit, 2024). The subreddit r/Construction, for example, is a vibrant space for construction professionals, covering a variety of topics such as safety protocols, career advice, and technical problem-solving. Reddit’s strength lies in its ability to capture grassroots, unfiltered discussions making it a rich data source for understanding current trends and knowledge exchange in construction.

To analyze such unstructured data at a high scale, AI offers crucial advantages. AI refers to computational techniques designed to replicate human intelligence, including natural language processing (NLP), machine learning (ML), and generative algorithms (Yalamati & Batchu, 2024)(Uddin, 2024). These technologies are particularly effective at identifying patterns and extracting themes from complex, unstructured data like social media posts—tasks that would be time-consuming or infeasible with traditional qualitative methods (Deshpande & Kumar, 2018).

While researchers have recognized the value of social media data in construction research, few studies have used AI to analyze Reddit specifically, leaving a gap in understanding how professionals use the platform to share knowledge and express concerns (Tang et al., 2017) (Zeng et al., 2010). This study addresses that gap by combining AI-based analysis of Reddit data with expert interviews, enabling both thematic exploration and real-world validation (Morgan, 2023).

This expanded approach not only captures the diverse ways professionals share and consume knowledge but also facilitates more informed decision-making and strategic planning in the construction sector. Through these efforts, the study aims to contribute to both academic understanding and practical advancements, fostering innovation and collaboration in the construction industry.

To support this analysis, the study uses application programming interfaces (APIs) software intermediaries that allow structured access to social media data (Ofoeda et al., 2019). APIs offered by platforms like Reddit enable automated extraction of user-generated content. By using Python, a versatile and widely-used programming language, this project streamlines the data retrieval and cleaning process, increasing efficiency (*Welcome to Python.Org*, 2025).

In addition to computational analysis, the study incorporates **interviews with experienced construction professionals**. These interviews provide qualitative depth, helping contextualize AI-identified patterns and offering practical insights into how digital discourse reflects real-world challenges. This will ultimately help to answer the research question: “How can AI-driven analysis of Reddit discussions and expert interviews provide actionable insights into current challenges, innovations, and knowledge-sharing practices in the construction industry?”

**2. Method**

This study employs a mixed-methods approach to explore current challenges, innovations, and knowledge-sharing practices within the construction industry. The methodology integrates computational analysis of social media data with qualitative insights from expert interviews. The research process is organized into four stages: (1) data collection, (2) data processing, (3) semi-structured interviews, (4) thematic analysis.

**Data Collection:** The primary dataset was obtained from the social media platform Reddit, focusing on the subreddit r/Construction, which hosts discussions among industry professionals and enthusiasts. The data collection phase covered all posts and their corresponding comments from January 2025.

To access this data, Python was used in combination with the Reddit API. The Reddit API enables programmatic access to public subreddit data, allowing researchers to retrieve content, metadata, and user engagement metrics efficiently. With support from ChatGPT-4o, a custom Python script was developed to extract post titles, content, comments, timestamps, upvotes/downvotes, and interaction threads. This ensured a comprehensive and structured collection of discussion from that time period.

In parallel with the Reddit data collection, the study incorporated qualitative interviews to provide deeper context and validation. Interviews were conducted with professionals from various roles in the construction industry.

**Data Collection & Processing**: Once collected, the Reddit dataset underwent processing to ensure quality and relevancy. The Reddit data was then categorized into structured fields using Python scripts, with each post and its discussion tagged under the following categories:

* Title
* Key Findings
* Common Challenges
* Notable Tools and Equipment
* Useful Tips

After categorization, the cleaned data was converted into a CSV file format to support structured analysis and visualization.

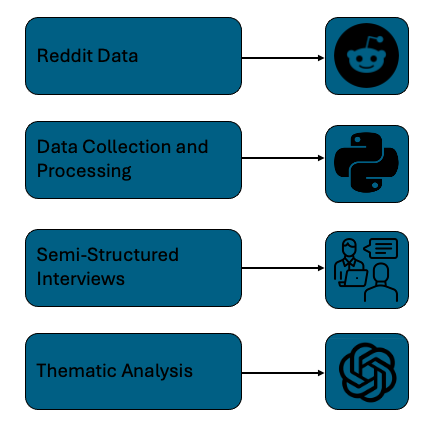
**Semi-Structured Interviews:** To complement the Reddit-based analysis, this study incorporates a **mixed-methods approach** that integrates computational techniques with qualitative insights. In particular, four **semi-structured interviews** were conducted with experienced professionals in the construction industry, including site managers, engineers, estimators, and project managers. These interviews were designed to explore perceptions of AI, technology adoption, and ongoing industry challenges. The combination of interview data with AI-processed Reddit discussions allows for a more robust, multi-layered understanding of the construction sector.

**Thematic Analysis:** The data analysis combined automated techniques using Python and the OpenAI API. Using the OpenAI API, thematic clustering was applied to identify dominant topics such as:

* Career development
* Safety practices
* Technical problem-solving
* Equipment and tool usage
* AI and technology in construction

Patterns were identified based on frequency, user engagement, and relevance across discussions.

Interview transcripts were processed using AI-supported tools which extracted key themes and opinions, which were then categorized and compared against findings from the Reddit data. This comparison allowed for a multi-perspective understanding of industry realities and challenges.



**Figure 1.** Visual Research Methodology Flowchart

**3. Results**

The dataset consisted of 464 posts, including all associated comments, from the r/Construction subreddit during January 2025. It was analyzed using natural language processing (NLP) techniques. The thematic analysis identified seven distinct categories of discussion, capturing the complex nature of the challenges and conversations present within the construction community.

**Table 1.** Thematic Categorization of Discussions in the r/Construction subreddit

|  |  |
| --- | --- |
| **Theme** | **Details** |
| Construction Materials & Techniques | * Material selection, quality, and cost considerations * Installation and maintenance techniques * Structural integrity and engineering concerns * Sustainability and historical construction methods * Insulation, waterproofing, and weatherproofing strategies |
| Tools, Equipment, & Technology | * Tool preferences, performance, and maintenance * Software solutions for project management and estimation * Integration of new technology, automation, and AI in construction * Equipment safety, rental issues, and troubleshooting * Digital modeling, BIM, and CAD usage |
| Safety, Regulations, & Compliance | * Workplace and safety practices and regulatory adherence * OSHA compliance, site hazards, and emergency response * Construction sequencing and structural risks * Industry standards, ADA compliance, and inspections * Worker classification, employment rights, and liability concerns |
| Career Development & Workforce Challenges | * Apprenticeships, trade skills, and mentorship * Transitioning into construction from other careers * Union vs. Non-union work and labor market trends * Long-term career growth and leadership development * Work-life balance |
| Project Management & Communication | * Coordination between trades, architects, and contractors * Project planning, bidding, and cost estimation * Construction documentation and accountability * Client management, expectations, and conflict resolution * Software integration for efficiency reporting |
| Workplace Culture & Social Aspects | * Humor, camaraderie, and job site dynamic * Alcohol consumption and cultural norms in construction * Diversity, language barriers, and generational differences * Mental health, stress, and toxic workplace environments * Perceptions of trades and professional identity |
| Specialized Construction & Niche Topics | * Historical preservation and restoration * Urban infrastructure, space construction, and future developments * Niche craftmanship and custom design work * Seasonal challenges and extreme weather considerations * Portable restrooms, sanitation, and site hygiene |

**Figure 2.** Thematic Analysis of Key Themes Found in The Reddit Data

As shown in Table 1, the most frequently discussed topics were grouped into seven primary themes. Their relative frequencies and distributions are illustrated in Figure 2. The most discussed theme was **Construction Materials & Techniques**, which accounted for 26.9% of the posts (n = 125). This category included discussions on insulation methods, structural integrity, installation strategies, and historical building practices. Contributors frequently expressed concerns about balancing material quality and cost, particularly in projects limited by budget constraints or environmental conditions.

Discussions around **Career Development & Workforce Challenges** centered on mentorship, trainee programs, union versus non-union work, and long-term job satisfaction. Issues such as work-life balance and burnout were also commonly raised, often in the context of preparing the next generation of skilled laborers. This theme appeared in 79 posts, representing 17.0% of the dataset. The **Project Management & Communication** theme, which appeared in 70 posts (15.1%), highlighted recurring issues between contractors, architects, and clients. These posts detailed problems such as project delays, cost mismanagement, and communication breakdowns. Users frequently mentioned scheduling software, coordination inefficiencies, and challenges maintaining accountability in documentation processes.

Other themes included the **Workplace Culture & Social Aspects** category, which addressed both humorous and serious content, from job site jokes and memes to critical discussions on toxic work environments, language barriers, and trade perception. This theme appeared in 59 posts (12.7%). Similarly, the **Tools, Equipment, & Technology** category (n = 58; 12.5%) included posts about tool preferences, troubleshooting, and debates over software such as AutoCAD, Revit, and emerging AI technologies. Users in this category often focused on enhancing efficiency and minimizing delays caused by equipment issues or unfamiliar technology.

A smaller, yet noteworthy, number of posts addressed **Specialized Construction & Niche Topics**, such as adapting to extreme weather, historical restoration, and construction in unique environments This theme accounted for 8.2% of the posts (n = 38). The least discussed theme was **Safety, Regulations, & Compliance**, which made up 7.5% of the dataset (n = 35). Posts in this category focused primarily on OSHA requirements, on-site hazards, and adherence to accessibility standards. Discussions frequently addressed the stress of regulatory compliance and inspections, indicating a heightened awareness of risk and liability on job sites.

**Figure 3.** Thematic Analysis of Common Challenges Found in The Reddit Data

**Figure 4.** Thematic Analysis of Notable Tools & Equipment Found in The Reddit Data

**Figure 5.** Thematic Analysis of Useful Tips Found in The Reddit Data

Figures 3 through 5 present key visualizations summarizing the most commonly discussed challenges, tools & equipment, and practical tips extracted from the Reddit data. **Figure 3** shows that the most frequently reported challenges were related to **Material Sourcing & Quality** (n = 79), followed by concerns about **Construction Methods & Structural Integrity** and **Career Growth & Workplace Culture**, each discussed around 60 posts. These findings suggest a strong emphasis on basic construction practices and workforce issues.

**Figure 4** represent the distribution of Tools & Equipment used in different areas of the construction industry. Discussions about actual **Tools & Equipment** comprising the largest share (30%), followed by **Materials & Structural Components** (20%). This reinforces the narrative that much of the conversation is rooted in hands-on, tool-based problem-solving and product selection.

**Figure 5** highlights areas where users provided practical advice. The most commonly shared tips related to **Construction Materials & Methods** (n = 145), followed by insights on **Workforce & Career Growth, Tools & Equipment**, and **Business Strategies**, each receiving 60 to 80 mentions. This pattern indicates that users not only seek help but also actively offer experience-based solutions across technical and organizational topics.

A close-up of words

Description automatically generated

**Figure 6.** Word Cloud of the Social Media Data Collected from r/Construction Subreddit

Lastly, **Figure 6** displays a word cloud generated from the dataset. Terms such as **“clarify,” “techniques,” “measurement,”** and **“avoid”** underscore the community’s focus on accuracy, communication, and procedural clarity. These keywords align with broader themes of reducing confusion, ensuring compliance, and improving on-site efficiency.

**Table 2.** Qualitative Analysis Results of the Interviews

Theme 1: Technical and Practical Questions and Solutions (Frequency\* = 26 mentions)

* **Structural & Construction Planning** – Plan errors and RFIs, constructability reviews, coordination of scopes
* **Concrete & Paving Work** – Challenges with takeoffs, asphalt tonnage misorders, field inspections
* **Scheduling Tools & Methods** – CPM scheduling complexities, sequence disruptions, timeline tracking
* **Estimating & Documentation** – FDOT pay estimate burden, cost proposal development, bid preparation errors
* **Data Lookup & Specification Use** – Searching specs manually (CTRL+F), issues with inconsistent document formats
* **Regulatory Compliance** – Verifying standard specs, aligning with evolving FDOT documentation

Theme 2: Miscellaneous and Humor (Frequency = 3 mentions)

* **Workplace Banter & Relatable Frustrations** – Frustration with unproductive meetings, software overload
* **Skepticism Toward AI & Humor** – “AI may make me seem smarter than I am”

Theme 3: Career & Job-related (Frequency = 21 mentions)

* **Career Growth & Mentorship** – Importance of peer learning, strong PM–super relationships, value of experience over formal training
* **Industry Transitions & Expectations** – Concerns that AI may shortcut skill development, adapting to new workflows
* **Workplace Culture** – Need for collaboration, team selection affecting project success, support structures in place
* **Professional Practices** – Using lessons learned after projects, emphasis on best practices in decision-making

Theme 4: Tool, Equipment and Material Recommendations (Frequency = 14 mentions)

* **Software & Platforms** – Multiple tools used (Build2Win, Box, P-Vault, Viewpoint), difficulty accessing centralized info
* **Search & Automation Tools** – Desire for AI to search documents/emails, automate submittals or specs searches
* **Equipment Planning** – No specific gear/machinery brands were discussed, but examples were given on trucking logistics and hauling materials
* **AI Recommendations** – Suggestions for AI in takeoff generation, letter writing, and trend analysis across data

Theme 5: Safety and Health Concerns (Frequency = 12 mentions)

* **Compliance Processes -** Managing OJT tracking, wage documentation for federal funding, site safety board maintenance
* **Health and Admin Burden** – Stress from excessive compliance tasks, frustration from duplicative paperwork
* T**raining and Risk** – Challenges training new hires on safety requirements or document compliance

Theme 6: Cost, Pricing & Budgeting (Frequency = 10 mentions)

* Project Costing – FDOT monthly pay estimate prep, risk of missing subcontractor billing
* **Estimation Accuracy** – Mistakes in forgetting key cost factors (e.g., trucking), catching errors after project ends
* **Labor & Compensation Considerations** – Mentioned in relation to benefits of having AI reduce manual workload and errors

Theme 7: Process and Procedural Clarification (Frequency = 17 mentions)

* **Permitting & Submittals** – Challenges navigating FDOT submittals, building submittal registers manually
* **Project Management Workflows** – Daily coordination duties, invoicing, RFI/submittal tracking, hauling logs
* **Decision-making Processes** – Referring to past cases, peer discussion before final decisions
* **AI Potential in Procedures** – Strong potential seen in summarizing long documents, searching historical project records

Theme 8: Workplace Dissatisfaction and Conditions (Frequency = 11 mentions)

* **Overload & Burnout** – Time spent managing compliance, meetings without structure, scattered platforms
* **Tech Fatigue** – Difficulty learning new platforms, frustrations with “too many systems”
* **Concerns About AI** – Worries AI will diminish the human element, or create overconfidence in younger workers
* **Training & Support Gaps** – Struggles to stay updated with evolving specs unless directly impacted

\*Frequencies represent the number of times each theme or subtheme was referenced across all interviews, not just the number of interviewees who mentioned it. This includes repeated mentions of the same topic across different responses.

Four semi-structured interviews were conducted with professionals within the construction sector, specifically in the transportation/roadway sector. Transcripts analyzed using AI-assisted tools and validated manually to ensure accuracy. The analysis revealed eight overarching themes that provide contextual depth to the Reddit findings and surface internal perspectives not commonly shared online.

The most occurring theme was **Technical and Practical Questions and Solutions**, with 26 mentions across interviews. Interviewees described repeated issues with plan errors, scheduling breakdowns, and coordination problems. Common frustrations included rework caused by insufficient constructability reviews and misalignment between design intent and field conditions. Interviewees also elaborated on **Estimating and Documentation** burdens, such as navigating Florida Department of Transportation (FDOT) pay estimate procedures, identifying cost errors post-project, and struggling with manual bid preparation processes. A recurring pain point involved locating information within digital files, participants described the need to manually “CTRL+F” through inconsistent or poorly formatted documents.

Another theme that was well discussed was **Career and Job-Related Perspectives**, with 21 mentions. Participants emphasized the importance of mentorship, informal learning, and collaborative relationships on project outcomes. There was a strong sentiment that formal education alone does not prepare individuals for the dynamic challenges of the job site.The theme of **Tools, Equipment, and AI Integration** surfaced in 14 mentions. While specific equipment brands were not emphasized, participants discussed their reliance on multiple platforms (e.g., Box, Viewpoint, P-Vault) and the desire for a unified or searchable database system. Several interviewees expressed cautious optimism about AI applications, suggesting uses such as automated takeoff generation, trend detection across project reports, and assistance in document summarization.

Concerns about **Safety and Health Compliance** were raised 12 times. Beyond the standard need for comply with regulations, participants expressed frustration with administrative overhead, difficulties onboarding new hires to safety protocols, and the stress caused by duplicative paperwork requirements for federally funded projects.

**Cost and Budgeting** challenges, mentioned 10 times, resonated with the issues seen in Reddit discussions. Participants described the complexity of accurately preparing cost estimates and the potential financial consequences of overlooking key pricing variables like transportation logistics. A total of 17 references related to **Process and Procedural Clarification**. These included issues with submittal processes, decision-making under uncertainty, and recordkeeping. Many interviewees noted the time lost searching through previous documentation and identified AI as a potential tool to streamline such workflows.

Themes of **Workplace Dissatisfaction and Conditions** were also noticeable. Eleven mentions highlighted burnout, frustration with constant platform switching, and skepticism about over-reliance on AI by less experienced workers. A small number of comments (3 mentions) were categorized under **Miscellaneous and Humor**, reflecting personal anecdotes, relatable workplace frustrations, and jokes about AI potentially “making them seem smarter than they are.”

**Table 2** summarizes the interview themes, illustrating the frequency of mention and associated examples. Frequencies reflect the total number of theme-related statements across all interviews, not the number of individual participants who raised the issue.

A comparison of Reddit and interview findings reveals significant thematic alignment, particularly in areas related to safety, documentation, and workforce concerns. Reddit content, however, presented a broader variety of informal, peer-generated insights that spanned from technical troubleshooting to workplace humor. In contrast, interview data emphasized detailed procedural challenges and organizational inefficiencies that were not always visible in public discourse.

One notable overlap was the shared interest in artificial intelligence. Reddit users tended to discuss AI in speculative terms questioning its capabilities or imagining its future applications while interviewees provided specific, actionable ideas for AI tools to address real bottlenecks. Interview responses underscored a desire for AI not to replace decision-making, but to enhance efficiency, reduce error, and simplify repetitive administrative tasks.

**4. Discussion**

A central objective of this study was to evaluate the feasibility and value of integrating artificial intelligence into the analysis of construction-related discourse. From data collection through thematic synthesis, AI tools played a critical role both enabling scale and presenting certain limitations that shaped the research process.

The Reddit data was processed using Python scripts supported by OpenAI’s GPT-4o API, which facilitated thematic extraction, clustering, and keyword identification across hundreds of user posts and comments. This automation was highly efficient compared to manual coding, allowing for a rapid scan of language patterns, sentiment trends, and recurring challenges. Tasks like categorizing discussions into themes or filtering technical questions were executed in minutes rather than days. This efficiency made it possible to engage with a larger volume of social media content than would typically be feasible in a traditional qualitative study. However, this speed came with some mistakes. During analysis, some content required closer inspection, as AI tools may have struggled to distinguish between technical commentary and humor or sarcasm especially in informal Reddit posts. These edge cases reinforced the need for manual review to ensure thematic accuracy.

In the interview phase, AI was used to extract themes, cluster quotes, and flag repeated ideas across transcripts. This workflow was crucial in structuring the data for comparison with Reddit findings. For example, AI-assisted transcript analysis quickly highlighted frequently mentioned issues such as specification searches or FDOT compliance tasks. Interview themes such as tech fatigue, documentation overload, and the desire for more searchable platforms were revealed early through keyword clustering and then validated through close reading.

Interestingly, the role of AI in this research closely parallels how construction professionals view AI in their own work. Reddit users tended to discuss AI in speculative or humorous ways, while interviewees offered concrete ideas for AI-supported tools ranging from document summarization to specification lookup and estimation support. Participants emphasized that AI should not replace human expertise but instead serve as a tool to reduce repetitive tasks and enhance decision-making. These findings align with prior studies suggesting that while AI holds promise for improving efficiency in construction, its impact is often limited by organizational readiness and user adaptability. Concerns about burnout, digital fatigue, and fragmented platforms suggest that technology adoption must be approached with care to avoid creating new inefficiencies or burdens.

Ultimately, this study demonstrates the potential of AI to enhance the scope and efficiency of qualitative construction research, particularly when analyzing unstructured content. However, it also highlights the importance of balancing automation with critical human insight. As AI continues to evolve, researchers and industry professionals alike must consider not just what the technology can do, but how it can be implemented responsibly and meaningfully in real-world workflows.

While the combined use of Reddit data and expert interviews provides a more complete picture of the construction industry's current state, the study has limitations. First, the Reddit sample was limited to posts from January 2025 and may not fully capture seasonal variations or long-term trends. Additionally, the informal nature of Reddit content means that user identities, qualifications, and regional contexts are unknown, making it difficult to verify the representativeness of the data.

Second, only four expert interviews were conducted, which limits the diversity of professional roles and experiences captured. Although the interviews were rich in detail, a broader sample would strengthen the generalizability of the insights. There is also potential bias introduced by the use of AI tools for coding and summarizing themes—while these tools improved efficiency, they may have missed nuances that a purely manual analysis might have caught.

Despite these limitations, the study demonstrates the potential of combining social media analysis with expert input to uncover challenges and opportunities within construction. It offers a framework that can be refined and expanded in future research to explore industry trends with greater depth and accuracy.

**5. Conclusion**

This study demonstrates the value of integrating AI-driven analysis of social media data with qualitative insights from construction professionals to better understand the evolving challenges in the construction industry. The analysis of Reddit discussions revealed that material selection, tool usage, workforce development, and project coordination are central concerns for practitioners. These themes highlight the industry's ongoing need for practical problem-solving, efficient workflows, and support for career growth.

Interview findings added depth by exposing the procedural and administrative burdens that often go unspoken in public forums. Challenges related to documentation, compliance, and coordination point to a critical need for better information management tools. Across both data sources, there was a growing recognition of artificial intelligence as a promising solution to reduce manual workload and streamline decision-making.

Building on the findings of this study, future research should expand the data collection timeframe and incorporate additional social media platforms such as LinkedIn, YouTube or industry-specific forums to capture a broader and more diverse range of construction discourse. An extended timeframe of the collected data would allow researchers to track changes in professional concerns, technology adoption, and workforce dynamics over time. In addition, increasing the number and diversity of interview participants across roles, geographic regions, and organization types would provide a more comprehensive understanding of industry challenges and technology perceptions.

Finally, as AI capabilities continue to evolve, researchers should investigate the ethical and practical implications of automating decision support in construction environments. Topics such as trust in AI, training needs, and human oversight will be critical to ensuring that technological adoption is both effective and responsible.

**Data availability statement**

Data and codes that support this study are accessible from: <https://github.com/idaferding/aic>

**Funding statement**

None

**Competing interests**

None

**AI assistance statement**

Data extraction and analysis were conducted using standard Python packages, with code generation support from ChatGPT-4o and ChatGPT-4o-mini. AI assistance from these models also supported thematic categorization and analysis of data. Additionally, AI was used to provide review comments, refine text for clarity and conciseness, suggest paragraph restructuring to improve logical flow, and perform semantic analysis of qualitative survey responses. All AI-generated content was reviewed, verified, and contextualized to ensure accuracy and alignment with the study’s objectives.

**Ethical standards**

This study adhered to ethical research standards, ensuring informed consent, participant anonymity, and responsible use of AI tools with human oversight to maintain accuracy, integrity, and respect for all contributors.

**Author contributions**

None

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