Understanding Stakeholder Engagement in Large-Scale Engineering Projects: A Qualitative Study

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Abstract

This study aimed to explore how professionals involved in large-scale engineering projects understand, organize, and sustain stakeholder engagement across complex project environments in Hungary. A qualitative research design was adopted to obtain an in-depth understanding of stakeholder engagement practices from the perspectives of professionals directly involved in large-scale engineering projects. Data were collected through semi-structured interviews with 24 participants from Hungary, including project managers, engineering leads, procurement specialists, public-sector representatives, environmental and social impact experts, and community liaison officers. Participants were selected through purposive sampling to ensure variation in role, sector, and professional experience. Interviews continued until theoretical saturation was reached, with no substantially new codes emerging after the twenty-first interview and three additional interviews conducted to confirm saturation. Interviews were audio-recorded with consent, transcribed verbatim, anonymized, and analyzed using thematic analysis. NVivo software was used to organize transcripts, support systematic coding, compare categories, and develop higher-order themes. The analysis generated four main categories: dynamic stakeholder identification and prioritization, communication as a mechanism of alignment, trust and legitimacy in contested project environments, and institutional-contractual constraints on engagement. Participants described stakeholder engagement as a continuous and adaptive process rather than a fixed procedural requirement. Effective engagement depended on early mapping of formal and informal actors, transparent communication, responsiveness to local concerns, and the ability to negotiate competing expectations among government bodies, contractors, communities, consultants, and end users. However, fragmented governance, political pressure, rigid contractual arrangements, and delayed communication often reduced the quality of engagement. Stakeholder engagement in large-scale engineering projects is best understood as a relational, political, and iterative process embedded in technical, institutional, and social complexity. The findings suggest that successful engagement requires more than compliance-based consultation; it requires continuous stakeholder intelligence, credible communication, trust-building, and flexible governance mechanisms that allow project teams to respond to emerging concerns throughout the project life cycle.

Keywords: stakeholder engagement; large-scale engineering projects; qualitative research; project management; Hungary; stakeholder management; infrastructure projects

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1. Introduction

Large-scale engineering projects occupy a central position in contemporary economic development, urban transformation, industrial modernization, and infrastructure renewal. These projects include transport systems, energy facilities, water and wastewater infrastructure, industrial plants, logistics hubs, bridges, rail systems, and other technically complex undertakings that require substantial capital investment, long delivery periods, multi-organizational coordination, and extensive public or private accountability. Although such projects are often evaluated through technical indicators such as cost, schedule, quality, and operational performance, their success increasingly depends on how effectively project organizations engage the stakeholders who affect or are affected by the project. Stakeholder engagement has therefore become a core concern in project management, engineering governance, and infrastructure delivery because large projects rarely fail only for technical reasons; they also encounter social opposition, regulatory delay, misaligned expectations, political contestation, contractual fragmentation, and insufficient communication among actors with divergent interests (Flyvbjerg, 2014; Mok et al., 2015).

The theoretical foundation of stakeholder engagement is commonly traced to stakeholder theory, which argues that organizations must attend not only to shareholders or formal owners, but also to the broader groups and individuals who can influence or are influenced by organizational action (Freeman, 1984). In project contexts, this perspective is especially relevant because engineering projects are temporary organizations embedded in permanent social, institutional, environmental, and political settings. Stakeholders may include project sponsors, contractors, engineering consultants, public authorities, local governments, regulatory agencies, investors, suppliers, landowners, residents, environmental organizations, end users, labor groups, media actors, and future operators. Each of these actors may possess different degrees of power, legitimacy, urgency, technical knowledge, or social influence. Mitchell et al. (1997) introduced the influential stakeholder salience model, emphasizing that managers prioritize stakeholders based on perceived power, legitimacy, and urgency. This model remains useful in project environments because stakeholder relevance is rarely fixed; it changes as projects move from planning to permitting, procurement, construction, commissioning, and operation.

Large-scale engineering projects are particularly stakeholder-intensive because they produce visible, long-term, and spatially embedded consequences. Unlike smaller organizational projects, major engineering works often reshape land use, mobility patterns, environmental conditions, public expenditure, industrial capacity, and community life. Flyvbjerg et al. (2003) argued that megaprojects are frequently characterized by underestimated costs, overestimated benefits, and insufficient attention to risk and accountability. These challenges are not merely technical estimation problems; they also

reflect power relations, strategic communication, institutional incentives, and selective inclusion of stakeholder perspectives. When affected communities, regulators, local governments, or operational users are engaged too late, project organizations may encounter resistance, reputational damage, redesign costs, or political intervention. Conversely, when stakeholder engagement is embedded early and maintained throughout the project life cycle, it can improve risk identification, enhance legitimacy, clarify requirements, reduce conflict, and support more sustainable project outcomes.

Within project management literature, stakeholder engagement has evolved from a relatively procedural activity of identifying and communicating with stakeholders toward a more relational and dynamic understanding of stakeholder interaction. Early approaches often emphasized stakeholder mapping, influence assessment, communication planning, and issue monitoring. Olander and Landin (2005) showed that stakeholder influence can significantly shape the implementation of construction projects, while Olander (2007) proposed stakeholder impact analysis as a way to assess stakeholder power, probability of influence, and position toward the project. Bourne and Walker (2005) similarly emphasized the importance of visualizing and mapping stakeholder influence as part of project relationship management. These contributions helped formalize stakeholder management as a project management process, but subsequent research has shown that engagement cannot be reduced to static mapping tools alone. Stakeholders interact with one another, form coalitions, reinterpret project meanings, and shift their positions over time.

Aaltonen (2011) advanced this dynamic perspective by describing project stakeholder analysis as an environmental interpretation process. In this view, stakeholder management is not simply the classification of actors but an ongoing effort to interpret changing stakeholder environments. Aaltonen and Kujala (2016) further developed the concept of project stakeholder landscapes, emphasizing complexity, uncertainty, dynamism, and institutional context. This is particularly relevant to large-scale engineering projects because the stakeholder environment can change substantially during long project cycles. A municipality that initially supports a project may later become critical due to community complaints; a regulatory agency may impose new requirements; a contractor may renegotiate responsibilities; residents may mobilize through media or local associations; and end users may challenge design assumptions. Therefore, stakeholder engagement must be understood as an adaptive process that combines analysis, communication, negotiation, and institutional learning.

Research on mega construction projects has also highlighted the importance of context. Mok et al. (2015), in their review of stakeholder management studies in mega construction projects, identified major research topics including stakeholder interests and influences, stakeholder management processes, stakeholder analysis methods, and stakeholder engagement. They concluded that stakeholder management approaches are shaped by national and institutional contexts. This is important because large engineering projects are

not implemented in a vacuum. Legal frameworks, procurement regimes, public consultation practices, political culture, media systems, and administrative traditions all shape how stakeholders are identified, heard, prioritized, and responded to. In the Hungarian context, large-scale engineering projects are often embedded in European Union funding requirements, national development priorities, municipal interests, environmental regulations, and private-sector delivery arrangements. Such institutional layering can create both opportunities and constraints for meaningful stakeholder engagement.

Stakeholder engagement is also connected to legitimacy. Large engineering projects require technical legitimacy, legal legitimacy, political legitimacy, and social legitimacy. Technical legitimacy emerges when stakeholders trust the competence of engineers and project organizations. Legal legitimacy is created through compliance with planning, permitting, environmental, and procurement rules. Political legitimacy depends on alignment with public priorities and governmental accountability. Social legitimacy depends on whether affected stakeholders perceive the project as fair, transparent, and responsive to their concerns. Cuppen et al. (2016), in their study of stakeholder engagement in large-scale energy infrastructure projects, showed that different stakeholders may hold different perspectives on what engagement should accomplish. Some may expect information, others negotiation, others co-creation, and others protection from harm. This implies that project teams must clarify not only who the stakeholders are but also what kind of engagement is appropriate, credible, and feasible.

Despite the growing literature, several gaps remain. First, much stakeholder management research continues to emphasize formal tools and frameworks, while less attention is given to how professionals actually interpret engagement in practice. Second, the experiences of project actors working in Central and Eastern European contexts remain relatively underrepresented compared with studies from Western Europe, Australia, the United Kingdom, and large Asian infrastructure settings. Third, engineering project research often treats stakeholder engagement as a managerial function, whereas participants may experience it as a negotiated process constrained by contracts, politics, institutional procedures, and project delivery pressures. Fourth, there is a need for qualitative inquiry that captures the meanings, tensions, and practical dilemmas experienced by professionals involved in stakeholder engagement across different types of large-scale engineering projects.

A qualitative approach is suitable for addressing these gaps because stakeholder engagement is not only a measurable process but also an interpretive and relational phenomenon. Professionals must decide which stakeholders matter, how to communicate uncertain information, when to disclose risk, how to manage conflict, and how to balance technical constraints with social expectations. These judgments are shaped by experience, organizational culture, institutional rules, and project-specific histories. Semi-structured interviews allow participants to describe these processes in their own terms, including the informal practices and tacit knowledge that may not appear in formal project documentation.

Therefore, this study aimed to explore how professionals involved in large-scale engineering projects in Hungary understand, organize, and sustain stakeholder engagement across complex project environments.

2. Methods and Materials

This study used a qualitative research design to explore stakeholder engagement in large-scale engineering projects. The qualitative design was selected because the purpose of the study was not to test a predetermined hypothesis, but to understand how experienced professionals interpret stakeholder engagement, describe engagement challenges, and explain the practical mechanisms through which stakeholders are identified, communicated with, and incorporated into project decision-making. The study was guided by an interpretive orientation, assuming that stakeholder engagement is socially constructed through interactions among project actors, institutional authorities, contractors, communities, and technical experts.

Participants were selected through purposive sampling. The inclusion criteria were: being professionally involved in at least one large-scale engineering project in Hungary during the previous five years; having direct experience with stakeholder engagement, project communication, engineering coordination, permitting, procurement, community relations, or project governance; and willingness to participate in an audio-recorded semi-structured interview. Large-scale engineering projects were defined as technically complex projects with multi-organizational delivery arrangements, substantial financial investment, and significant interaction with public, regulatory, community, or inter-organizational stakeholders.

The final sample consisted of 24 participants from Hungary. Participants included 6 project managers or program directors, 5 engineering or technical leads, 3 procurement and contract managers, 4 public authority or regulatory representatives, 3 environmental and social impact specialists, and 3 community or municipal liaison officers. Participants had experience in transport infrastructure, energy projects, water and wastewater systems, industrial facilities, and logistics-related engineering projects. Recruitment continued until theoretical saturation was achieved. Saturation was considered reached after the twenty-first interview, when no substantially new codes or categories emerged; three additional interviews were conducted to confirm the stability of the thematic structure.

Data were collected through semi-structured interviews. An interview guide was developed based on the study objective and relevant literature on stakeholder theory, stakeholder salience, project stakeholder landscapes, and stakeholder engagement in large-scale engineering projects. The guide included open-ended questions such as: “How do project teams identify stakeholders in large engineering projects?”, “What types of stakeholders are most difficult to engage?”, “How are stakeholder concerns incorporated into project decisions?”, “What communication practices support or damage trust?”, and “What institutional or contractual factors influence engagement quality?” Follow-up questions were used to encourage participants to provide examples from their professional experience.

Interviews were conducted either face-to-face or online, depending on participant availability and location. Each interview lasted approximately 45 to 80 minutes. Before each interview, participants received information about the study purpose, confidentiality, voluntary participation, and their right to withdraw. Written or recorded informed consent was obtained. Interviews were audio-recorded with permission and transcribed verbatim. Identifying information, including names of individuals, organizations, municipalities, and projects, was removed from the transcripts. Participants were assigned codes from P01 to P24.

Data were analyzed using thematic analysis. The analysis followed an iterative process of familiarization, initial coding, category development, theme refinement, and interpretation. First, the researchers read the transcripts several times to become familiar with the data. Second, meaningful units related to stakeholder identification, communication, trust, conflict, institutional constraints, and engagement outcomes were coded. Third, similar codes were grouped into subcategories. Fourth, subcategories were compared across interviews and organized into broader main categories. Fifth, the categories were reviewed against the transcripts to ensure that they accurately represented the data.

NVivo software was used to support data organization, coding, retrieval, and comparison. The software assisted in managing the interview corpus, creating code hierarchies, comparing patterns across participant roles, and storing analytic memos. However, interpretation remained the responsibility of the researchers. To enhance credibility, coding decisions were discussed among the research team, and disagreements were resolved through re-reading transcripts and refining category definitions. Dependability was supported through an audit trail consisting of interview guides, coding notes, memos, category development records, and analytic decisions. Confirmability was strengthened by reflexive memoing, and transferability was supported through thick description of the study context, participants, and findings.

3. Findings

The demographic characteristics of the participants showed that the study included a diverse group of professionals involved in large-scale engineering projects in Hungary. Of the 24 participants, 14 were men (58.3%) and 10 were women (41.7%). In terms of age, 6 participants (25.0%) were 30–39 years old, 10 participants (41.7%) were 40–49 years old, 6 participants (25.0%) were 50–59 years old, and 2 participants (8.3%) were 60 years or older. Regarding professional role, 6 participants (25.0%) were project managers or program directors, 5 (20.8%) were engineering or technical leads, 3 (12.5%) were procurement or contract managers, 4 (16.7%) were public authority or regulatory representatives, 3 (12.5%) were environmental and social impact specialists, and 3 (12.5%) were community or municipal liaison officers. Participants' professional experience ranged from 6 to 28 years: 4 participants (16.7%) had 5–9 years of experience, 8 (33.3%) had 10–14 years, 7 (29.2%) had 15–19 years, and 5 (20.8%) had 20 years or more. Their project backgrounds included transport infrastructure (n = 9, 37.5%), energy projects (n = 6, 25.0%), water and wastewater systems (n = 4, 16.7%), and

industrial or logistics facilities (n = 5, 20.8%). Geographically, participants were based in Budapest (n = 11), Pest County (n = 3), Győr-Moson-Sopron (n = 3), Hajdú-Bihar (n = 2), Csongrád-Csanád (n = 2), Baranya (n = 2), and Borsod-Abaúj-Zemplén (n = 1).

Dynamic stakeholder identification and prioritization. The first main category concerned the way project teams identify, classify, and reprioritize stakeholders throughout the project life cycle. Participants emphasized that stakeholder identification in large-scale engineering projects cannot be completed only at the beginning of the project because new actors, concerns, and sources of influence emerge as the project moves from planning to permitting, procurement, construction, and commissioning. Formal stakeholders such as clients, ministries, municipalities, regulators, engineering consultants, contractors, and operators were usually identified through project governance structures and contractual arrangements. However, informal or less visible stakeholders, including local residents, land users, professional associations, subcontractors, environmental groups, and media actors, were often identified later, usually after concerns or conflicts became visible. One participant explained, "At the beginning, the stakeholder list looks very official. Later you realize that the person who can stop the work is not always in the organogram" (P07). Participants described effective stakeholder prioritization as a combination of formal authority, technical relevance, local influence, urgency of concern, and potential to affect project continuity. Several participants noted that relying only on hierarchical authority was risky because local actors with limited formal power could still create delays through complaints, media attention, or political escalation. As one project manager stated, "A small municipality may look minor in the risk matrix, but if their residents feel ignored, the issue becomes national very quickly" (P02). This category shows that stakeholder engagement was experienced as a continuous sensemaking process in which project teams repeatedly interpreted who mattered, why they mattered, and how their influence changed over time.

Communication as a mechanism of alignment. The second main category referred to communication practices that supported or weakened stakeholder alignment. Participants consistently described communication as more than information transfer; it was a mechanism for building shared understanding among actors who often used different professional languages and evaluated project success through different criteria. Engineering teams tended to communicate through drawings, schedules, technical reports, and risk registers, while public authorities focused on compliance, municipalities focused on local disruption, contractors focused on deliverability, and communities focused on safety, access, noise, environmental impact, and compensation. Misalignment occurred when communication was too technical, too late, or too defensive. One engineering lead commented, "We sent the documentation, but sending documents is not the same as communicating. People wanted to understand what would change in their street, not read a technical annex" (P11). Participants identified early briefings, visual materials, regular coordination meetings, issue logs, bilingual or plain-language summaries, and named contact persons as useful practices. However,

communication was often reactive rather than proactive, especially when project teams were under schedule pressure. A public-sector participant stated, “Many problems came because communication started when the conflict was already active. At that point every message is interpreted as justification, not dialogue” (P18). Participants also emphasized the importance of internal communication among project organizations. Fragmented communication between designers, contractors, authorities, and client representatives often produced inconsistent messages to external stakeholders. Therefore, stakeholder engagement required internal alignment before external engagement could be credible.

Trust and legitimacy in contested project environments. The third main category concerned the role of trust and legitimacy in stakeholder engagement. Participants noted that large-scale engineering projects often enter environments where stakeholders already have expectations, fears, or previous negative experiences with public works, land acquisition, environmental permitting, or construction disruption. In such contexts, formal approval does not automatically create social acceptance. Participants distinguished between legal permission and practical legitimacy. Legal permission allowed the project to proceed, but practical legitimacy depended on whether stakeholders believed that project organizations were competent, honest, and responsive. One environmental specialist explained, “You can have every permit and still have no trust. The paper allows construction, but trust allows cooperation” (P14). Trust was built when project teams acknowledged uncertainty, responded to complaints, explained constraints honestly, and demonstrated that stakeholder input could influence practical decisions. Participants gave examples of modifying access roads, adjusting construction schedules, changing noise mitigation measures, or improving information channels after stakeholder feedback. Such adjustments were often small relative to the whole project budget, but they had symbolic importance because they showed that engagement was not merely ceremonial. Conversely, trust declined when stakeholders perceived decisions as already finalized before consultation. A municipal liaison officer stated, “People know when a meeting is only theatre. If everything is decided, calling it consultation damages trust more than saying directly what is fixed and what is open” (P21). This category indicates that legitimacy in large-scale engineering projects is produced through visible responsiveness, procedural fairness, and credible communication.

Institutional and contractual constraints on engagement. The fourth main category captured the structural constraints that limited stakeholder engagement even when professionals recognized its importance. Participants identified rigid procurement rules, fragmented contracts, political deadlines, funding requirements, permitting procedures, and unclear responsibility for stakeholder communication as recurring barriers. In many projects, stakeholder engagement was formally required but weakly integrated into project governance. Some participants explained that engagement responsibilities were divided among the client, consultant, contractor, municipality, and communication subcontractor, resulting in ambiguity about who had authority to respond to stakeholder concerns. A procurement

manager stated, “The contract says the contractor must manage communication, but the contractor cannot promise design changes, and the designer is no longer fully involved. So the stakeholder receives answers from people who cannot decide” (P09). Political and funding deadlines also created pressure to move quickly through consultation phases. Participants reported that engagement was sometimes treated as a procedural milestone rather than an ongoing project capability. This reduced learning because feedback collected during consultation was not always translated into design, scheduling, risk management, or compensation decisions. A regulatory participant observed, “The system is good at proving that consultation happened. It is less good at proving what changed because of consultation” (P16). Participants also noted that contractual fragmentation made it difficult to maintain continuity across project phases. Stakeholder knowledge collected during planning was not always transferred to construction teams, causing repeated mistakes and stakeholder fatigue. This category demonstrates that stakeholder engagement depends not only on professional intention but also on governance structures that define authority, accountability, and flexibility.

4. Discussion

The findings of this study show that stakeholder engagement in large-scale engineering projects is a dynamic, relational, and institutionally constrained process. The first main finding, dynamic stakeholder identification and prioritization, is strongly aligned with stakeholder theory and project stakeholder literature. Freeman’s (1984) stakeholder perspective emphasizes that organizations must consider multiple actors who influence or are influenced by organizational action, while Mitchell et al. (1997) explain that stakeholder salience depends on power, legitimacy, and urgency. The present study extends these ideas in the context of large-scale engineering projects by showing that stakeholder salience is not stable across the project life cycle. Participants repeatedly stated that the stakeholder list created at project initiation often failed to capture informal actors who later became influential. This supports Aaltonen’s (2011) argument that stakeholder analysis functions as an environmental interpretation process rather than a one-time classification exercise. It also aligns with Aaltonen and Kujala’s (2016) concept of the project stakeholder landscape, in which complexity, dynamism, uncertainty, and institutional context shape the stakeholder environment. In this study, professionals did not describe stakeholder identification as a purely technical mapping exercise; they described it as practical sensemaking under uncertainty. The finding is also consistent with Olander and Landin (2005), who emphasized that stakeholders can significantly influence construction project implementation, and with Olander’s (2007) view that stakeholder impact depends on both influence and position toward the project. The implication is that engineering project teams should not rely solely on early stakeholder registers. They need repeated stakeholder reviews at phase transitions, especially before permitting, procurement, construction mobilization, traffic changes, land access decisions, and commissioning.

The second finding, communication as a mechanism of alignment, reinforces the idea that stakeholder engagement requires translation across different professional and social worlds. Participants reported that engineers, regulators, municipalities, contractors, and community members often interpret the same project through different criteria. Technical documentation may satisfy formal requirements but fail to address the everyday concerns of affected stakeholders. This finding is consistent with Bourne and Walker's (2005) argument that stakeholder management requires not only identification and mapping but also relationship-oriented communication. It also corresponds with Cuppen et al. (2016), who found that stakeholders in large-scale energy infrastructure projects may hold different expectations about the purpose and quality of engagement. In the present study, communication failures emerged when project teams assumed that formal information provision was equivalent to meaningful communication. Participants emphasized plain-language explanation, visual tools, regular updates, named contact persons, and internal message alignment. This supports the broader project management view that stakeholder engagement is linked to productive involvement in decision-making and implementation rather than one-directional information delivery. The findings also show that external communication depends on internal coordination. When designers, contractors, clients, and public authorities deliver inconsistent messages, stakeholder trust declines. Therefore, communication should be treated as a project integration function, not merely as a public relations activity.

The third finding, trust and legitimacy in contested project environments, highlights the social and political dimensions of engineering project delivery. Participants distinguished between having legal permission and having practical legitimacy. This distinction is important because large-scale engineering projects can be formally approved but socially contested. Flyvbjerg et al. (2003) argued that major projects are vulnerable to strategic misrepresentation, underestimated risk, and weak accountability. Although the present study did not directly examine strategic misrepresentation, participants' accounts showed that stakeholders are sensitive to whether consultation is genuine or symbolic. When affected stakeholders perceive that decisions are already finalized, consultation may reduce rather than increase trust. This finding aligns with legitimacy-oriented approaches to stakeholder management, which emphasize that project acceptance depends on procedural fairness, responsiveness, and credibility. It also supports Lehtinen et al. (2019), who showed that engagement and disengagement of stakeholders in complex product systems are processual and shaped by practical rationales over time. In the present study, small adjustments to construction schedules, access routes, mitigation measures, or communication channels helped build trust because they demonstrated responsiveness. Thus, legitimacy was not produced only by large strategic decisions but also by everyday evidence that stakeholder input mattered. This suggests that project organizations should identify which elements of the project are fixed and which are negotiable, communicate this distinction clearly, and document how stakeholder input affects decisions.

The fourth finding, institutional and contractual constraints on engagement, shows that stakeholder engagement is shaped by governance architecture. Participants recognized the value of engagement but described barriers created by procurement systems, contract boundaries, political deadlines, funding requirements, and fragmented authority. This finding is consistent with Mok et al. (2015), who emphasized that stakeholder management in mega construction projects is influenced by national context and institutional conditions. It also corresponds with Flyvbjerg's (2014) broader analysis of megaprojects, which highlights that large projects are shaped by political, economic, technological, and institutional forces. In this study, engagement was sometimes treated as evidence of compliance rather than as a mechanism for learning and adaptation. Participants noted that project systems were often able to prove that consultation occurred, but less able to demonstrate how consultation influenced project decisions. This is a critical distinction. Compliance-based engagement may protect the project legally but may not reduce conflict, improve design, or build legitimacy. The findings also show that contractual fragmentation can interrupt stakeholder knowledge transfer. Information collected during planning may not reach construction teams, while contractors may be responsible for communication without having authority to change design or compensation decisions. This suggests that stakeholder engagement should be embedded in contracts, governance boards, risk registers, change-control systems, and phase-transition documentation. Engagement cannot be effective when responsibility is assigned without authority.

Overall, the study contributes to the literature by showing that stakeholder engagement in large-scale engineering projects is best understood as an adaptive project capability. It involves identifying and re-identifying stakeholders, translating technical information into meaningful communication, building legitimacy through responsiveness, and designing governance arrangements that allow stakeholder concerns to influence project decisions. The findings support previous research but also emphasize the lived tensions experienced by professionals in Hungary. Participants did not reject formal stakeholder tools; rather, they suggested that tools are insufficient unless combined with professional judgment, local knowledge, institutional coordination, and decision authority. Stakeholder registers, communication plans, and consultation records are necessary but not sufficient. Meaningful engagement requires continuity, transparency, and responsiveness across the project life cycle. This finding is especially relevant to large engineering projects because their long duration and institutional complexity create repeated opportunities for stakeholder expectations to shift. The study therefore supports a movement from stakeholder management as procedural control toward stakeholder engagement as relational governance.

The study has several limitations. First, the sample consisted of 24 professionals from Hungary, which provides rich contextual insight but limits transferability to other countries with different legal, political, procurement, and public consultation systems. Second, the study relied on semi-structured interviews, meaning that findings reflect participants'

accounts and interpretations rather than direct observation of stakeholder meetings, project documents, or community responses. Third, although the sample included multiple professional roles, it did not include all possible stakeholder groups, such as residents, landowners, activist organizations, or end users. Fourth, the study focused on professionals involved in large-scale engineering projects and therefore may underrepresent the perceptions of stakeholders who experienced engagement as insufficient or exclusionary. Finally, because large-scale projects vary considerably by sector, ownership model, funding structure, and public visibility, the findings should be interpreted as transferable concepts rather than universal claims.

Future research should examine stakeholder engagement from the perspectives of both project organizations and affected external stakeholders. Comparative studies across countries would be valuable for understanding how national institutions, procurement rules, and public participation traditions shape engagement practices. Longitudinal research could follow large engineering projects across planning, permitting, procurement, construction, and operation to examine how stakeholder priorities change over time. Future studies may also compare sectors such as transport, energy, water, and industrial infrastructure to identify sector-specific engagement challenges. Mixed-methods research could combine interviews, document analysis, meeting observation, and social network analysis to map how stakeholder influence develops across project phases. Further research should also examine digital stakeholder engagement tools, including online consultation platforms, geographic information systems, visual dashboards, and social media monitoring, while critically assessing whether these tools genuinely improve dialogue or simply accelerate information distribution.

In practice, project owners and engineering organizations should treat stakeholder engagement as a strategic governance function rather than a communication add-on. Stakeholder mapping should be updated at key project transitions, and informal stakeholders should be considered alongside formal authorities. Communication should be adapted to stakeholder needs, using plain language, visual materials, clear timelines, and accessible points of contact. Project teams should distinguish between negotiable and non-negotiable elements of the project to avoid symbolic consultation. Contracts should define not only who communicates with stakeholders but also who has authority to respond, modify, escalate, and document stakeholder-related decisions. Stakeholder knowledge should be transferred from planning to construction and operation teams through structured handover processes. Finally, project organizations should evaluate engagement quality not only by whether meetings were held, but by whether stakeholder input improved risk management, design decisions, mitigation measures, local coordination, and project legitimacy.

5. Conclusion

This qualitative study explored stakeholder engagement in large-scale engineering projects in Hungary. The findings show that stakeholder engagement is not a static procedural

requirement but a continuous and adaptive process shaped by technical complexity, institutional context, communication quality, trust, legitimacy, and contractual governance. Participants described effective engagement as beginning with dynamic stakeholder identification and prioritization, continuing through clear and credible communication, and becoming meaningful when stakeholder concerns influence practical project decisions. However, they also reported that engagement is often constrained by fragmented responsibilities, rigid contracts, political and funding pressures, and insufficient transfer of stakeholder knowledge across project phases.

The study contributes to project management and engineering governance literature by emphasizing stakeholder engagement as a relational capability embedded in project systems. Large-scale engineering projects require more than accurate designs, permits, and contracts; they require sustained interaction with the social and institutional environment in which the project is delivered. Stakeholders may support, resist, reinterpret, or reshape project implementation depending on whether they perceive the process as transparent, fair, responsive, and legitimate. Therefore, project organizations should move beyond compliance-based consultation and develop engagement systems that support continuous learning, trust-building, and adaptive decision-making. In large-scale engineering projects, stakeholder engagement is not peripheral to project success; it is one of the core mechanisms through which technical plans become socially and institutionally deliverable.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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