Exploring Professional Identity Formation Among Engineers Working in Multidisciplinary Environments

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Abstract

This study aimed to explore how engineers working in multidisciplinary organizational environments construct, negotiate, and sustain their professional identity through daily interactions with diverse occupational groups. A qualitative research design was used to examine engineers' lived and interpreted experiences of professional identity formation. The participants were 24 engineers working in multidisciplinary project environments in Tehran, Iran. Participants were selected through purposive sampling based on their direct involvement in projects requiring collaboration with professionals from different disciplinary backgrounds, including management, architecture, finance, information technology, environmental science, and regulatory affairs. Data were collected through semi-structured interviews lasting 45 to 75 minutes. Interviews continued until theoretical saturation was achieved. All interviews were audio-recorded with participants' consent, transcribed verbatim, and analyzed using thematic analysis. NVivo software was used to organize transcripts, assign codes, compare categories, and develop final themes. The analysis generated five main categories: negotiating technical expertise within collaborative work, translating engineering knowledge across disciplinary boundaries, seeking recognition and legitimacy in multidisciplinary teams, integrating ethical and social responsibility into engineering identity, and developing a hybrid professional self. Participants described professional identity formation as a dynamic process shaped not only by technical competence but also by communication, boundary work, organizational recognition, and the ability to align engineering judgment with broader social, economic, and environmental expectations. The findings suggest that engineers in multidisciplinary settings form their professional identities through continuous negotiation between disciplinary expertise and collaborative adaptability. Professional identity was strengthened when engineers experienced recognition, meaningful participation, ethical agency, and opportunities to translate technical knowledge for non-engineering stakeholders. Organizations should support identity development by creating inclusive project cultures, clarifying professional roles, and valuing both technical and relational dimensions of engineering practice.

Keywords: Professional identity formation; engineers; multidisciplinary teams; qualitative research; thematic analysis; Tehran; boundary crossing.

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1. Introduction

Professional identity formation has become a significant topic in contemporary organizational and professional studies because modern work increasingly requires individuals to define who they are professionally in complex, changing, and collaborative environments. Professional identity refers to the set of meanings, values, competencies, responsibilities, and social recognitions through which individuals understand themselves as members of a profession. It is not merely a static label attached to a job title; rather, it is an evolving process through which professionals interpret their work, internalize disciplinary expectations, negotiate organizational demands, and position themselves in relation to other occupational groups. Trede, Macklin, and Bridges (2012) emphasized that professional identity development is central to professional education and practice because it shapes how individuals make sense of their roles, ethical responsibilities, and future career trajectories. Similarly, Ibarra (1999) conceptualized professional identity as a process of experimentation, adaptation, and provisional self-construction through which individuals test possible professional selves in changing work contexts.

Engineering is a particularly important field in which to examine professional identity formation. Engineering has traditionally been associated with technical expertise, problem solving, rational analysis, design thinking, and responsibility for the safety and functionality of systems. However, engineering work has increasingly moved beyond narrowly technical tasks. Engineers now participate in multidisciplinary projects involving sustainability, digital transformation, urban development, healthcare technologies, organizational innovation, risk governance, and social impact assessment. In such environments, engineers must collaborate with managers, economists, architects, software developers, legal experts, policymakers, environmental specialists, and end users. This transformation complicates the meaning of being an engineer. The engineer is no longer only a technical specialist who solves bounded technical problems but also a boundary-spanning professional who must translate technical knowledge, negotiate priorities, communicate uncertainty, and contribute to decisions that have organizational and societal consequences.

Engineering identity research has shown that identification with engineering is shaped by competence, performance, recognition, interest, belonging, and participation in engineering communities. Godwin (2016) highlighted that engineering identity is not reducible to technical ability alone; rather, it includes the degree to which individuals see themselves and are recognized by others as engineers. Eliot and Turns (2011) similarly argued that engineering professional identity develops through processes of sense-making, reflection, and narrative construction. From this perspective, engineers develop identity not only by acquiring technical knowledge but also by interpreting experiences that confirm, challenge, or transform their understanding of what engineering means. This is especially relevant in multidisciplinary environments, where engineers frequently encounter alternative epistemologies, languages, values, and definitions of success.

Multidisciplinary work introduces both opportunities and tensions for professional identity formation. On the one hand, collaboration with other disciplines can broaden engineers' understanding of their role, increase awareness of social and organizational dimensions of engineering, and create opportunities for professional growth. On the other hand, it may generate identity ambiguity, status conflict, communication barriers, and perceived devaluation of technical expertise. Carlile (2004) argued that knowledge boundaries become more complex when actors from different domains must not only transfer information but also translate meanings and transform practices. In engineering projects, such boundaries may appear when technical specifications must be explained to financial managers, when safety concerns conflict with cost pressures, or when environmental requirements challenge conventional design assumptions. These situations require engineers to engage in boundary work, translating disciplinary knowledge into forms that can be understood and used by others.

Boundary crossing is not only a knowledge process but also an identity process. Akkerman and Bakker (2011) described boundaries as sociocultural differences that create discontinuities in action and interaction but also provide opportunities for learning. When engineers cross boundaries between technical and non-technical communities, they may become more aware of what distinguishes their professional worldview. They may also develop hybrid forms of identity that integrate engineering expertise with managerial, communicative, ethical, or interdisciplinary capacities. Bechky (2003) showed that occupational communities often interpret the same work object differently, and that shared understanding emerges through situated interaction. This insight is highly applicable to engineers working in multidisciplinary environments, where professional identity is shaped through daily negotiations over meaning, authority, evidence, and responsibility.

The social recognition of engineering expertise is another important factor in identity formation. Professional identity is strengthened when individuals feel that their expertise is acknowledged by colleagues, supervisors, clients, and other stakeholders. Conversely, identity strain may arise when engineers feel that technical judgment is ignored, simplified, or subordinated to short-term organizational priorities. Dutton, Dukerich, and Harquail (1994) argued that organizational identification is influenced by how individuals perceive the image and value of their organization and their role within it. For engineers, professional identity may therefore be affected by whether the organization treats engineering knowledge as a core strategic resource or as a merely operational function. In multidisciplinary projects, recognition becomes more complex because legitimacy must often be negotiated across professional groups with different criteria of value.

The relational and communicative dimensions of engineering work have also received increasing scholarly attention. Faulkner (2007) challenged the narrow view of engineering as purely technical by showing that engineering identities are shaped by the relationship between “nuts and bolts” and “people.” Engineering practice involves not only technical artifacts but also communication, coordination, negotiation, and social judgment. Yet engineers may experience tension when relational work is undervalued or seen as secondary to “real” engineering. This tension can be intensified in multidisciplinary environments, where engineers must repeatedly explain, defend, or adapt technical perspectives in relation to non-engineering priorities. As a result, engineers may reconstruct their identity from being only technical problem solvers toward becoming integrative professionals capable of linking technology, people, systems, and strategy.

Professional identity formation is also connected to ethical responsibility. Engineering decisions can affect public safety, environmental sustainability, economic development, and social welfare. In multidisciplinary environments, ethical responsibility may become more visible because engineers encounter competing demands from clients, managers, regulators, and communities. Professional identity is therefore shaped by how engineers interpret their obligation to protect technical standards, communicate risks, and resist decisions that may compromise safety or sustainability. Pratt, Rockmann, and Kaufmann (2006) emphasized that professional identity is formed through cycles of work and identity learning, particularly when individuals experience discrepancies between expected and actual professional roles. For engineers, such discrepancies may occur when the ethical ideals of the profession conflict with organizational or commercial pressures.

Despite the growing literature on engineering identity, much existing research has focused on students, early professional development, or educational settings. Less attention has been paid to practicing engineers who work in complex multidisciplinary organizational environments, particularly in non-Western urban contexts such as Tehran. Tehran provides a relevant context because it contains diverse engineering-intensive sectors, including construction, energy, transportation, information technology, manufacturing, environmental consulting, and urban infrastructure. Engineers in these sectors frequently work with multidisciplinary teams and must navigate technical, regulatory, economic, and social expectations. Understanding their professional identity formation can contribute to engineering management, organizational development, human resource practices, and professional education.

This study addresses this gap by exploring how engineers working in multidisciplinary environments in Tehran construct and negotiate their professional identity. Rather than treating professional identity as a fixed psychological attribute, the study approaches it as a dynamic, relational, and context-dependent process. The central assumption is that engineers’ professional identities are shaped through interaction with other disciplines, organizational structures, project demands, and broader social expectations. By using qualitative interviews, the study seeks to capture the meanings engineers attach to their professional experiences, the tensions they encounter, and the strategies they use to maintain a coherent sense of self in multidisciplinary work.

Therefore, the aim of this study was to explore professional identity formation among engineers working in multidisciplinary environments in Tehran.

2. Methods and Materials

This study used a qualitative research design to explore how engineers experience and interpret professional identity formation in multidisciplinary work environments. A qualitative approach was appropriate because the purpose of the study was not to measure predefined variables but to understand the meanings, tensions, and interpretive processes through which engineers construct their professional selves. The study was guided by an interpretive paradigm, assuming that professional identity is formed through social interaction, workplace experience, and individual meaning-making.

The participants were 24 engineers working in Tehran, Iran. They were selected using purposive sampling. Inclusion criteria were: having an academic degree in an engineering field, having at least three years of professional work experience, being employed in a multidisciplinary work environment, and having direct experience collaborating with professionals from at least two non-engineering or different engineering disciplines. Participants were recruited from engineering consulting firms, construction and infrastructure companies, technology-based firms, energy-related organizations, manufacturing companies, and urban development projects.

The final sample consisted of 16 men and 8 women. Participants' ages ranged from 27 to 49 years. Their professional experience ranged from 4 to 23 years. Their fields included civil engineering, mechanical engineering, electrical engineering, industrial engineering, software engineering, chemical engineering, environmental engineering, and biomedical engineering. Interviews continued until theoretical saturation was reached, meaning that no substantially new codes, categories, or conceptual insights emerged from additional interviews. Saturation was observed after the twenty-first interview, and three additional interviews were conducted to confirm the stability and adequacy of the categories.

Data were collected through semi-structured interviews. Semi-structured interviewing was selected because it allowed the researcher to explore key topics consistently while also giving participants freedom to describe their experiences in detail. The interview guide included open-ended questions about participants' understanding of being an engineer, their experiences of working in multidisciplinary teams, moments that strengthened or challenged their professional identity, interactions with non-engineering professionals, organizational recognition, ethical tensions, and changes in their understanding of engineering over time.

Examples of interview questions included: "How do you describe yourself professionally as an engineer?" "Can you describe a situation in which working with other disciplines changed your understanding of your engineering role?" "What challenges do you experience when explaining engineering knowledge to non-engineers?" "When do you feel most recognized as an engineer in multidisciplinary projects?" and "How has your professional identity changed since entering multidisciplinary work?"

The interviews lasted between 45 and 75 minutes. All interviews were conducted in a private and comfortable setting or through secure online communication, depending on participant preference. With participants' consent, interviews were audio-recorded and later transcribed verbatim. Field notes were written after each interview to capture contextual observations, initial interpretations, and emerging analytic ideas.

Data were analyzed using thematic analysis. The analysis followed an iterative process involving familiarization with the data, initial coding, searching for themes, reviewing themes, defining and naming themes, and producing the final report. First, the researcher read each transcript several times to gain an overall understanding of participants' experiences. Second, meaningful units related to professional identity formation were coded. Third, codes were compared across interviews to identify similarities, differences, and recurring patterns. Fourth, related codes were grouped into subcategories and then organized into broader main categories.

NVivo software was used to manage and analyze the qualitative data. The software supported systematic organization of transcripts, coding, memo writing, retrieval of coded segments, and comparison of categories across participants. However, the interpretation of meanings and final theme development remained the responsibility of the researcher. Coding was conducted inductively, meaning that categories were developed from the data rather than imposed in advance.

To enhance trustworthiness, several strategies were used. Credibility was supported through prolonged engagement with the data, member checking with selected participants, and use of direct quotations. Dependability was strengthened through documentation of analytic decisions, coding steps, and category development. Confirmability was supported by maintaining reflexive memos to identify possible researcher assumptions. Transferability was enhanced by providing detailed descriptions of participants, organizational contexts, and the analytic process.

Participants were informed about the purpose of the study, voluntary participation, confidentiality, and their right to withdraw at any stage. Written or recorded informed consent was obtained before each interview. Participants' names and organizational identities were replaced with codes. All audio files and transcripts were stored securely and used only for research purposes.

3. Findings

A total of 24 engineers participated in the study. Sixteen participants were male (66.7%) and eight were female (33.3%). Participants' ages ranged from 27 to 49 years, with most participants between 31 and 40 years old (n = 13, 54.2%). Regarding educational level, 9 participants held a bachelor's degree (37.5%), 13 held a master's degree (54.2%), and 2 held a doctoral degree (8.3%). In terms of engineering discipline, participants included civil engineers (n = 5, 20.8%), mechanical engineers (n = 4, 16.7%), electrical engineers (n = 4, 16.7%), industrial engineers (n = 3, 12.5%), software engineers (n = 3, 12.5%), chemical engineers (n = 2, 8.3%), environmental engineers (n = 2, 8.3%), and biomedical engineers (n = 1, 4.2%). Their work experience ranged from 4 to 23 years; 7 participants had 4–7 years of experience (29.2%), 10 had 8–14 years (41.7%), and 7 had more than 15 years (29.2%). All participants worked in Tehran-based multidisciplinary environments involving collaboration with professionals from management, finance, architecture, environmental assessment, information technology, legal affairs, policy, or client organizations.

The first main category reflected how participants understood professional identity through the negotiation of technical expertise in multidisciplinary projects. Many engineers stated that their initial sense of professional identity was strongly tied to technical knowledge, calculation, design accuracy, standards, and problem-solving ability. However, multidisciplinary work required them to redefine expertise as something that must be communicated, defended, and integrated with other forms of knowledge. Participants explained that being an engineer in such environments meant more than "knowing the correct technical answer"; it also involved understanding how that answer fits within economic, managerial, environmental, and user-related constraints. One participant stated, "At university, I thought being an engineer meant solving the technical problem. In real projects, especially with managers and financial teams, I learned that my identity depends on whether I can make the technical solution meaningful for others" (P6, civil engineer). Another participant explained, "Sometimes the engineering answer is clear, but the project answer is not clear. I have to keep my engineering standards but also understand why other people see the problem differently" (P14, mechanical engineer). This category shows that professional identity was formed through a continuous balance between maintaining disciplinary authority and adapting to collaborative project realities.

The second main category concerned the role of translation and boundary crossing in identity formation. Participants frequently described themselves as translators between technical and non-technical worlds. They reported that multidisciplinary environments required them to convert formulas, drawings, risk estimates, technical standards, and design limitations into language understandable to managers, clients, policymakers, or other specialists. This translation work was not seen as secondary; rather, it became central to how participants defined professional maturity. A software engineer noted, "When I explain a system architecture to a business team, I am not reducing engineering; I am making it usable. That is when I feel I am doing real engineering" (P11, software engineer). Another participant said, "In environmental projects, I speak with civil engineers, municipality people, lawyers, and sometimes local stakeholders. My engineering identity has become more interdisciplinary because I must build bridges between these languages" (P19, environmental engineer). Participants also noted that poor translation could lead to misunderstanding, unrealistic expectations, and conflict. Therefore, the ability to communicate across boundaries became a key component of professional identity formation.

The third main category described the importance of recognition and legitimacy. Participants stated that their professional identity was strengthened when their technical judgment was respected by other team members and decision-makers. Recognition was not limited to formal titles or organizational position; it also involved being invited into early decision-making, having technical warnings taken seriously, and being trusted to define quality criteria. Some participants reported positive experiences in which multidisciplinary collaboration increased their status because other professionals recognized the value of engineering thinking. However, others described frustration when engineering expertise was treated as a technical service rather than a strategic contribution. One participant stated, "When they call the engineer after all important decisions are already made, you feel like a tool, not a professional. But when they involve you from the beginning, you feel your identity is respected" (P3, electrical engineer). Another participant explained, "My strongest professional moments are when a non-engineering manager says, 'We need your judgment before we decide.' That recognition makes me feel that engineering has a real voice in the organization" (P21, industrial engineer). The findings suggest that professional identity formation depends partly on whether multidisciplinary teams create space for engineering legitimacy.

The fourth main category showed that multidisciplinary work expanded participants' understanding of engineering responsibility. Participants explained that exposure to environmental, financial, legal, safety, and social perspectives made them more aware of the consequences of engineering decisions. Several participants described identity-shaping moments in which they had to defend safety standards, resist cost-cutting pressures, or communicate long-term risks. These experiences reinforced the idea that being an engineer involves ethical responsibility beyond technical performance. One participant stated, "A design is not only numbers. If something fails, people may be harmed. In multidisciplinary meetings, I sometimes feel pressure to reduce cost, but my identity as an engineer is connected to saying no when safety is at risk" (P9, structural engineer). Another participant noted, "Working with environmental experts changed me. I used to think mainly about efficiency, but now I think about sustainability and public impact. It made my engineering identity wider" (P17, chemical engineer). This category indicates that engineers' professional identity develops through engagement with broader consequences of technical decisions.

The fifth main category reflected the emergence of a hybrid professional identity. Participants described changes in how they saw themselves over time. Early in their careers, many defined themselves primarily by discipline, such as civil engineer, mechanical engineer, or software engineer. After years of multidisciplinary work, they increasingly described themselves through combined roles such as "technical coordinator," "systems thinker," "project interpreter," "engineering strategist," or "problem integrator." This did not mean abandoning engineering identity; rather, participants felt that their engineering identity became more complex and mature. One participant said, “I am still an engineer, but not only in the narrow sense. I know how to connect design, cost, people, and implementation. Maybe I became a bridge person” (P8, industrial engineer). Another participant explained, “Multidisciplinary work made me less defensive and more confident. I do not need to prove that engineering is separate from other fields. I can keep my engineering core and still learn from others” (P23, biomedical engineer). This category suggests that professional identity formation in multidisciplinary environments involves movement from a purely discipline-based identity toward a hybrid identity that combines technical depth with collaborative breadth.

4. Discussion

The aim of this study was to explore professional identity formation among engineers working in multidisciplinary environments in Tehran. The findings showed that engineers' professional identities were constructed through five interconnected processes: negotiating technical expertise within collaborative work, translating engineering knowledge across disciplinary boundaries, seeking recognition and legitimacy, integrating ethical and social responsibility, and developing a hybrid professional self. Overall, the results indicate that professional identity formation among engineers is not a linear process of simply internalizing disciplinary norms. Rather, it is a dynamic and relational process shaped by interaction with other professions, organizational expectations, project constraints, ethical responsibilities, and changing definitions of engineering work.

The first finding showed that engineers negotiated their technical expertise within collaborative work. Participants initially associated engineering identity with technical competence, precision, calculation, design, and problem solving, but multidisciplinary environments required them to reinterpret expertise as an integrative and communicative capacity. This finding is consistent with Trede et al. (2012), who argued that professional identity involves more than the acquisition of technical knowledge; it includes learning how to think, act, and make judgments as a professional within real practice contexts. The finding also aligns with Eliot and Turns (2011), who emphasized that engineering identity develops through sense-making processes in which individuals interpret the meaning of engineering experiences. In the present study, engineers' identities became more complex as they realized that technical correctness alone was insufficient in multidisciplinary projects. They had to connect technical solutions with organizational feasibility, economic constraints, user needs, and regulatory expectations.

The second finding highlighted the importance of translating engineering knowledge across disciplinary boundaries. Participants described themselves as interpreters or boundary spanners who transformed technical information into shared project understanding. This finding strongly aligns with Carlile's (2004) framework of knowledge boundaries, which distinguishes between transferring, translating, and transforming knowledge across domains.

In multidisciplinary engineering work, knowledge boundaries were not only informational but also semantic and pragmatic. Engineers needed to explain what technical data meant, why it mattered, and how it should influence decisions. This finding also supports Akkerman and Bakker's (2011) view that boundary crossing can generate learning through identification, coordination, reflection, and transformation. Participants' professional identities were strengthened when they learned to move between disciplinary languages without losing their engineering core. Translation therefore emerged as a central identity practice rather than a peripheral communication skill.

The third finding concerned recognition and legitimacy in multidisciplinary teams. Participants reported that professional identity was strengthened when their technical judgment was respected and weakened when engineering input was delayed, ignored, or treated as merely operational. This finding is consistent with Godwin's (2016) emphasis on recognition as a key dimension of engineering identity. Engineers do not develop identity only by seeing themselves as competent; they also need others to recognize them as legitimate engineering professionals. The finding also connects with Dutton et al. (1994), who argued that identification is shaped by perceived organizational value and image. When organizations positioned engineering as strategically important, participants experienced stronger professional confidence. Conversely, when engineering expertise was marginalized, participants experienced identity strain. This suggests that professional identity formation is not only an individual psychological process but also an organizational and relational phenomenon.

The fourth finding showed that engineers integrated ethical and social responsibility into their professional identity. Participants described situations in which they had to defend safety, sustainability, quality, or long-term public interest against cost or time pressures. These moments were central to how they defined themselves as engineers. This finding aligns with Pratt et al. (2006), who showed that professional identity develops through work-identity learning cycles, particularly when professionals encounter tensions between ideal and actual practice. For engineers, ethical tensions in multidisciplinary environments forced reflection on what responsibilities are non-negotiable. The finding also supports Faulkner's (2007) argument that engineering identity should not be understood narrowly as technical work detached from people and social consequences. In this study, engineers' identities expanded when they recognized that engineering decisions affect safety, sustainability, and public welfare.

The fifth finding revealed the development of a hybrid professional self. Participants did not abandon their engineering identity; rather, they reconstructed it by combining technical depth with collaborative, communicative, strategic, and ethical capacities. This finding supports Ibarra's (1999) concept of provisional selves, according to which professionals experiment with and adapt possible identities in changing work contexts. It also aligns with Wenger's (1998) theory of communities of practice, which suggests that identity develops through participation in social practices. Multidisciplinary environments exposed engineers to multiple communities of practice, requiring them to maintain disciplinary belonging while also participating in broader project communities. The resulting identity was hybrid: engineers continued to value technical expertise but increasingly understood themselves as integrators, translators, coordinators, and systems thinkers.

The findings also extend previous research by showing how multidisciplinary environments reshape professional identity among practicing engineers in Tehran. Much engineering identity literature has focused on students or educational contexts. While this work is valuable, practicing engineers face different identity challenges, including organizational politics, client demands, project risks, professional hierarchy, and interdepartmental negotiation. The present findings suggest that professional identity formation continues throughout the career and may become especially active when engineers work across disciplinary boundaries. This supports the argument that identity formation is not completed at graduation or professional entry but continues through workplace participation and reflection.

Another important contribution of the study is its emphasis on identity tension. Participants experienced tension between technical standards and organizational constraints, disciplinary authority and collaborative flexibility, professional autonomy and managerial control, and engineering ideals and project realities. These tensions were not simply negative; they often stimulated identity development. Engineers became more reflective about what aspects of their professional role were essential and what aspects could be adapted. This finding corresponds with boundary-crossing literature, which suggests that discontinuities between communities can become resources for learning (Akkerman & Bakker, 2011). In the present study, multidisciplinary tension encouraged engineers to clarify their values, improve communication, and develop broader professional identities.

The study also has implications for engineering management. If professional identity is shaped by recognition, participation, and boundary-crossing opportunities, then organizations should not treat identity development as an individual matter alone. Project structures, leadership behavior, communication norms, and decision-making processes can either support or undermine engineers' professional identity. Nembhard and Edmondson (2006) showed that inclusive leadership can reduce the negative effects of status differences and support psychological safety in cross-disciplinary teams. In the present study, engineers felt more professionally secure when multidisciplinary teams created space for open technical discussion and early engineering involvement. Therefore, inclusive project leadership may be essential for sustaining strong engineering identity in multidisciplinary settings.

The findings further suggest that engineering education and professional development should prepare engineers for multidisciplinary identity work. Technical knowledge remains essential, but engineers also need preparation in communication, ethical reasoning, stakeholder engagement, systems thinking, and reflective practice. The participants' experiences showed that engineers often learn these capacities informally after entering the workplace. However, if professional programs explicitly address identity formation and multidisciplinary collaboration, engineers may be better prepared to navigate complex work environments. This is consistent with Trede et al. (2012), who emphasized the role of higher education in supporting professional identity development, and with Eliot and Turns (2011), who highlighted reflective sense-making as a mechanism for engineering identity formation.

This study had several limitations. First, the participants were selected from Tehran-based organizations; therefore, the findings may not fully represent engineers working in other cities, rural contexts, or international environments. Second, the study used only semi-structured interviews, which provided rich self-reported accounts but did not include direct observation of multidisciplinary meetings or project interactions. Third, although the sample included engineers from different fields, some engineering disciplines were represented by only a small number of participants. Fourth, professional identity is a dynamic process, but the study captured participants' experiences at one point in time. A longitudinal design could provide deeper insight into how identity formation changes across career stages and project experiences.

Future research should examine professional identity formation among engineers using longitudinal qualitative designs to understand how identity changes over time. Comparative studies across different cities, industries, and national contexts could also clarify how organizational culture and professional systems shape engineering identity. Future studies may combine interviews with workplace observations, reflective diaries, or focus groups to capture identity formation as it occurs in real interaction. Quantitative or mixed-methods studies could also test relationships between multidisciplinary collaboration, recognition, psychological safety, ethical climate, and strength of engineering identity. In addition, future research should explore identity formation among women engineers, early-career engineers, senior engineering managers, and engineers working in digital transformation or sustainability-focused projects.

Organizations should recognize that engineers' professional identity is strengthened when their expertise is included early in decision-making and when technical judgment is respected in multidisciplinary projects. Project managers should create inclusive environments where engineers can explain risks, challenge unrealistic assumptions, and contribute strategically rather than only operationally. Engineering firms should provide professional development programs focused on interdisciplinary communication, ethical decision-making, stakeholder negotiation, and systems thinking. Mentoring programs can also help younger engineers understand how to maintain technical integrity while adapting to multidisciplinary work. Finally, organizations should value engineers not only as technical specialists but also as boundary-spanning professionals who connect technology, people, strategy, and social responsibility.

5. Conclusion

This study explored professional identity formation among engineers working in multidisciplinary environments in Tehran. The findings showed that engineering identity is shaped through ongoing negotiation between technical expertise and collaborative practice. Participants formed their professional identities by defending technical standards, translating engineering knowledge, seeking recognition, engaging with ethical responsibility, and developing hybrid professional selves. Multidisciplinary environments created challenges, including communication barriers, role ambiguity, and status tensions, but they also provided opportunities for identity expansion and professional growth.

The study concludes that professional identity among engineers is not fixed or limited to disciplinary training. It is continuously reconstructed through workplace participation, interaction with other professions, organizational recognition, and reflection on the broader consequences of engineering work. Engineers in multidisciplinary environments become more than technical problem solvers; they become translators, integrators, ethical agents, and systems-oriented professionals. Supporting this identity formation requires organizations to create inclusive, respectful, and reflective multidisciplinary cultures in which engineering expertise is valued as both technically essential and socially consequential.

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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