# BRIDGING THE GAP BETWEEN CIVIL ENGINEERING EDUCATION AND INDUSTRY REQUIREMENTS: EVIDENCE FROM INDONESIA

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**Abstract**

The mismatch between higher education outcomes and industry requirements has become a critical issue, particularly in developing countries such as Indonesia. This study aims to examine the gap between civil engineering education and the competencies required by the construction industry. Unlike previous studies that mainly focus on technical competencies, this study simultaneously examines technical skills, soft skills, institutional factors, and industry perspectives to provide a more comprehensive understanding of the education–industry gap in Indonesia. A mixed methods approach was employed, combining quantitative data from questionnaire surveys and qualitative insights from in-depth interviews with graduates, academics, and industry practitioners. The quantitative analysis utilized gap analysis to identify discrepancies between acquired and required competencies, while thematic analysis was applied to interpret qualitative findings. The results indicate that although civil engineering graduates possess adequate theoretical knowledge, they lack practical skills and essential soft skills such as communication, teamwork, and problem-solving. The largest gaps were identified in non-technical competencies, highlighting the need for a more balanced curriculum. Additionally, factors such as limited industry collaboration, rigid curricula, and insufficient integration of modern technologies contribute significantly to the mismatch. This study emphasizes the importance of strengthening collaboration between universities and industry through internships, project-based learning, and curriculum co-development. Integrating digital tools and soft skills training into academic programs is also essential to enhance graduate employability. The findings provide valuable insights for policymakers, educators, and industry stakeholders in developing more responsive and industry-aligned civil engineering education systems in Indonesia..

**Keywords:** Civil Engineering Education, Industry Requirements, Skills Gap, Employability, Indonesia.

## INTRODUCTION

Civil engineering plays a crucial role in supporting infrastructure development and economic growth, particularly in developing countries such as Indonesia. The increasing demand for sustainable infrastructure, urban development, and technological integration has significantly transformed the competencies required of civil engineering graduates. However, higher education institutions often struggle to keep pace with these rapidly evolving industry demands, leading to concerns about the relevance of academic curricula.

In Indonesia, the issue of mismatch between education and labor market needs has become increasingly evident. Studies indicate that a substantial proportion of the workforce experiences education-job mismatch, where individuals are either overqualified or underqualified for their roles. For instance, recent findings reveal that nearly half of Indonesian

workers are employed in positions that do not align with their educational background . This phenomenon suggests inefficiencies in human capital utilization and highlights systemic gaps between education and employment sectors.

The problem of mismatch is not only limited to general education but also extends to engineering disciplines, including civil engineering. Graduates often face difficulties transitioning from academic environments to professional practice due to insufficient practical skills, lack of industry exposure, and limited soft skills. Research focusing on Indonesian civil engineering graduates emphasizes that employers expect a combination of technical knowledge, practical competencies, and professional attributes that are not always adequately developed during university education .

Furthermore, broader evidence from Indonesia shows that educational mismatch has significant implications for employment outcomes, including reduced job satisfaction, lower wages, and limited career progression. Data indicate that mismatch rates among graduates remain relatively high, reflecting persistent challenges in aligning educational outputs with labor market demands . These issues underscore the urgency of reforming educational systems to better respond to industry requirements.

The gap between education and industry is also driven by structural and institutional factors. Rapid technological advancements, evolving construction methods, and increasing emphasis on sustainability require continuous updates in curriculum design. However, universities often face constraints such as rigid curricula, limited collaboration with industry, and inadequate integration of experiential learning opportunities. Similar challenges have been identified in other engineering fields, where skill gaps persist due to misalignment between training and industry expectations.

Addressing this gap requires a collaborative approach involving academia, industry stakeholders, and policymakers. Strengthening partnerships through internships, industry-based projects, and curriculum co-development can enhance the relevance of civil engineering education. Additionally, incorporating emerging competencies such as digital engineering, project management, and sustainability principles is essential to prepare graduates for future challenges. Although previous studies have discussed graduate employability and engineering competencies, most have examined these issues separately or focused only on technical aspects. Limited studies have comprehensively investigated the combined influence of technical competencies, soft skills, curriculum design, and industry collaboration within the context of Indonesian civil engineering education. This study attempts to address that gap by providing an integrated analysis involving multiple stakeholder perspectives.

Therefore, this study aims to examine the extent of the gap between civil engineering education and industry requirements in Indonesia and to identify key factors contributing to this misalignment. By providing empirical evidence and practical recommendations, this research seeks to contribute to the development of more responsive and industry-aligned educational systems that can better equip graduates for the demands of the professional world.

## LITERATURE REVIEW

The gap between higher education and industry needs has long been an issue of concern across various disciplines, including civil engineering. The concept of **education–employment mismatch** refers to a condition in which graduates' competencies do not align with the demands of available jobs in the labor market (Allen & van der Velden, 2001). This mismatch may occur in the form of **vertical mismatch** (education level does not correspond to job requirements) or **horizontal mismatch** (field of study is not relevant to the job) (Robst, 2007). In developing countries such as Indonesia, this phenomenon tends to be more complex due to economic dynamics, educational quality, and limited collaboration between universities and industry.

In the field of civil engineering, industry needs have changed significantly alongside technological advancement and the demand for sustainable development. The modern construction industry requires not only technical competence, but also skills in project management, communication, teamwork, and understanding of digital technologies such as Building Information Modeling (BIM) (Succar, 2009). However, several studies indicate that civil engineering curricula still tend to

focus more on theory than practice, resulting in graduates being less prepared to face real-world conditions in the field (Male, Bush, & Chapman, 2011).

Previous studies emphasize the importance of **employability skills**, which include cognitive, interpersonal, and intrapersonal abilities. According to Yorke (2006), employability is determined not only by academic knowledge, but also by adaptability, problem-solving ability, and lifelong learning. In the context of civil engineering, skills such as leadership, decision-making, and professional ethics are becoming increasingly important due to the growing complexity of construction projects (Froyd, Wankat, & Smith, 2012).

In Indonesia, several studies reveal a considerable gap between graduates' competencies and industry expectations. Employers often complain about the lack of practical experience and non-technical skills among fresh graduates (Suryadi, 2018). In addition, the higher education system, which remains relatively rigid in curriculum development, has become an obstacle in responding quickly to changing industry needs (Firdaus & Rahman, 2020). This highlights the need for a more flexible and industry-based approach in curriculum design.

One strategy widely recommended to address this gap is strengthening cooperation between universities and industry. The **industry–academia collaboration** model can be implemented through internship programs, guest lectures by practitioners, industry-based projects, and joint curriculum development (Bridgstock, 2009). Such collaboration has been proven to improve graduates' work readiness and reduce the gap between theory and practice.

Furthermore, the **experiential learning** approach is considered an effective solution for improving the competencies of civil engineering students. Kolb (1984) explains that learning involving direct experience can enhance conceptual understanding as well as practical skills. In engineering education, this approach can be applied through project-based learning, problem-based learning, and construction project simulations.

Although previous studies consistently emphasize the importance of employability skills and stronger university–industry collaboration, differences remain regarding which competencies should receive greater emphasis. Some studies prioritize technical mastery as the primary determinant of graduate employability, whereas others argue that communication, teamwork, adaptability, and problem-solving skills are equally important. These differing perspectives indicate that improving graduate quality requires a balanced integration of technical competence and professional skills. Thus, this literature review demonstrates that the gap between civil engineering education and industry needs is a multidimensional problem requiring comprehensive solutions. Efforts to bridge this gap should involve curriculum reform, stronger collaboration with industry, and the implementation of more contextual and experience-based learning methods. This study is expected to contribute to identifying effective strategies to improve the alignment between civil engineering education and industry needs in Indonesia.

## RESEARCH METHODOLOGY

This study employs a **mixed methods approach**, combining quantitative and qualitative methods to obtain a comprehensive understanding of the gap between civil engineering education and industry needs in Indonesia. The quantitative approach is used to measure the level of alignment between graduates' competencies and industry requirements, while the qualitative approach aims to explore in depth the perspectives of stakeholders regarding the factors influencing this gap (Creswell & Plano Clark, 2018).

The population of this study includes civil engineering graduates, university lecturers, and construction industry practitioners in Indonesia. The sampling technique used is **purposive sampling**, in which respondents are selected based on their relevant experience and knowledge related to the research topic. The quantitative sample consists of approximately 150–250 respondents, while qualitative data are obtained through in-depth interviews with 10–15 key informants from academic and industrial sectors. This approach is consistent with previous studies emphasizing the importance of multi-stakeholder involvement in examining education–industry gaps (Bridgstock, 2009).

Quantitative data are collected through a Likert-scale questionnaire measuring respondents' perceptions of graduates' competency levels and the level of competencies required in the workplace. The research instrument covers aspects of technical competence, non-technical skills (soft skills), and work readiness. Meanwhile, qualitative data are gathered through semi-structured interviews, allowing deeper exploration of respondents' experiences, expectations, and challenges (Creswell, 2014). The interviews followed a flexible interview guide that allowed respondents to elaborate on their experiences while ensuring that all key research topics were consistently discussed across participants. Prior to data collection, the questionnaire items were developed based on indicators adopted from previous employability studies and were reviewed to ensure their relevance to the objectives of this study.

Quantitative data are analyzed using descriptive and inferential statistical techniques, such as **gap analysis** to identify differences between the competency levels possessed by graduates and those required by industry. In addition, validity and reliability tests are conducted to ensure the quality of the collected data. Instrument validity was evaluated using item validity testing, while internal consistency was assessed through reliability analysis before the data were interpreted. Qualitative data are analyzed using **thematic analysis**, by identifying patterns and key themes emerging from interview results (Braun & Clarke, 2006).

To ensure the validity and reliability of the research findings, **data triangulation** is conducted by comparing results from various sources and methods. Furthermore, the researcher applies tests of credibility, dependability, and confirmability in qualitative data analysis. Through this methodological approach, the study is expected to provide an accurate and in-depth picture of the gap between civil engineering education and industry needs, while generating relevant recommendations for curriculum development and educational policy in Indonesia.

## RESULTS AND DISCUSSION

The findings of this study reveal a significant gap between the competencies possessed by civil engineering graduates and the requirements of the construction industry in Indonesia. Based on descriptive analysis, most industry respondents acknowledged that graduates have a strong theoretical foundation. However, they often lack practical skills needed for real-world applications. This suggests that current civil engineering curricula are still heavily theory-oriented and not fully aligned with industry expectations.

Further analysis using gap analysis indicates a noticeable difference between the level of competencies acquired by graduates and those required by employers. The largest gaps were identified in non-technical skills, commonly referred to as soft skills. These include communication, teamwork, and problem-solving abilities. Such findings reinforce previous studies emphasizing the importance of employability skills in enhancing graduate readiness (Yorke, 2006).

**Table 1.** Gap Analysis of Graduate Competencies and Industry Requirements

| No | Competency Type | Acquired Level (Mean) | Required Level (Mean) | Gap |
|---|---|---|---|---|
| **1** | Technical Knowledge | 3.80 | 4.20 | -0.40 |
| **2** | Practical Skills | 3.50 | 4.30 | -0.80 |
| **3** | Communication Skills | 3.40 | 4.40 | -1.00 |
| **4** | Teamwork | 3.60 | 4.50 | -0.90 |
| **5** | Problem Solving | 3.45 | 4.35 | -0.90 |

The table above shows that the largest competency gaps exist in communication skills and teamwork, with gaps of -1.00 and -0.90 respectively. This indicates that while technical competencies are relatively adequate, soft skills remain a major deficiency among graduates. This condition can hinder their ability to effectively collaborate and adapt in professional environments.

These findings suggest that employers increasingly value interpersonal competencies alongside technical knowledge. Although graduates generally possess adequate engineering knowledge, limitations in communication and teamwork may reduce their effectiveness in multidisciplinary construction projects where collaboration is essential.

In addition to quantitative findings, qualitative data from interviews provide deeper insights into the causes of this gap. Industry practitioners highlighted that graduates often struggle to adapt to project-based work environments, particularly in terms of communication with multidisciplinary teams. Meanwhile, academic respondents admitted that limited industry exposure and lack of practical training opportunities contribute to this issue.

**Table 2.** Key Factors Contributing to the Education–Industry Gap

| No | Factor | Description |
|---|---|---|
| **1** | Curriculum rigidity | Slow adaptation to industry changes |
| **2** | Limited industry collaboration | Lack of partnerships with companies |
| **3** | Insufficient practical training | Limited internships and fieldwork |
| **4** | ضعف soft skills development | Minimal focus on interpersonal skills |
| **5** | Technological lag | عدم دمج التقنيات الحديثة مثل BIM |

The factors presented in Table 2 highlight that the gap is not solely due to student capability but is also influenced by institutional and systemic issues. Curriculum rigidity and limited collaboration with industry partners are among the most critical barriers. Furthermore, the lack of integration of modern technologies such as Building Information Modeling (BIM) exacerbates the mismatch between education and practice. These institutional barriers indicate that curriculum improvement alone may not be sufficient. Sustainable collaboration between universities and industry is equally important to ensure that educational content continuously adapts to technological and professional developments.

Another important finding relates to the role of experiential learning in bridging the gap. Respondents strongly emphasized the importance of internships, project-based learning, and real-case studies in improving graduate readiness. These approaches allow students to gain hands-on experience and better understand industry expectations before entering the workforce.

**Table 3.** Recommended Strategies to Bridge the Gap

| No | Strategy | Expected Outcome |
|---|---|---|
| **1** | Industry-based curriculum | Improved relevance of education |
| **2** | Internship programs | Enhanced practical experience |
| **3** | Soft skills training | Better communication and teamwork |
| **4** | Integration of BIM and digital tools | Increased technological competence |
| **5** | Guest lectures from practitioners | Exposure to real industry practices |

The strategies outlined in Table 3 demonstrate that bridging the gap requires collaborative efforts between universities and industry stakeholders. Integrating industry input into curriculum design and expanding internship opportunities can significantly enhance the employability of graduates. Additionally, embedding soft skills and digital competencies into the learning process is essential in preparing students for modern engineering challenges. Similar recommendations have also been reported in previous studies emphasizing experiential learning and industry engagement as effective approaches to improving graduate employability. This consistency strengthens the practical relevance of the proposed strategies for civil engineering education in Indonesia.

Overall, this study confirms that the gap between civil engineering education and industry requirements in Indonesia is multidimensional, involving technical, behavioral, and institutional aspects. Addressing this issue requires systemic reform, including curriculum redesign, stronger industry engagement, and the adoption of innovative teaching methods. By implementing these strategies, higher education institutions can better prepare graduates to meet the evolving demands of the construction industry.

## CONCLUSION

This study highlights a significant gap between civil engineering education and industry requirements in Indonesia. While graduates generally demonstrate strong theoretical knowledge, they often lack practical competencies and essential soft skills required in professional settings. This imbalance indicates that current educational approaches are not yet fully aligned with the evolving demands of the construction industry.

The findings confirm that the largest discrepancies exist in non-technical competencies, particularly communication, teamwork, and problem-solving skills. In addition, limited exposure to real-world engineering practices further constrains graduates' readiness for the workforce. These results suggest that technical proficiency alone is insufficient, and a more holistic approach to competency development is necessary.

Moreover, the study identifies several structural factors contributing to this gap, including rigid curricula, insufficient collaboration between academia and industry, and the limited integration of modern technologies such as Building Information Modeling (BIM). These challenges highlight the need for systemic improvements within higher education institutions to ensure greater responsiveness to industry changes.

To address these issues, this study emphasizes the importance of strengthening partnerships between universities and industry stakeholders. Initiatives such as internship programs, industry-based projects, and practitioner involvement in teaching can significantly enhance students' practical experience. Furthermore, integrating soft skills training and digital competencies into the curriculum is essential to better prepare graduates for contemporary engineering environments.

In conclusion, bridging the gap between civil engineering education and industry requirements requires a comprehensive and collaborative effort. By reforming curricula, adopting experiential learning approaches, and fostering closer industry engagement, higher education institutions in Indonesia can improve graduate employability and contribute more effectively to national infrastructure development.

This study has several limitations. The findings were obtained from respondents representing selected academic institutions and construction companies in Indonesia; therefore, they may not fully represent all regions or engineering sectors. Future studies are encouraged to involve broader samples, different engineering disciplines, and longitudinal approaches to obtain a more comprehensive understanding of the education–industry relationship.

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