International Journal of Education, Vocational and Social Science
https://e-journal.citakonsulindo.or.id/index.php/IJEVSS
E-ISSN : 2963 4954
IJEVSS

Implementation Of Engineering Professional Ethics In Risk-Based Spun Pile Operations: A Qualitative Study In Precast Companies In Indonesia

Ranti Hidayawanti
Institut Teknologi PLN, Jakarta 11750, Indonesia
Muhammad Habibie
Institut Teknologi PLN, Jakarta 11750, Indonesia

Corresponding Author:

Abstract

The precast concrete industry plays an important role in supporting modern infrastructure development, particularly through the use of spun piles as foundation elements with a high level of operational risk. The success of spun pile operations is determined not only by technical capabilities but also by the implementation of engineering professional ethics in decision-making related to quality, safety, and risk control. However, studies on the implementation of engineering professional ethics in the precast industry in Indonesia are still relatively limited. This study aims to analyze the implementation of engineering professional ethics in risk-based spun pile operations in precast companies in Indonesia. The study employed a qualitative approach with a multiple case study design. Data were collected through in-depth interviews, field observations, and documentation studies involving 15–20 informants consisting of engineers, production managers, quality control personnel, site engineers, and other related parties. Data analysis was conducted using the interactive model of Miles, Huberman, and Saldaña through the stages of data condensation, data display, and conclusion drawing. The results show that the implementation of engineering professional ethics is reflected in four main aspects, namely integrity in quality reporting, compliance with technical standards, responsibility for occupational safety, and independence in technical decision-making. The findings also indicate that the implementation of professional ethics contributes to the control of quality, safety, cost, time, and corporate reputation risks. The main supporting factors include management commitment, safety culture, and internal supervision systems, while the inhibiting factors include production target pressures, resource limitations, and operational conflicts of interest. This study confirms that engineering professional ethics functions not only as a moral guideline but also as a strategic instrument in risk

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

management within the precast industry.

Keywords: Engineering Professional Ethics; Spun Pile; Risk Management; Precast Industry; Occupational

INTRODUCTION

The precast concrete industry is one of the sectors that has a strategic role in supporting the acceleration of modern infrastructure development. Along with the increasing construction of toll roads, ports, airports, industrial estates, dams, and high-rise buildings in Indonesia, the demand for high-quality, efficient, and standardized structural components continues to increase. One of the widely used precast products is the spun pile, or cylindrical prestressed concrete pile, which functions as a deep foundation to support structural loads in various types of construction. The use of spun piles is increasingly preferred because they have high bearing capacity, more controlled concrete quality, shorter construction time, and cost efficiency compared to conventional foundation methods. In addition, the prefabrication system allows the production process to be carried out in a standardized factory environment, thereby improving product quality, reducing material waste, and supporting the principles of sustainable development. Various studies have shown that the application of prefabrication technology contributes positively to increased productivity, construction quality, occupational safety, and resource-use efficiency in modern construction projects (Tam et al., 2018; Yu et al., 2019). Therefore, the success of spun pile operations is not only an indicator of the success of precast companies but also an important factor affecting the quality, safety, and sustainability of infrastructure development as a whole.

Although offering various advantages, spun pile operations are activities with a high and complex level of risk. Risks may arise at every stage of the process, starting from raw material procurement, production processes, quality control, stockyard storage, distribution to project sites, and pile-driving activities in the field. During the production stage, various problems such as variations in concrete quality, honeycombing, early cracking, dimensional nonconformities, and joint defects may affect the quality of the final product. Risks may also occur during transportation due to impacts, improper handling procedures, or delivery delays. At the installation stage, risks such as pile head damage, vertical deviation, misinterpretation of soil data, and foundation failure may result in significant financial losses and threaten public safety. Li et al. (2020) explained that prefabrication-based construction projects have risk characteristics that differ from conventional

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

construction because they involve a more complex and integrated process chain. Furthermore, various studies have shown that construction project failures are not always caused by technical factors but also by weaknesses in organizational governance, safety culture, communication, and the quality of professional decision-making (Loosemore & Lim, 2018; Al-Bayati et al., 2021). These conditions indicate that risk management in spun pile operations requires an approach that focuses not only on technical aspects but also on the behavioral and professional aspects of the stakeholders involved.

Various countries have developed strategies to control risks in the prefabrication industry and foundation works through the integration of technology, quality management systems, safety culture, and professional governance. Japan implements strict lean manufacturing and quality assurance systems to minimize product quality variations and improve production reliability. Singapore, through the Design for Manufacturing and Assembly (DfMA) concept, has successfully integrated design, production, and installation aspects to reduce the potential for construction errors from the early stages of projects. Meanwhile, European countries have developed digital-based approaches through Building Information Modeling (BIM), safety audits, and quality management systems based on international standards to improve the effectiveness of construction risk control. Research by Song et al. (2022) showed that the success of risk management in prefabrication projects is strongly influenced by human factors, leadership, and organizational culture in addition to technological support. Similar findings were also reported by Anaç et al. (2023), who explained that risks in the prefabrication industry cannot be resolved solely through technical innovation but require strengthened governance, accountability, and professional behavior among construction stakeholders. Thus, international experience indicates that the success of risk control largely depends on the quality of decisions made by engineers and stakeholders involved in every stage of operations.

In this context, engineering professional ethics becomes one of the important factors influencing the quality of decision-making in risk-based spun pile operations. Engineering professional ethics is a set of moral and professional principles that regulate the behavior of engineers in carrying out their duties, including the obligation to prioritize public safety, uphold integrity, maintain objectivity, preserve professional competence, comply with technical standards, and be responsible for the social impacts of every decision made (Harris et al., 2019). An engineer is not only required to possess adequate technical capabilities but must also be able to make ethical decisions when facing cost pressures, production targets, and strict project completion demands. Herkert (2020) emphasized that many engineering failures occurring in

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

various countries are often caused not by a lack of technical knowledge but by weak moral responsibility, organizational cultures that tolerate deviations, and low ethical awareness in decision-making. In the precast industry, ethical dilemmas may arise when there is pressure to accelerate production, reduce inspection procedures, accept products at the limits of tolerance, or ignore potential safety risks in order to meet project targets. Therefore, the implementation of engineering professional ethics plays an important role in ensuring that all operational processes continue to run in accordance with safety standards, quality requirements, and professional responsibility.

Despite its importance, research on the implementation of engineering professional ethics in the precast industry in Indonesia remains relatively limited. Most previous studies have focused on technical aspects such as concrete quality, foundation bearing capacity, production efficiency, supply chain management, quality control, and project cost and time analysis. Studies on professional ethics are generally conducted in the context of engineering education, consulting professions, or construction project governance in general, without specifically examining the operational processes of precast products that involve high levels of risk. Suryanto and Abdullah (2021) explained that governance practices and professional ethics in engineering projects in developing countries still face various challenges, including weak supervision systems, economic pressures, and differences in organizational culture. However, the study did not specifically examine how ethical principles are implemented in spun pile production, distribution, and installation activities. In addition, most previous studies still viewed professional ethics as an independent normative concept and did not directly link it to operational risk control, occupational safety, or product quality. These limitations indicate the existence of a research gap that needs to be addressed through a more contextual study within the Indonesian precast industry.

The novelty of this study lies in the integration of engineering professional ethics and risk management perspectives within the context of spun pile operations in precast companies in Indonesia. Unlike previous studies that tended to position technical aspects, safety, and organizational behavior as separate variables, this study views professional ethics as an integral part of the operational risk control system. This study does not merely discuss ethics as a normative concept but examines how ethical principles are manifested in daily work practices, decision-making processes, quality reporting, compliance with standards, and responsibility for public safety. Furthermore, this study employs a qualitative approach to obtain a deeper understanding of the experiences, perceptions, and interpretations of engineers, production

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

managers, quality control personnel, and other related parties in dealing with various ethical dilemmas in high-risk work environments. Thus, this study is expected to provide a more comprehensive understanding of the relationship between professional ethics and risk management compared with previous studies that predominantly employed technical and quantitative approaches.

Based on the description above, this study aims to analyze the implementation of engineering professional ethics in risk-based spun pile operations in precast companies in Indonesia. Specifically, this study aims to identify the forms of professional ethics implementation in the production, distribution, and installation processes of spun piles; explore the role of professional ethics in controlling quality, safety, time, cost, and corporate reputation risks; identify factors that support and hinder the implementation of professional ethics in precast companies; and formulate strategic recommendations to strengthen professional culture and risk governance in the national precast industry. The scope of the study is limited to precast companies producing spun piles in Indonesia, with informants consisting of engineers, production managers, quality control personnel, site engineers, and parties directly involved in operations. The dimensions of professional ethics that form the focus of this study include integrity, professional competence, objectivity, responsibility for public safety, compliance with standards, and professionalism (Harris et al., 2019; Kaptein, 2017), while the observed risk context includes product quality risk, occupational safety risk, project delay risk, cost risk, and corporate reputation risk. The results of this study are expected to provide theoretical contributions to the development of engineering ethics studies while also offering practical recommendations for improving governance and sustainability in the Indonesian construction industry.

RESEARCH METHODOLOGY

Research Design

This study employed a qualitative approach with a multiple case study design to gain an in-depth understanding of the implementation of engineering professional ethics in risk-based spun pile operations in precast companies in Indonesia. The qualitative approach was selected because this study aims to explore social and professional phenomena that cannot be measured solely through numerical data but require an understanding of the experiences, perceptions, values, and practices carried out by industry actors. According to Creswell and Poth (2018), qualitative research enables researchers to obtain a comprehensive understanding of a phenomenon within its natural context through direct interaction with participants and the

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

research environment. The case study design was chosen because it can provide a contextual description of the implementation of professional ethics in work environments characterized by high-risk conditions, organizational complexity, and diverse decision-making dynamics.

The study was conducted in several precast concrete companies producing spun piles in Indonesia. The selection of more than one research site was intended to obtain variations in perspectives and increase data richness, thereby allowing cross-case comparisons. The focus of the study was directed toward the implementation of engineering professional ethics in production processes, quality control, distribution, and installation of spun piles that have direct implications for operational risk management. Conceptually, this study views the implementation of professional ethics as a phenomenon influenced by the interaction among individuals, organizational culture, management systems, and operational pressures that arise within industrial environments. Therefore, the multiple case study design was considered the most appropriate approach to generate an in-depth understanding of the relationship between professional ethics and risk management in the precast industry.

Research Subjects

The research subjects consisted of professionals directly involved in spun pile operations within precast companies in Indonesia. Participants were selected using a purposive sampling technique by considering the ability of informants to provide relevant and in-depth information regarding the implementation of engineering professional ethics. According to Patton (2015), purposive sampling enables researchers to select informants who possess experience, knowledge, and direct involvement with the phenomenon under investigation so that the data obtained are richer and more meaningful.

The number of informants in this study ranged from 15 to 20 individuals from several precast companies. Informants consisted of production engineers, production managers, quality control personnel, site engineers, project supervisors, occupational health and safety (OHS) managers, and company technical leaders. The criteria for selecting informants included: (1) having at least three years of work experience in spun pile production or operations; (2) being involved in technical and managerial decision-making processes; and (3) understanding quality procedures, occupational safety, and risk management systems applied within the company. The number of informants was determined based on the principle of data saturation, which is the condition in which additional interviews no longer generate significant new information. In addition to considering positions and work experience, this study also considered variations in

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

informant characteristics to obtain diverse perspectives regarding professional ethics practices in the workplace. Thus, the data obtained were expected to represent various perspectives that develop within risk-based spun pile operations.

Research Instruments and Procedures

The primary instrument in this study was the researcher (human instrument), who was responsible for collecting, interpreting, and analyzing data directly. To support the data collection process, semi-structured interview guidelines, observation sheets, and documentation formats were used. The interview guidelines were developed based on the principles of engineering professional ethics proposed by Harris et al. (2019) and Herkert (2020), including the dimensions of integrity, professional competence, objectivity, responsibility for public safety, compliance with technical standards, and professionalism. In addition, operational risk aspects were adapted from construction and prefabrication risk management literature, including product quality risk, occupational safety risk, project delay risk, cost risk, and corporate reputation risk.

Instrument validity was established through expert judgment involving two civil engineering academics and one precast industry practitioner to ensure the suitability of indicators with the research objectives. In qualitative research, instrument reliability is reflected through consistency in the data collection process, the use of the same interview guidelines, and systematic documentation of all research activities. Data were collected through in-depth interviews, field observations, and documentation studies of standard operating procedures (SOPs), quality reports, occupational safety documents, and company internal audit documents. All interviews were recorded with the consent of the informants and subsequently transcribed verbatim. The data collection process was conducted over a period of three months until data saturation was achieved. The use of multiple data sources enabled researchers to conduct triangulation to enhance the credibility and trustworthiness of the research findings.

Data Analysis

Data analysis was conducted using the interactive analysis model developed by Miles, Huberman, and Saldaña (2020), which consists of three main stages: data condensation, data display, and conclusion drawing. During the data condensation stage, interview results, observations, and documentation were transcribed, classified, and selected based on their relevance to the research focus. Subsequently, the data were coded to identify major themes related to the implementation of engineering professional ethics and operational risk

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

management in spun pile operations. The next stage involved presenting the data through thematic matrices, descriptive narratives, and mapping relationships among themes to facilitate the identification of patterns emerging from the field data.

To enhance the credibility of the research findings, source triangulation, method triangulation, and member checking were conducted. Source triangulation was carried out by comparing information obtained from different groups of informants, while method triangulation was conducted by comparing findings from interviews, observations, and documentation. Member checking was performed by asking several informants to review the researchers' interpretations to ensure consistency with the experiences they had conveyed. The analysis focused on identifying forms of professional ethics implementation, factors influencing its application, the relationship between ethical practices and risk management, and their impacts on the quality of spun pile operations. The results were then interpreted based on engineering professional ethics theory and construction risk management literature to generate a comprehensive understanding of the phenomenon under study.

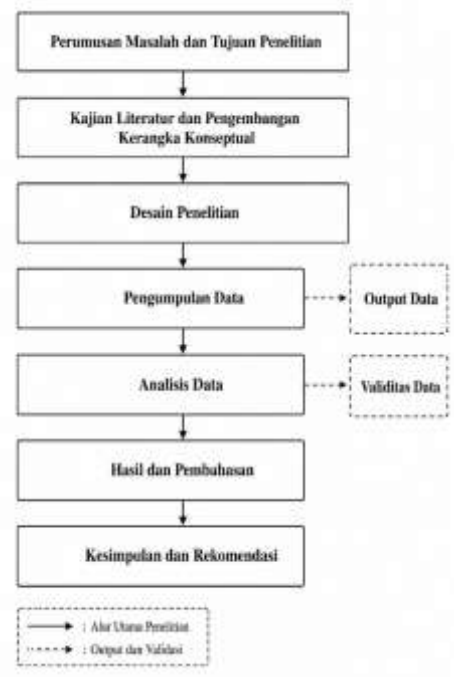


Figure 1. Research Framework

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

International Journal of Education, Vocational and Social Science
https://e-journal.citakonsulindo.or.id/index.php/IJEVSS
E-ISSN : 2963 4954
IJEVSS

RESEARCH RESULTS

Implementation of Engineering Professional Ethics in Spun Pile Operations

Based on the results of in-depth interviews, field observations, and documentation studies conducted in several precast companies in Indonesia, it was found that the implementation of engineering professional ethics has become part of the company's operational system, particularly in the areas of quality control, occupational safety, and compliance with technical standards. However, the level of implementation of each ethical principle still varies depending on organizational culture, leadership style, personnel experience, and operational pressures faced by the company.

Data analysis generated six major themes describing the implementation of engineering professional ethics in risk-based spun pile operations, namely: (1) integrity in quality reporting, (2) compliance with technical standards, (3) responsibility for occupational safety, (4) professional competence, (5) independence in technical decision-making, and (6) courage to report deviations.

Table 1. Themes of the Analysis Results on the Implementation of Engineering Professional Ethics

Theme	Description of Findings
Integrity	Quality reporting is conducted based on actual testing results without data manipulation
Compliance with Standards	Production and inspection processes follow SOPs and company standards
Occupational Safety	Worker safety becomes the primary consideration in operational activities
Professional Competence	Decision-making is carried out by personnel with adequate technical competence
Technical Independence	Technical decisions are not influenced by production target pressures
Reporting Deviations	Employees are given opportunities to report process and product nonconformities

Integrity in Product Quality Reporting

The findings indicate that integrity is the ethical principle most frequently observed in spun pile operational activities. Informants emphasized that all results of concrete compressive

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

strength testing, product dimensions, joint quality, and visual inspection results must be reported according to actual conditions.

One informant serving as a Quality Control Engineer stated:

"If there are test results that do not meet the standards, we still report them as they are. The product cannot be directly shipped before further decisions are made by the technical team." (Informant 4)

This statement was supported by observational findings showing the existence of a digitalized quality documentation and inspection reporting system, thereby minimizing opportunities for data manipulation.

In addition, company documentation showed that every product that failed to meet quality standards was placed in a quarantine area before further evaluation was conducted.

These findings indicate that integrity plays an important role in preventing products that may create structural risks in construction projects from entering the field.

Compliance with Technical Standards

The second theme identified was compliance with technical standards. All informants stated that the spun pile production process must follow standard operating procedures (SOPs), customer specifications, and applicable national standards.

Table 2. Forms of Compliance with Technical Standards

Activity	Form of Compliance
Production	Concrete mix control according to design specifications
Inspection	Examination of dimensions and visual quality
Storage	Stacking according to capacity and procedures
Distribution	Product protection during transportation
Installation	Supervision of pile-driving processes

A Production Manager stated:

"We cannot sacrifice standards just to achieve production targets because the consequences may appear when the product is already in the field." (Informant 7)

These findings indicate that compliance with standards is the primary instrument for reducing the risk of product failure.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

Responsibility for Occupational Safety

The results show that occupational safety is the most dominant aspect in the implementation of engineering professional ethics.

Based on field observations, it was found that companies implement various safety procedures, including the use of personal protective equipment (PPE), daily toolbox meetings, lifting equipment inspections, and near miss reporting.

Table 3. Implementation of Occupational Safety

Safety Program	Implementation
Toolbox Meeting	Conducted before work begins
Use of PPE	Mandatory for all workers
Equipment Inspection	Conducted periodically
Near Miss Reporting	Internal reporting system available
Safety Briefing	Conducted before high-risk activities

One Site Engineer stated:

"In spun pile work, the risk of accidents is quite high because it involves heavy equipment and large materials. Therefore, safety aspects are non-negotiable." (Informant 11)

These findings indicate that occupational safety is viewed as both a moral and professional responsibility of engineers toward workers and society.

Independence in Technical Decision-Making

The next theme relates to independence in technical decision-making. Most informants stated that production targets and project schedules frequently create ethical dilemmas. Nevertheless, decisions related to quality and safety must remain based on technical considerations.

One informant explained:

"Sometimes there are requests to accelerate deliveries. However, if inspection results are not yet completed, we still hold the product until all requirements are fulfilled." (Informant 9)

This statement indicates efforts to maintain objectivity and professional independence in situations that may create conflicts of interest.

Supporting and Inhibiting Factors in the Implementation of Professional Ethics

The analysis results identified several factors that support the implementation of

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

engineering professional ethics.

Table 4. Supporting and Inhibiting Factors

Supporting Factors	Inhibiting Factors
Management commitment	High production targets
Safety culture	Project time pressures
Clear SOPs	Resource limitations
Periodic training	Lack of ethics training
Internal audit system	Operational conflicts of interest

Most informants mentioned that support from company leadership has a significant influence on the successful implementation of professional ethics.

Conversely, production pressures and demands for rapid project completion become the main challenges that may encourage deviations from established procedures.

DISCUSSION

Integrity in Quality Reporting as a Form of Engineering Professional Ethics Implementation

The results indicate that integrity is the most dominant ethical principle implemented in spun pile operations. This finding is reflected in the consistency of informants in emphasizing the importance of reporting quality based on actual product conditions without data manipulation. In spun pile production processes, every concrete compressive strength test result, dimensional inspection, joint quality evaluation, and visual inspection is recorded and reported according to conditions found in the field. Even when products are found not to meet technical specifications, companies continue to apply product quarantine procedures before corrective actions are taken. These findings indicate that integrity is not only understood as an individual moral value but has become part of the organizational quality control system. This condition occurs because companies recognize that any unreported nonconformity may generate much greater risks during distribution and installation stages. In the context of spun pile operations as primary foundation elements of structures, minor errors in quality reporting may lead to structural failures affecting public safety, financial losses, and corporate reputation. Therefore, integrity in quality reporting becomes an important mechanism for ensuring that all technical decisions are based on valid and accountable information.

This finding is consistent with Harris et al. (2019), who stated that integrity is the primary

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

foundation of engineering professional ethics because it determines the quality of decisions made by engineers. Herkert (2020) also emphasized that many engineering failures are not caused by limited technical capabilities but by weak moral responsibility and dishonesty in reporting technical information. The results of this study strengthen the findings of Suryanto and Abdullah (2021), which showed that good professional governance practices contribute to increased transparency and accountability in engineering projects. The primary similarity between this study and previous research lies in the importance of integrity as an instrument for risk prevention and improvement of technical decision quality. However, this study provides a more specific contribution by revealing how integrity is practically manifested in spun pile quality control activities characterized by high levels of risk. Thus, integrity functions not only as an ethical principle but also as a risk management instrument supporting the sustainability of precast company operations.

Compliance with Technical Standards in Operational Risk Control

The findings indicate that compliance with technical standards is one of the forms of professional ethics implementation most consistently applied in spun pile operations. All informants stated that every stage of production, storage, distribution, and installation must be carried out in accordance with standard operating procedures established by the company and applicable technical regulations. Compliance with standards is viewed not merely as an administrative obligation but as a form of professional responsibility to ensure product quality and safety. These findings can be explained by the characteristics of spun piles as foundation components that receive structural loads over long periods and therefore require a very high level of reliability. Noncompliance with technical specifications may result in product defects, installation damage, and foundation failures that affect the safety of building users. Furthermore, technical standards serve as objective guidelines that help engineers make consistent decisions despite production target pressures and resource limitations. Therefore, compliance with technical standards becomes a tangible manifestation of professional responsibility in maintaining product quality and controlling operational risks.

This finding is supported by Li et al. (2020), who showed that the success of prefabrication projects is highly influenced by consistent implementation of standards throughout the production and construction process chain. Tam et al. (2018) also explained that one of the primary advantages of prefabrication systems lies in their ability to produce more standardized products compared with conventional methods. The findings of this study are similar to those of

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

Yu et al. (2019), who found that the successful adoption of prefabricated construction in Indonesia is strongly influenced by the quality of standards and quality control systems implemented by companies. However, this study found that compliance with standards also has a strong ethical dimension as a form of protection for public safety and organizational reputation. This perspective is relatively rarely discussed in previous prefabrication studies, which generally emphasize technical and productivity aspects. Therefore, this study expands the understanding that technical standards function not only as quality control tools but also as instruments of professional ethics in engineering practice.

Responsibility for Occupational Safety as the Main Priority

The results of this study indicate that responsibility for occupational safety is the aspect of professional ethics that receives the greatest attention in spun pile operations. This finding is reflected in the implementation of various safety programs such as toolbox meetings, the use of personal protective equipment, equipment inspections, near miss reporting, and safety briefings before high-risk work activities are carried out. Informants consistently emphasized that worker safety must remain the primary priority even when companies face production pressures and project completion targets. This finding can be explained by the fact that spun pile operations involve high-risk activities such as lifting heavy materials, operating heavy equipment, and pile-driving processes that may cause serious accidents if not properly supervised. In addition to legal and economic considerations, engineers view safety as a moral responsibility that cannot be compromised. This awareness indicates that the implementation of professional ethics is reflected not only in compliance with procedures but also in a commitment to protecting the safety of workers and communities affected by construction activities.

This finding is consistent with the study of Al-Bayati et al. (2021), which stated that a strong safety culture significantly contributes to reducing workplace accident rates in the construction industry. Song et al. (2022) also found that human factors and organizational culture have a greater influence on the safety of prefabrication projects than technological factors alone. The findings of this study further support the view of Harris et al. (2019), who identified public safety as the primary moral obligation of engineers. The similarity between this study and previous studies lies in the recognition that safety is an important indicator of professionalism and organizational governance quality. However, this study provides an additional contribution by demonstrating that occupational safety is also understood as part of the implementation of professional ethics within the context of spun pile operations. In other words, safety is not merely

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

a management program but a tangible manifestation of an engineer's ethical responsibility in carrying out professional duties.

Independence in Technical Decision-Making in Facing Operational Pressures

The findings indicate that independence in technical decision-making is both a challenge and an important indicator of the implementation of engineering professional ethics. Most informants acknowledged the existence of production pressures, demands for accelerated deliveries, and strict project targets. Nevertheless, they continued to strive to maintain objectivity by refusing to release products that had not met quality and safety requirements. These findings indicate that the implementation of professional ethics is not only related to compliance with rules but also to the courage to uphold professional decisions even when such decisions may create short-term operational consequences. This condition occurs because engineers understand that decisions that do not comply with standards may create greater risks in the future, including structural damage, workplace accidents, and reputational losses for the company. Therefore, independence becomes an important mechanism for maintaining objectivity and decision quality in high-pressure work environments.

This finding is in line with Kaptein (2017), who explained that a strong organizational ethical culture can enhance individual courage in making decisions consistent with professional principles. Herkert (2020) also emphasized that professional independence is one of the key elements in preventing engineering failures caused by organizational pressures or economic interests. Furthermore, the study by Loosemore and Lim (2018) showed that organizations implementing ethical governance tend to achieve better operational performance because they are able to reduce practices that may create long-term risks. The similarity between this study and previous research lies in the importance of independence as a prerequisite for responsible decision-making. However, this study demonstrates more specifically how such independence is applied within the context of spun pile operations characterized by significant risks and production pressures. Therefore, professional independence can be viewed as a key factor linking professional ethics with effective risk management in the precast industry.

CONCLUSION

This study aimed to analyze the implementation of engineering professional ethics in risk-based spun pile operations within precast companies in Indonesia. Based on the results of interviews, observations, and documentation studies, it was found that the implementation of

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

engineering professional ethics has become an important part of company operational practices, particularly in efforts to control risks related to product quality, occupational safety, costs, project duration, and organizational reputation. This implementation is reflected through four main aspects, namely integrity in quality reporting, compliance with technical standards, responsibility for occupational safety, and independence in technical decision-making. These four aspects contribute to ensuring that every operational decision is carried out professionally, objectively, and with a focus on public safety.

The results also indicate that the successful implementation of professional ethics is influenced by several supporting factors, including management commitment, a strong safety culture, effective internal supervision systems, and human resource competence. Conversely, production target pressures, resource limitations, and operational conflicts of interest become factors that may hinder the application of professional ethical principles in the workplace. These findings confirm that engineering professional ethics cannot be separated from corporate risk management systems because both mutually support the creation of safe, high-quality, and sustainable operations.

Theoretically, this study expands the field of engineering professional ethics by demonstrating that ethics functions not only as a moral norm but also as a risk control mechanism within the precast industry. Practically, the findings provide recommendations for precast companies to strengthen ethical culture through continuous training, reinforcement of deviation reporting systems, improvement of quality supervision, and the development of ethical leadership at all organizational levels. Future studies are recommended to combine qualitative and quantitative approaches to measure the influence of professional ethics implementation on operational performance and risk management effectiveness across various construction sectors.

REFERENCES

Al-Bayati, A. J., Albert, A., & Ford, G. (2021). Construction safety culture and climate: The relative importance of contributing factors. *Safety Science, 143*, 105413.

Anaç, C., Kaya, M., & Yılmaz, G. (2023). Risk management in prefabricated construction projects: A systematic review. *Sustainability, 15*(15), 11916. https://doi.org/10.3390/su151511916

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.

Harris, C. E., Pritchard, M. S., Rabins, M. J., James, R., & Englehardt, E. (2019). *Engineering ethics: Concepts and cases* (6th ed.). Cengage Learning.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License

Herkert, J. R. (2020). Engineering ethics education in the twenty-first century. *Science and Engineering Ethics, 26*(4), 1883–1901. https://doi.org/10.1007/s11948-020-00234-8

Kaptein, M. (2017). The effectiveness of ethics programs: The role of scope, composition, and sequence. *Journal of Business Ethics, 132*(2), 415–431. https://doi.org/10.1007/s10551-016-3313-3

Li, C. Z., Hong, J., Xue, F., Shen, G. Q., Xu, X., & Mok, M. K. (2020). Schedule risks in prefabricated construction projects in Hong Kong: A social network analysis. *Buildings, 10*(6), Article 101. https://doi.org/10.3390/buildings10060101

Loosemore, M., & Lim, B. T. H. (2018). Linking corporate social responsibility and organizational performance in the construction industry. *Construction Management and Economics, 36*(2), 90–105. https://doi.org/10.1080/01446193.2018.1427902

Miles, M. B., Huberman, A. M., & Saldaña, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). SAGE Publications.

Patton, M. Q. (2015). *Qualitative research & evaluation methods* (4th ed.). SAGE Publications.

Song, Y., Wang, X., Li, D., & Wang, Y. (2022). Safety risk assessment and management in prefabricated construction: A systematic review. *International Journal of Environmental Research and Public Health, 19*(3), 1523. https://doi.org/10.3390/ijerph19031523

Sugiyono. (2022). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.

Suryanto, T., & Abdullah, M. A. (2021). Professional ethics and governance practices in engineering projects: Evidence from developing countries. *International Journal of Construction Management, 21*(9), 945–956. https://doi.org/10.1080/15623599.2021.1904123

Tam, V. W. Y., Soomro, M., & Evangelista, A. C. J. (2018). A review of benefits and challenges of prefabricated construction in housing delivery. *Journal of Cleaner Production, 183*, 108–121. https://doi.org/10.1016/j.jclepro.2018.02.123

Yu, Y., Wang, X., Wang, J., & Ma, L. (2019). Adoption of prefabricated construction in emerging economies: Evidence from Indonesia. *Sustainability, 11*(21), 5939. https://doi.org/10.3390/su11215939

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-Share Alike 4.0 International License