



Review Article

Competency Evolution: A Framework for Construction Project Managers

Susy F. Rostiyanti^{1,*}, Seng Hansen², and Riri Vermatasari¹

¹Universitas Agung Podomoro, Jakarta, Indonesia

²Universitas Presiden, Cikarang, Indonesia

Received: 3 February 2024, Accepted: 22 August 2024, Published: 12 November 2024

Abstract

The effective execution of a construction project heavily relies on a diverse set of human resources possessing various competencies. Competency is a multifaceted concept with varied interpretations depending on its application and development. In this diverse landscape, competencies are commonly understood to encompass attributes such as knowledge, skills, and abilities. These competencies also feature distinct transferable qualities within intrapersonal and interpersonal competencies. This study delves into the crucial role of competencies in managing construction projects efficiently, emphasizing the three primary components. Employing a Systematic Literature Review, the study aims to uncover the nuanced aspects influencing project manager competencies. The primary objective is to unravel the competencies empowering project managers to successfully navigate construction projects. The findings highlight leadership as the paramount skill competency and underscore the importance of responsibility as a key attitude competency. Additionally, the study introduces a framework delineating the evolutionary progression of project manager competencies from intrapersonal to interpersonal over time. This framework serves as a valuable resource for project management professionals seeking to enhance their competencies and effectively address the dynamic challenges inherent in construction projects.

© 2024 published by Sriwijaya University

Keywords: *framework, interpersonal, intrapersonal, project manager competencies.*

1. INTRODUCTION

Construction projects are inherently unique endeavors, each presenting its own set of challenges and requirements. Unlike mass-produced products, construction projects are often custom-made, and tailored to specific location purposes and client needs [1], [2], [3]. What sets construction projects apart is their unique nature, as they involve a series of activities that occur only once and are never exactly replicated. Moreover, construction projects are of a temporary nature, with the organization formed solely for the purpose of executing the project; upon achieving the project objectives, the organization is disbanded. As a result, construction projects demand a high level of adaptability and creativity to address the intricacies that arise.

The execution of a construction project relies heavily on human resources with diverse skills and competencies. Construction teams consist of professionals from various disciplines, such as architects, engineers, project managers, construction workers, and subcontractors. The successful

integration of these different skill sets is vital for achieving project objectives. Effective communication and collaboration among team members are essential to navigate the complexities of the project and ensure the efficient use of resources. Human resource management has traditionally focused on task areas within the employment relationship, such as recruitment, compensation, job conditions, and training [4]. On the other hand, successful businesses rely on their staff to learn critical skills. Studies have shown that the majority of exemplary firms have identified critical managerial abilities required for exceptional performance in diverse job categories [5].

Human resources refers to individuals actively engaged in their roles to fulfill an organization or company's objectives [6]. In the context of construction projects, the pivotal role of human resources cannot be overstated. Even when a project enjoys ample financial resources and possesses state-of-the-art equipment, its success hinges primarily on the competence and expertise of the workforce.

Without a skilled and proficient team, the project's desired outcomes cannot be optimally achieved. Therefore, it is imperative that the workforce functions effectively within designated working hours and delivers efficient results [7].

As Safrial et al. [8] point out, among the crucial human resources required during the execution of a construction project, a competent project manager stands out. The outcome of a project is deeply influenced by both the individuals involved and the manner in which it is managed. Brahmantariguna et al. [9] further emphasize the significance of a project manager's role in the context of construction projects. They assert that a construction project can only be deemed successful if it satisfies the criteria of quality, cost, and time adherence. However, the absence of any of these elements detracts from the project's overall success. In these situations, the role of a project manager becomes exceptionally vital.

A project manager is an individual designated or chosen to oversee the management of a project on behalf of a specific organization. The responsibilities and obligations associated with the role of a project manager encompass various tasks. These include formulating and assessing the budget for a construction project, accurately defining the project's scope, selecting the appropriate resources, both in terms of materials and personnel, guiding the project team from its initial phase through to its conclusion, and effectively managing and identifying any potential risks and issues within the project [10].

In order to qualify as a project manager, an individual must possess competence. Sudarmanto [11] defines competence as an inherent attribute possessed by each person, enabling them to carry out their work in a manner that aligns with their abilities, resulting in effective achievements. Standar Kompetensi Kerja Nasional Indonesia (SKKNI), or Indonesian National Work Competency Standards, stated in Decree of the Minister of Manpower Number 106 of 2015, elaborates on competence as a person's capacity to perform activities encompassing several crucial characteristics, such as knowledge, skills, and attitudes. The level of proficiency in these knowledge, skills, and attitudes can vary, contingent upon the extent to which they have been honed and developed.

Within the construction industry, the ability of project managers to extract top performance from their teams is critical to project success. To achieve positive results, construction project managers must combine their technical knowledge with attitudes that promote efficient teamwork and communication across numerous businesses. These particular abilities are known as core competencies. Recognizing, evaluating, and maintaining these

competencies may be critical for improving the efficiency and effectiveness of today's engineering organizations.

Competency exhibits a variety of conceptualizations based on its usage and development. Competence evolves through a diverse range of activities aimed at enhancing proficiency. These activities encompass structured training and development programs and informal learning in the workplace through work-related experiences. Wallo et al. [12] describe the evolution of competency as closely related to "workplace learning," which involves people actively engaging in learning opportunities to enhance their knowledge, skills, and attitudes. In this context, competence evolves as an individual learning process that leads to competence development. This evolution is an ongoing process to adapt to a dynamic environment [13]. Several studies underline the importance of competency evolution in project management since developing project managers' competencies will allow for more efficient project execution [14, [15].

Within this diverse terrain, competencies are usually believed to include characteristics such as knowledge, skills, and abilities, which are frequently denoted by the KSA model and all aim to improve performance [16], [17], [18]. [11] emphasizes that those competencies expected of a project manager serve as the primary determinants of a construction project's success.

Knowledge encompasses the entirety of information that an individual possesses to fulfill their tasks and obligations. Those individuals endowed with ample knowledge tend to easily attain their work objectives. Conversely, individuals lacking sufficient knowledge encounter formidable challenges, necessitating considerable time, financial resources, and additional effort [19]. As per [20], project managers, in their endeavor to oversee projects, must possess proficiency in ten knowledge domains: Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Human Resources Management (HR), Communication Management, Risk Management, Procurement Management, and Stakeholder Management. These knowledge domains as a whole are known as Project Management.

Skills, on the other hand, denote an individual's aptitude or expertise in executing a particular task or job. Skills are imperative competencies that individuals require to execute their work effectively. Those who possess the requisite skills find their work manageable, while those who lack them encounter difficulties, often necessitating a learning curve [21]. According to Heryanto & Triwibowo [10], the skill

set of a project manager encompasses leadership, problem-solving acumen, writing proficiency, presentation skills, communication prowess, team management ability, professionalism, and a deep understanding of project management.

Attitude constitutes the disposition held by individuals within an organization or company, which can significantly influence their conduct and actions when fulfilling their duties or responsibilities [22]. In line with Prianto et al. [23], the attitude of an effective project manager is characterized by unwavering commitment to diligent work, proactive problem-solving, proficient task completion even in the face of challenges, high motivation, unwavering work ethic, a profound sense of responsibility, a clear understanding of project objectives, and the capacity to inspire and motivate the project team to achieve project goals.

Podmetina [24] characterizes that the unique managerial competency is enhanced by distinct transferable intrapersonal and interpersonal competencies. Interpersonal competencies pertain to those skills that are evident and applied in both interpersonal and organizational settings. They are context-specific to the organization and align, to some extent, with interpersonal management. On the other hand, intrapersonal competencies are visible at the individual level and are not tied to any particular organizational environment. They are universal and correspond, in part, to self-management.

Among all the roles within construction projects, project managers are the principal. They possess the responsibility of overseeing the entirety of the project's life cycle. Project managers are not only charged with steering the project towards its goals but also with ensuring that it is completed within the stipulated timelines, adheres to budgetary limits, and attains the specified quality standards. It requires a unique set of skills and knowledge tailored to the intricacies of construction projects. These competencies extend beyond general leadership abilities, encompassing a specialized toolkit that equips them to navigate the challenges posed by the construction industry's uniqueness. The aim of the research is to delve into these competencies—those specialized attributes, skills, and knowledge areas that empower project managers to steer construction projects toward successful outcomes. By uncovering and defining these essential competencies, the research provides a roadmap for project managers, organizations, and stakeholders in the construction industry.

2. METHOD

The strategy employed in this study was an SLR (Systematic Literature Review) using the PRISMA

(Preferred Reporting Items for Systematic Review and Meta-Analysis) protocol. The PRISMA protocol in SLR is adopted to uncover, assess, and interpret literature linked to a particular subject or research issue using an organized, replicable, and well-documented technique [25], [26]. Because of the enormous volume of research and publications on project management competencies, SLR is the best method for systematically gathering and analyzing the findings of current publications. The research flow can be seen in Figure 1 below.

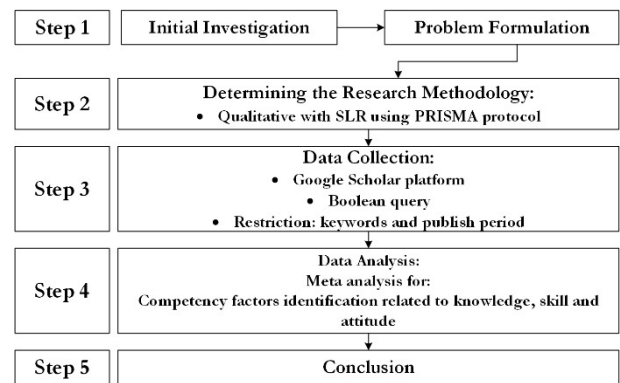


Figure 1. Research Flow

This research also employs a meta-analysis approach, utilizing a range of literature about the competencies of project managers. Meta-analysis serves as a methodology for condensing, evaluating, and scrutinizing research data originating from multiple research findings [27], [28]. Data collection was carried out through the Google Scholar platform, where relevant scholarly articles from the period spanning 2013 to 2023 were sought and gathered. The source of this data was acquired from the website scholar.google.com, employing keywords in Indonesian such as “kompetensi,” “keahlian,” “manajer proyek,” “proyek konstruksi,” and “keberhasilan.” Boolean query strategies are used to conduct data searching. The use of boolean queries precisely decides which quotations are obtained, allowing for greater control over the search [29].

The primary objective of this study is to investigate the prevalent competencies exhibited by project managers and their influence on the success of construction projects. The initial search yielded a total of 190 articles. Within the past decade, 18 papers featuring keywords related to the subject matter were published. To enhance the credibility of the articles selected for analysis, additional research was conducted, focusing on articles published in accredited journals indexed in Sinta. This search identified seven articles in Sinta-indexed journals, as shown in Table 1.

Table 1. Extracted articles related to project manager competency

Code	Article
A1	[9]
A2	[30]
A3	[31]
A4	[32]
A5	[33]
A6	[23]
A7	[34]

3. RESULTS AND DISCUSSION

Competency of Project Manager

Five skills required by a project manager in Indonesia are extracted from the literature reviewed to establish project manager skills. These skills are shown in Table 2. Project managers are also expected to have the right attitude in order for the project to succeed. This study discovered four key attitudes that a project manager must possess. Table 2 also depicts these attitudes.

Table 2. Project manager competencies

No	Project Manager Competency	References							Total
		A1	A2	A3	A4	A5	A6	A7	
Skill									
1	Leadership	✓	✓	✓	✓	✓		✓	6
2	Problem solving & decision making	✓			✓	✓	✓	✓	5
3	Project management	✓	✓	✓	✓			✓	5
4	Communication		✓		✓	✓		✓	4
5	Technical/Engineering		✓		✓		✓	✓	4
Attitude									
1	Ambitious	✓				✓			2
2	Responsibility	✓				✓	✓		3
3	Having priority	✓				✓			2
4	Hardworking	✓					✓		2

According to the statistics in Table 2, a Project Manager is mandated to exhibit proficiency in five fundamental skills. The outcomes of this study reveal that Leadership claims the topmost positions in terms of importance. This is succeeded by Problem Solving and Decision Making, as well as Project Management skills. Technical/Engineering competencies and Communication skills are ranked third. These findings underscore the notion that a Project Manager engaged in overseeing construction projects is compelled to possess a balanced blend of both hard skills and soft skills, reflecting the multifaceted nature of their responsibilities in this context.

The table also shows that Responsibility is the key attitude for project manager to successfully completing construction projects. Other attitudes that contribute to project success are Ambitious, Having priorities and Hardworking.

Leadership is established as basic information that is learned with Project Management proficiency at an early level. Leadership competency includes not just knowledge but also soft skills that a Project Manager requires in the field to be comfortable in managing and directing a construction project team. According to Brahmantariguna et al. [9], a project manager's leadership competency involves the ability to run and direct the team to achieve project aims and goals. This assertion is reinforced by Heryanto & Triwibowo [10] and Tanzil et al. [33], who state that

one of the abilities required by a Project Manager is leadership competency. Later on, a Project Manager's leadership competency emerges not only as knowledge and skill but also as an attitude. In this context, leadership is defined as an attitude that demonstrates the project manager's behavior and ability to act and respond to the project team in any situation throughout the project. Leadership will demonstrate the Project Manager's ability to handle challenging situations.

Problem Solving and Decision Making competency is also vital in shaping a project manager. This competence is cultivated through continuous knowledge development, and the skill is refined through experiential learning. According to Brahmantariguna et al. [9], when a project manager encounters technical and non-technical challenges in the field, competency in Problem Solving and Decision Making evolves from knowledge to skills. This capability is demonstrated by a Project Manager's response to a situation and his accountability for the decisions made. Competency in Problem addressing and Decision Making grows to attitude because, at this level, competency is directly tied to a project manager's actions and behavior in addressing problems on construction projects and making decisions on problems that arise. As elucidated by Brahmantariguna et al. [9] and Tanzil et al. [33], proficiency in the domains of



Problem Solving and Decision Making within the purview of project management, matures from the acquisition of knowledge to the practical application of skills, particularly when confronted with both technical and non-technical challenges within the field. A project manager's adeptness in this competency manifests in their response to challenges and their accountability for the decisions made. The evolution of proficiency in Problem Solving and Decision Making eventually extends to encompass an attitudinal dimension. At this stage, competence is intricately linked to the behaviors and actions of a project manager as they grapple with problem-solving in the context of construction projects and the decision-making process regarding the issues at hand.

The Project Management Body of Knowledge (PMBOK) defines project management competency as the ability to manage all aspects of a project, including project integration management, project scope management, project time management, project cost management, project quality management, human resource management (HR), communication management, risk management, procurement management, management stakeholders, and project management [20]. Project Management Competency is fundamental knowledge that a Project Manager must possess and apply throughout his or her profession. Furthermore, Project Management competency develops not only into information but also abilities. According to Brahmantariguna et al. [9], project management is a skill that encompasses mastery of planning approaches, organizational methods, management

knowledge, the ability to carry out the implementation process, and project control. Finally, Project Management competency becomes an attitude that has become ingrained in the Project Manager as a professional in the industry.

Responsibility is defined as being conscientious and responsible for one's own personal performance [35]. Interestingly, responsibility is always associated with leadership ability [36], [37]. According to Omran & Suleiman [36] and Moradi et al. [38], being responsible is one of the personal characteristics that plays a significant role in completing work tasks in a project. Furthermore, Moradi et al. [38] discovered that being responsible is one of the most important competencies based on project managers' behaviors. According to Li et al. [37], responsibility extends not only to project members but also to external stakeholders. It is known as social responsibility for project staff members, local people, and government in terms of health, safety, and environmental management.

Competency Framework

In a professional environment, the competence of project managers encompasses their interpersonal skill when working with teams or colleagues, along with intrapersonal qualities that evolve over time. These competencies can be enhanced through deliberate reflection, aiming to gain a personal understanding of real-world situations. Moreover, competency is a fused aspect of identity, with individuals gaining proficiency as they progressively refine their skills in their specialized area.

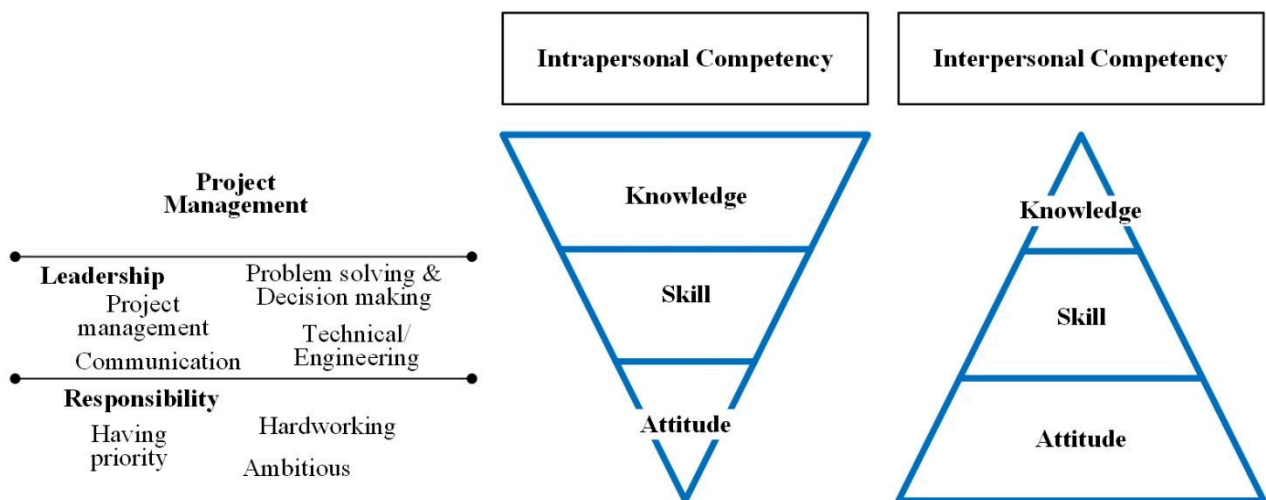


Figure 2. Project manager's competency framework

Figure 2 depicts the evolution of a project manager's intrapersonal and interpersonal competencies as seen through three competency

aspects: knowledge, skills, and attitude. The competencies are categorized into two distinct groups: Intrapersonal Competency and Interpersonal

Competency. Intrapersonal Competence is depicted by an inverted triangle, highlighting the fundamental need to collect information as the bedrock of a project manager's competence. Subsequently, the acquisition of abilities and, finally, the formation of attitudes ensue. The inverted triangle symbolizes that technical skills and knowledge are developed during the early stages of competency evolution. Interpersonal Competence is symbolized as an upright triangle, where attitudes form the base, followed by abilities and knowledge at the top.

In the beginning, the primary goal of this formative developmental stage is to assimilate knowledge that is directly related to the diverse competencies required to be a successful project manager. Figure 2 shows that at intrapersonal stage the focus of competency development is on knowledge. All knowledge areas of project management are studied to provide theoretical background related to engineering and managerial matters.

Individual competence, also known as intrapersonal competence, manifests at a personal level and extends beyond any specific organizational context. It is a universal aspect that, to some degree, involves self-management. Szczepańska-Woszczyna & Gatnar [39] underscore that, at this stage, competencies remain at a technical level, easily definable, classifiable, developable, and changeable. Consequently, the augmentation of this competence is primarily focused on knowledge development compared to the other two competencies. As a result, the depiction of intrapersonal competence in the shape of an inverted triangle emphasizes knowledge rather than skill and attitude.

As Project Managers go through this first stage, their professional journey is distinguished by a dedication to knowledge acquisition and skill improvement. In their pursuit of competence enhancement, project managers diligently refine their skills, improving their abilities across all dimensions of competency. It is critical to emphasize that a shift in attitude has not yet fully manifested itself at this point. The transformation of their attitude, which will be realized in subsequent stages, is still in its nascent phases. This is due to the inherent limits imposed by a lack of actual experience in dealing with the different issues in the project field. This stage serves as the essential underpinning for developing project management expertise toward mastery.

As a Project Manager's competencies progress toward mastery, a subsequent phase, termed interpersonal competency, comes into play. Interpersonal competence pertains to skills observable and applicable in both interpersonal interactions and organizational contexts. These

principles are specific to the organizational environment and, to some extent, align with interpersonal management [24]. According to Viitala's hierarchical model, interpersonal competence is the most challenging and enduring to measure [40]. At this stage, intrapersonal competence receives a significant boost from collaborative teamwork, resulting in a synergistic effect that propels the project manager to higher levels of proficiency. A collaborative team environment not only strengthens but also enhances intrapersonal competence, transforming it into interpersonal competence.

In this phase, leadership as a skill becomes instrumental in driving the project manager's success in project execution. A successful leader influences subordinates to ensure project success or the attainment of intended goals. The leadership style significantly impacts organizational performance or effectiveness. Therefore, developing an appropriate leadership style emerges as a pivotal factor for project success [41]. At this point, it becomes evident that attitude is a crucial aspect in developing interpersonal competence [5].

The study conducted by Müller and Turner [42] investigates the essential leadership skills that project managers need at various points in their professional journey and how these skills impact the overall performance of projects. The study emphasizes the development of certain skills as project managers accumulate experience and assume increasingly intricate responsibilities. As project managers go from a junior to a middle, and then to a senior level, they will oversee various projects as part of their professional growth. As they advance, they will need to improve their leadership skills. It is supported by Lantelme et al. [43] who suggest a greater focus on enhancing attitude-related competencies among project managers. Project managers must possess a substantial amount of information to address the challenges they encounter in their daily work effectively. Additionally, they must prepare themselves to handle complex interpersonal situations that may arise.

A Project Manager, bolstered by experience gained along the way, expertly applies these competencies in the practical execution of their professional obligations. The significant transition of competence from a mere repository of knowledge into an integral feature of the Project Manager's skill as they navigate their work defines this phase. At this point in time, it is critical to underline that the Project Manager not only has a vast knowledge base, but also a well developed skill set that encompasses the entire spectrum of competency. The emphasis on the development of knowledge competencies lies

primarily on the current advancements in the workplace and the demands of projects [44].

When directing more complicated projects, the impact of these gained talents pervades all elements of how a Project Manager works. Their approach is no longer restricted to factual and theoretical knowledge; rather, it is a manifestation of their mastery, which is firmly embedded in their attitude and expressed in every action. The transition from internal competency growth to more collaborative, competent Project Managers is a form that professionals choose to deal with dynamic issues at work.

The process of developing a project manager's competency serves as the foundation for success in managing construction projects. From the initial stage which focuses on development of intrapersonal competency, to the next phase which emphasizes skill refinement and attitude transformation, there is an evolution of a project manager's competence. As competence advances toward mastery, particularly in the interpersonal competency phase, the critical role of leadership becomes apparent. Supported by his previous experience, the project manager utilizes the competencies he has built in the practical performance of his professional tasks. The transformation from a reservoir of information to an integrated skill set is a significant shift, particularly when working with complicated tasks. This transforming journey not only helps project managers to efficiently manage obstacles but also positions them as collaborative and capable professionals committed to project success.

4. CONCLUSION

Competency encompasses three crucial elements: knowledge, abilities, and skills. Education plays a pivotal role in formally acquiring knowledge competency across various project management domains. There are at least five skills linked to competency that significantly influence the success of a project, with leadership being the most impactful. The leadership style serves as a key factor in directing a project team towards the efficient attainment of project goals. Additionally, the competency of responsibility, related to attitude, plays a vital role in a project manager's performance, ensuring the project's success.

Competency development unfolds in a continuous process, with the initial stage being intrapersonal. This stage signifies the commencement of a journey focused on acquiring knowledge for diverse competencies. While intrapersonal competency primarily revolves around knowledge, the other components contribute to overall competency, albeit in a rudimentary form. The intrapersonal stage plays

a crucial role in shaping a project manager's personal competence.

Over time, collaborative teamwork, experience, and challenges drive the evolution of project manager competencies to the subsequent stage, becoming interpersonal competencies. The emphasis shifts from knowledge to integral features, specifically attitudes expressed in every action. Competencies that initially developed internally transform into interpersonal competencies. Leadership assumes a pivotal role during this phase, influencing subordinates and impacting organizational performance. The transition from cultivating intrapersonal competencies to fostering more collaborative competencies reflects project managers' strategic adaptation to effectively confront the challenges inherent in managing dynamic construction projects.

A limitation of this research lies in its focus on the type of construction projects. The literature review across various publications does not specifically analyze the competencies of project managers in different types of projects. As a result, the findings tend to generalize the competencies of construction project managers without distinguishing between specific project types.

REFERENCES

- [1] J. Du, C. Liu, and D. Picken, "A preliminary study on human resources management in international construction," *Construction Economics and Building*, vol. 7, No. 2, pp. 1-11, Nov, 2007, doi.org/10.5130/AJCEB.v7i2.2986.
- [2] S.G. Abramyan, "Environmental compliance during construction," *Procedia Engineering*, Vol. 150, pp. 2146-2149, Aug, 2016, doi.org/10.1016/j.proeng.2016.07.255.
- [3] P. Fewings, and C. Henjewe, *Construction project management: an integrated approach*. Abingdon: Routledge, 2019.
- [4] R. Y. J. Siew, "Human resource management in the construction industry-Sustainability competencies," *The Australasian Journal of Construction Economics and Building*, Vol. 14, No. 2, pp. 87-103, Jan, 2014, [doi/10.3316/informit.379544808164141](https://doi.org/10.3316/informit.379544808164141).
- [5] M. I. Cheng, A. R. Dainty, and D. R. Moore, "What makes a good project manager?" *Human Resource Management Journal*, Vol. 15, No. 1, pp. 25-37, Aug, 2005, doi.org/10.1111/j.1748-8583.2005.tb00138.x.
- [6] C. Christalisana, "Pengaruh pengalaman dan karakter sumber daya manusia konsultan manajemen konstruksi terhadap kualitas pekerjaan pada proyek di Kabupaten Pandeglang," *Fondasi: Jurnal Teknik Sipil*, Vol. 7, No. 1, pp. 87-98, Apr, 2018, dx.doi.org/10.36055/jft.v7i1.3305.
- [7] Y. Willy and J. Sekarsari, "Analisis aspek sumber daya manusia terhadap kinerja pekerja proyek konstruksi," *JMTS: Jurnal Mitra Teknik Sipil*, Vol. 3, No. 3, pp. 523-532, Aug, 2020, doi.org/10.24912/jmts.v3i3.8392.
- [8] S. Safrial, M. Masimin, and A. Rauzana, "Analisis pengaruh faktor-faktor kompetensi project manager terhadap keberhasilan proyek konstruksi sungai pada Dinas Pengairan Aceh," *Jurnal Teknik Sipil*, Vol. 6, No. 3, pp. 317-328, May, 2017.

- [9] I. A. A. Brahmantariguna, G. C. Dharmayanti, I. W. Yansen, "Hubungan kompetensi project manager terhadap keberhasilan proyek konstruksi gedung," *Jurnal Spektran*, Vol. 4, No. 2, pp. 55-62, Jul, 2016, doi.org/10.24843/SPEKTRAN.2016.v04.i02.p01.
- [10] I. Heryanto and T. Triwibowo, *Manajemen proyek berbasis teknologi informasi*, Bandung: Informatika, 2013.
- [11] S. Sudarmanto, "Merancang manajemen SDM berbasis kompetensi," *JKAP (Jurnal Kebijakan dan Administrasi Publik)*, Vol. 9, No. 1, pp. 1-16, May, 2005, doi.org/10.22146/jkap.8332.
- [12] A. Wallo et al., "Understanding factors that enable and inhibit assessment of outcomes of competence development," *Human Resource Development Review*, Vol. 19, No. 4, pp. 384-421, Jul, 2020, doi.org/10.1177/1534484320943332.
- [13] R. Wagner, "Organisational competence in project management-new perspectives on assessing and developing organisations," *Journal of Project, Program & Portfolio Management*, Vol. 3, No. 1, pp. 45-57, Sep, 2012, doi.org/10.5130/pppm.v3i1.2663.
- [14] W. J. Gutjahr et al., "Competence-driven project portfolio selection, scheduling and staff assignment," *Central European Journal of Operations Research*, Vol. 16, pp. 281-306, Maret, 2008, doi.org/10.1007/s10100-008-0057-Z.
- [15] V. Papp-Horváth, J. Tóth, and N. Tóth, "The evolution of the project management competence concept: A systematic literature review," *Vezetéstudomány/Budapest Management Review*, Vol. 55, No. 7-8, pp. 4-17, Jul, 2024, doi.org/10.14267/VEZTUD.2024.07-08.02.
- [16] K. Ahsan, M. Ho, and S. Khan, "Recruiting project managers: A comparative analysis of competencies and recruitment signals from job advertisements," *Project Management Journal*, Vol. 44, No. 5, pp. 36-54, Sep, 2013, doi.org/10.1002/pmj.21366.
- [17] J. Zheng, Q. Wen, and M. Qiang, "Understanding demand for project manager competences in the construction industry: Data mining approach," *Journal of Construction Engineering and Management*, Vol. 146, No. 8, pp. 04020083, May, 2020, [doi.org/10.1061/\(ASCE\)CO.1943-7862.0001865](https://doi.org/10.1061/(ASCE)CO.1943-7862.0001865).
- [18] J. C. Alvarenga et al., "The project manager core competencies to project success," *International Journal of Managing Projects in Business*, Vol. 13, No. 2, pp. 277-292, Jun, 2019, doi.org/10.1108/IJMPB-12-2018-0274.
- [19] M. Busro, *Teori-teori manajemen sumber daya manusia*. Jakarta: Prenadamedia, 2018.
- [20] K. H. Rose, "A guide to the project management body of knowledge (PMBOK® Guide)-Fifth Edition," *Project Management Journal*, Vol. 3, No. 44, May, 2013, doi.org/10.1002/pmj.21345.
- [21] D. Suhelayanti, *Manajemen pendidikan*. Jakarta: Yayasan Kita Menulis, 2020.
- [22] F. Mastarida et al., *Service management*. Jakarta: Yayasan Kita Menulis, 2020.
- [23] K. Prianto, S. M. Dewi, and A. Pujiraharjo, "Pengaruh kompetensi manajer proyek terhadap keberhasilan proyek pada perusahaan kontraktor di Kabupaten Malang," *Media Teknik Sipil*, Vol. 10, No. 2, pp. 156-168, Aug, 2012, doi.org/10.22219/jmts.v10i2.1788.
- [24] D. Podmetina, "Developing a competency model for open innovation: From the individual to the organisational level," *Management Decision*, Vol. 56, No. 6, pp. 1306-1335, May, 2018, doi.org/10.1108/MD-04-2017-0445.
- [25] E. Hassler et al., "Identification of SLR tool needs—results of a community workshop," *Information and Software Technology*, Vol. 70, pp. 122-129, Feb, 2016, doi.org/10.1016/j.infsof.2015.10.011.
- [26] M Regona et al., "Opportunities and adoption challenges of AI in the construction industry: a PRISMA review," *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 8, No. 1, 45, Feb, 2022, doi.org/10.3390/joitmc8010045.
- [27] J. Edwards and G. Kaimal, "Using meta-synthesis to support application of qualitative methods findings in practice: A discussion of meta-ethnography, narrative synthesis, and critical interpretive synthesis," *The Arts in Psychotherapy*, Vol. 51, pp. 30-35, Nov, 2016, doi.org/10.1016/j.aip.2016.07.003.
- [28] J. G. Neely et al., "A practical guide to understanding systematic reviews and meta-analyses," *Otolaryngology-Head and Neck Surgery*, Vol. 142, No. 1, pp. 6-14, Jan, 2010, doi.org/10.1016/j.otohns.2009.09.005.
- [29] H. Scells et al., "Automatic boolean query formulation for systematic review literature search," in *Proceedings of The Web Conference 2020*, Apr. 2020, pp. 1071-1081, doi.org/10.1145/3366423.3380185.
- [30] J. Zachawerus and A. Soekiman, "Faktor-Faktor yang mempengaruhi kesuksesan pelaksanaan proyek jalan nasional di Maluku Utara," *Jurnal Infrastruktur*, Vol. 4, No. 1, pp. 26-33, Jul, 2018,
- [31] N. Sonelma and I. K. Sucita, "Pengaruh kompetensi project manager terhadap keberhasilan proyek konstruksi gedung Apartemen X," *Construction and Material Journal*, Vol. 4, No. 1, pp. 71-81, Maret, 2022, doi.org/10.32722/cmj.v4i1.4483.
- [32] I. P. Widyarsana and N. Jawa, "Analisis kompetensi manajer proyek berpengaruh terhadap kinerja konstruksi di Kota Denpasar dan Kabupaten Badung," *Widya Teknik*, Vol. 11, No. 02, pp. 123-132, 2018, doi.org/10.32795/widyateknik.v11i02.2049.
- [33] F. R. Tanzil, M. Wibowo, and W. V. Lumintan, "Studi relevansi kompetensi project manager dengan peningkatan jumlah proyek desain interior Surabaya," *Jurnal Ilmiah Desain & Konstruksi*, Vol. 21, No. 1, pp. 101-112, 2022, dx.doi.org/10.35760/dk.2022.v21i1.5120.
- [34] I. Miswar, B. Hidayat, and T. Ophiyandri, "Relevansi unit kompetensi insinyur sipil pada bidang pekerjaan dan pengaruhnya terhadap kinerja profesi," *Jurnal Rekayasa Sipil*, Vol. 13, No. 2, pp. 101-112, Oct, 2017, doi.org/10.25077/jrs.13.2.101-112.2017.
- [35] K. Liikamaa, "Developing a project manager's competencies: A collective view of the most important competencies," *Procedia Manufacturing*, Vol. 3, pp. 681-687, 2015, doi.org/10.1016/j.promfg.2015.07.305.
- [36] A. Omran and A. Suleiman, "Identifying the competence components of the construction project managers in the Palestinian construction industry," *The Engineering Project Organization Journal*, Vol. 7, No. 2, pp. 2-27, Oct, 2017, doi.org/10.25219/epoj.2017.00110.
- [37] J. Li, J. Li, and R. Xia, "The researches on construction project manager competency and its application," in: Chau, K., Chan, I., Lu, W., Webster, C. (eds) *Proceedings of the 21st International Symposium on Advancement of Construction Management and Real Estate*. Springer, Singapore, 2018, doi.org/10.1007/978-981-10-6190-5_128.
- [38] S. Moradi, K. Kähkönen, and K. Aaltonen, "Project managers' competencies in collaborative construction projects. *Buildings*, Vol. 10, No. 3, Mar, 2020, doi.org/10.3390/buildings10030050.
- [39] K. Szczepańska-Woszczyzna and S. Gatnar, "Key competences of research and development project managers in high technology sector," *Forum Scientiae Oeconomia*,

- Vol. 10, No. 3, pp. 107–130, Oct, 2022, doi.org/10.23762/FSO_VOL10_NO3_6.
- [40] R. Viitala, “Perceived development needs of managers compared to an integrated management competency model,” *Journal of Workplace Learning*, Vol. 17, No. 7, pp. 436-451, Oct, 2005, doi.org/10.1108/13665620510620025.
- [41] T. M. Alkadash and C. Nadam, “The correlation between leadership competency and project success in construction industry in Thailand,” *International Journal of Intellectual Human Resource Management*, Vol. 1, No. 01, pp. 53-63, Apr, 2020, DOI:10.46988/IJHRM.01.01.2020.006.
- [42] R. Müller and R. Turner, “Leadership competency profiles of successful project managers,” *International Journal of Project Management*, Vol. 28, No. 5, pp. 437-448, Jul, 2010, doi.org/10.1016/j.ijproman.2009.09.003.
- [43] E. M. Lantelme, C. T. Formoso, and J. A. Powell, “Integrating technical and social competencies of construction managers,” *Journal of Professional Issues in Engineering Education and Practice*, Vol. 143, No. 4, 04017004, Apr, 2017, [doi.org/10.1061/\(ASCE\)EI.1943-5541.0000332](https://doi.org/10.1061/(ASCE)EI.1943-5541.0000332).
- [44] D. Sangwan, K. S. Sangwan, and P. Raj, “21st-century competencies in engineering education: initiation, evolution, current, and now whither to,” in: *Proceedings of the SEFI 50th Annual Conference 2022*. European Society for Engineering Education, Sep, 2022, doi:10.5821/conference-9788412322262.1409.

