

The Influence of Project Managers' Hard and Soft Competencies on the Success of Fiber Optic Projects in Indonesia with Moderation of Project Managers' Work Experience

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Abstract

Fiber optic network development is a strategic priority for expanding equitable internet access and supporting socio economic growth. Despite its importance, fiber optic projects often face implementation challenges that create stakeholder conflicts and expose projects to risks that may hinder success. Because fiber optic communication systems are widely used from local to international levels, their implementation demands not only technological readiness but also capable human resources. In this context, project managers are central to project outcomes, and selecting the right manager becomes essential, although the competencies required may differ across organizations and projects. Based on the literature, project managers' hard competencies, soft competencies, and work experience are considered important factors related to project success. Work experience is also often viewed as a factor that can strengthen employee competencies. Accordingly, this study examines the effects of project managers' hard and soft competencies on the success of fiber optic projects in Indonesia and tests whether work experience moderates these relationships. This study uses a quantitative survey approach and analyzes the data with Partial Least Squares. The findings show that work experience does not significantly affect the success of fiber optic projects in Indonesia and does not moderate the influence of either hard or soft competencies on project success. In contrast, hard competencies have a positive and significant effect on project success, while soft competencies show a positive but not significant effect. These results indicate that technical competence remains the most decisive factor in the success of fiber optic projects.

Introduction

Fiber optic is a communication system that uses light as an information carrying signal with fiber optic cables as the transmission medium, and in principle serves as the backbone of communication systems in general (SKKNI, 2018). According to Ngugi and Mutuku (2023), the development of fiber optic networks is a top priority in supporting equitable internet access, which has been proven to contribute to socio economic development in various countries. The International Telecommunication Union (ITU) states that an increase in internet access of ten percent correlates with economic growth of one point two percent in developing countries. In addition to strengthening the economy, the internet is also used for various other purposes such as education and health (Aji, 2022).

According to the chairman of the Indonesian Telecommunication Network Operators Association (APJATEL), Jerry Mangasas Swandy, the vast territory of Indonesia consisting of many islands is an obstacle to the installation of fiber optic networks. As of March 8, 2023, only thirty percent of Indonesian territory has been served by fiber optic networks, and according to his prediction, it will only be in the year 2045 that internet networks in Indonesia will be connected by fiber optic networks (APJATEL, 2023).

According to Aji (2022), fiber optic as a transmission medium has performance and speed that are far superior to wireless media. According to Sari et al. (2025), replacing networks from copper cables to fiber optic cables is essential because copper cables are unable to support the high speed requirements needed today. In addition, the Ministry of Communication and Informatics (KOMINFO) also stated that fifth generation network services cannot be provided without the support of fiber optic infrastructure (APJATEL, 2022).

According to Akhwaba et al. (2020), in practice the implementation of fiber optic projects often does not proceed as planned, resulting in conflicts among stakeholders. According to Sari et al. (2025), fiber optic projects face various risks, such as limited implementation time as the main issue, as well as other threats that can affect project success. Akhwaba (2021) added that the implementation of fiber optic infrastructure projects still faces several major challenges, including project failure due to weak leadership, stakeholder management, and ineffective government policies. In addition, delays in project permits due to a lack of coordination among authorities are a major factor hindering project implementation. According to Setiyadi (2024), various potential hazard risks can occur during the implementation of fiber optic projects, including being struck by materials, slipping, injuries to hands or feet, being pinched by materials, cables caught by vehicles, entangled in cables, electric shock due to poles contacting power lines, being hit by poles, falling into holes, falling from heights of seven to eleven meters, being struck by ladders, exposure to fiber optic glass fragments, and cuts caused by cutters.

The need for skilled workers in the field of fiber optic installation continues to increase along with the rapid development of communication technology (Kaur et al., 2022; Veeranna et al., 2023; Putra et al., 2023). Fiber optic based communication systems require special attention, both in terms of technology and human resource readiness, because almost all internet communication networks, from local level, inter city, inter provincial, to international level, have used this technology. Currently, fiber optic networks have reached all provinces in Indonesia, and most office infrastructure has also migrated to this system to increase data transmission capacity and speed. Therefore, human resource competencies need to be improved to ensure work quality in the planning, installation, and maintenance of fiber optic networks (SKKNI, 2018). Research by Kiminza (2016) shows that fiber optic cable deployment projects face challenges in obtaining competent staff, which results in project completion delays or the need to recruit foreign labor.

According to GAPPS (2007), project success criteria are measures that describe how a project will be evaluated. According to Fareed et al. (2021), project success has become a major focus of research over the past two decades, although many projects still fail. Maqbool et al. (2017) stated that project success is not only determined by technology or modern equipment, but also by human aspects, especially the behavior, competencies, and emotional intelligence of project managers.

Maqbool et al. (2017) and Do Vale et al. (2018) emphasized that project managers play a very important role in determining the final outcome of a project, therefore selecting the right project manager is a major challenge for organizations and a key factor in project success. However, Do Vale et al. (2018) added that the competencies required by project managers may differ depending on the type of organization and project. According to SKKNI (2014), competence is an individual ability to master knowledge and skills to apply certain methods and techniques, supported by appropriate work attitudes and behaviors, so that individuals can achieve expected work results, either independently or together with a team in carrying out tasks.

According to Moradi et al. (2020), existing standards of project manager competency practices only present lists and classifications of project manager competencies from a more general perspective. Practice standards in the field of project manager competencies include ICB, PMBOK, Project Manager Competency Development Framework (PMCDF), APM Competence Framework, Global Alliance for Project Professions (GAPPS), SKKNI Number 349 Year 2014, and AIPM National Competency Standards for Project Management Certified Practising Project Manager (CPPM) (Zhang et al., 2013; Moradi et al., 2020; Do Vale et al., 2018; Varajao et al., 2019; Li et al., 2020).

Various studies show that project success is not solely determined by the technical or hard competencies of project managers, but also by interpersonal or soft competencies. According to Hamsah (2021), hard competencies are specific abilities that must be possessed by an individual, in the form of knowledge, skills, or technical procedures required to perform tasks or jobs effectively, usually related to functional or technical aspects of a job. In contrast, soft competencies are viewed as a complement to hard competencies and are generally associated with emotional factors, social relationships, and interpersonal management (Jaya and Nurendra, 2019). Recent research shows a shift in attention from technical aspects to strengthening interpersonal skills, which have been proven to have an important influence on project success (Do Vale et al., 2018). In addition, Alvarenga et al. (2019) suggested that future research examine the relationship between hard and soft competencies of project managers and compare the extent to which each competency contributes to project success.

According to Alvarenga et al. (2019), various studies over the past several decades have explored the relationship between project manager competencies and project success. As a result, the list of identified competencies has become very long, like a shopping list, so that the core competencies that should be possessed may be obscured. Therefore, identifying core competencies is very important so that project managers can perform their roles effectively.

According to Napitupulu (2025), work experience plays an important role in improving employee competencies. Hoxha (2017) added that work experience has a positive, although not significant, effect on project success. Based on this, in addition to examining the influence of hard and soft competencies on project success, this study also includes project manager work experience as a moderating variable to determine whether work experience can strengthen or weaken the relationship between project manager hard and soft competencies and the success of fiber optic projects in Indonesia.

The scope of this research is limited to outdoor land based fiber optic projects only, such as aerial fiber optic cables, direct buried fiber optic cables, and duct fiber optic cables. It does not include other installations, such as indoor fiber optic projects, wireless communication, satellite, and submarine cables.

Aerial cables are fiber optic cables that are installed by being suspended in the air. The installation of these cables is supported by poles. Direct buried cables are fiber optic cables that are installed underground using an open trench method without protective duct or subduct pipes. Meanwhile, duct cables are fiber optic cables that are installed using protective duct or subduct pipes (Saputra, n.d.).

Methods

This study employs a quantitative approach to measure causal relationships between variables and to test hypotheses (Sugiyono, 2013). Data were collected through a survey from a large population using a smaller sample and analyzed using Partial Least Square (PLS) with SmartPLS (v.3.2.9). PLS was chosen because it can be applied to various data scales, requires minimal assumptions, does not require a large sample, and is suitable for both theory

confirmation and developing new relationships, including models with formative and reflective indicators (Gunawan, 2014).

Data were collected from primary sources using questionnaires with a Likert scale. The minimum sample size follows the rule of 10 times the number of variables, i.e., $10 \times 4 = 40$, which meets the minimum requirement for PLS analysis of 30 samples (Sugiyono, 2012; Gunawan, 2014). Respondents consisted of project managers in contracting companies involved in fiber optic infrastructure projects in Indonesia.

Before the questionnaire was distributed to respondents, the instrument was tested in two stages. The first stage involved five experts, namely project managers with at least five years of experience and professional certifications such as ICT Project Manager and Project Management Expert. This stage aimed to ensure that each questionnaire item accurately represented the research variables according to the theoretical basis. Once validated, the instrument was pilot-tested with five respondents to ensure clarity of wording and consistent understanding of the questionnaire items.

Results and Discussion

This study assessed the influence of project managers' hard competencies, soft competencies, and work experience on the success of fiber optic projects in Indonesia through a questionnaire survey. Using a snowball sampling technique, 117 questionnaires were distributed through initial respondents, of which 64 were fully completed and met the research criteria for further analysis. The data from these 64 respondents were analyzed descriptively to provide an overview of the characteristics of the collected data, though not for generalization to the population, and statistically to answer the research questions. Table 1 presents a summary of the respondents' characteristics.

Table 1. Respondent Characteristics

Characteristic	Category	Number	Description
Age	Minimum	22	Years
	Maximum	56	Years
	Mean	34,828	Years
	SD	8,305	Years
Education	Vocational High School	3	Persons
	Diploma D3	7	Persons
	Bachelor S1	45	Persons
	Master S2	9	Persons
Position	Project Manager	64	Persons
Certification	Available	29	Persons
	Not Available	35	Persons
Work Experience in Fiber Optic Field	Minimum	2	Months
	Maximum	27	Years
	Mean	6,400	Years
	SD	4,765	Years

The questionnaire results provide an overview of the studied variables. This study involved four variables: project success as the dependent variable, project managers' hard and soft competencies as independent variables, and work experience as a moderating variable. Table 2 presents the characteristics of these variables based on the questionnaire response scores.

Table 2. Characteristics of the Variables Examined

Variable	Number of Items	Minimum	Maximum	Mean	Standard Deviation
Project Success	6	21	30	25,266	2,644
Hard Competencies	12	36	60	51,563	6,324
Soft Competencies	11	38	55	48,656	4,900
Work Experience	3	8	15	12,703	2,121

Table 3. Respondents' Response Scores

Respondent	Project Success	Hard Competencies	Soft Competencies	Work Experience
Total	1617	3300	3114	813
Maximum Score	1920	3840	3520	960
Total Percentage	84,219%	85,938%	88,466%	84,688%

Based on the comparison between the total scores obtained and the maximum possible scores, the percentages for project success, hard competencies, soft competencies, and work experience were 84.22%, 85.94%, 88.47%, and 84.69%, respectively. Referring to the Likert scale classification proposed by Gunawan (2014), percentages ranging from 81% to 100% are categorized as "very good." This indicates that respondents generally perceived all variables in this study at a highly favorable level. In other words, the fiber optic projects examined were considered to have been implemented successfully, while the project managers involved were viewed as possessing strong hard competencies, strong soft competencies, and substantial work experience. These findings provide an important initial overview that the overall condition of the studied variables is already strong from the respondents' perspective.

This descriptive result is important because it shows that the respondents tended to give positive assessments across all major constructs measured in the study. However, descriptive findings alone are not sufficient to explain the relationships among variables or to determine whether one variable significantly influences another. For that reason, after the descriptive analysis was completed, the data were further analyzed using a statistical approach to test the proposed hypotheses more rigorously.

The analytical method employed in this study was Partial Least Squares Structural Equation Modeling (PLS SEM) with the assistance of SmartPLS software version 3.2.9. This method was selected because it is suitable for examining complex relationships among variables, including direct effects and moderating effects, while also allowing the simultaneous assessment of the measurement model and the structural model. The analysis process was carried out through several stages, namely constructing the path diagram, evaluating the measurement model to assess the validity and reliability of the indicators, and evaluating the structural model to examine the strength and significance of the relationships among the variables.

The following figure presents the research path diagram:

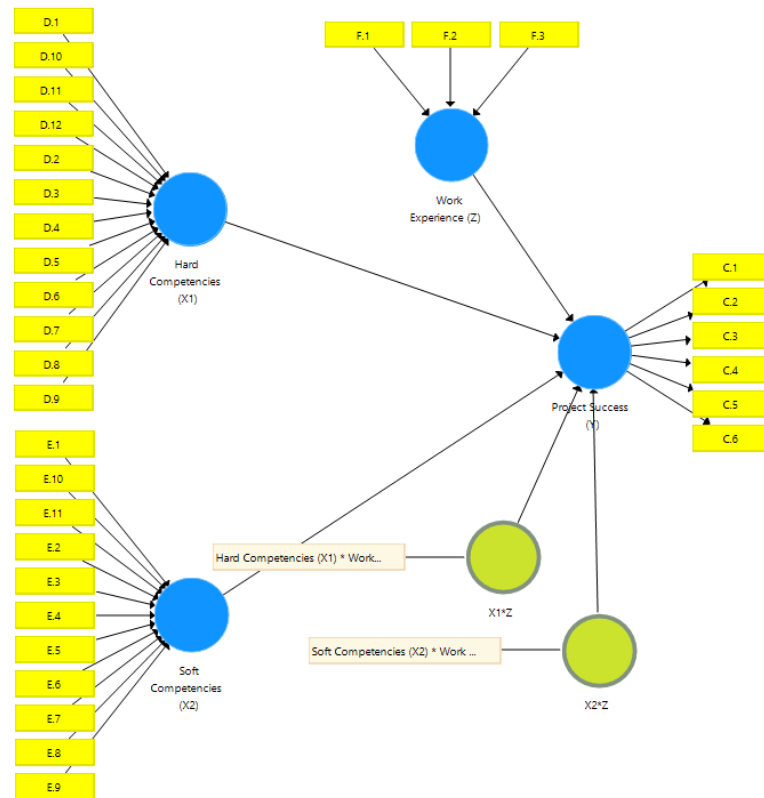


Figure 1. Research Path Diagram

Explanations of each variable, dimension, and indicator used in this study are presented in Table 4.

Table 4. Variables and Indicators Examined

Variable	Indicator
Project Success (Y)	C1 = Time
	C2 = Cost
	C3 = Scope
	C4 = Quality
	C5 = Customer Satisfaction
	C6 = Occupational Safety and Health (K3)
Hard Competencies (X1)	D.1 = Project integration management
	D.2 = Project scope management
	D.3 = Project schedule management
	D.4 = Project cost management
	D.5 = Project quality management
	D.6 = Project human resource management
	D.7 = Project communication management
	D.8 = Project risk management
	D.9 = Project procurement management

	D.10 = Project stakeholder management
	D.11 = Occupational Safety and Health management
	D.12 = Foreign language
Soft Competencies (X2)	E.1 = Strategic and business management
	E.2 = Leadership
	E.3 = Self reflection and self management
	E.4 = Personal integrity and reliability
	E.5 = Personal communication
	E.6 = Relationship and engagement
	E.7 = Teamwork
	E.8 = Conflict management
	E.9 = Cognitive ability

Table 5. (Continued)

Variable	Indicator
	E.10 = Negotiation
	E.11 = Results orientation
Work Experience (Z)	F.1 = Length of time or tenure
	F.2 = Level of knowledge and skills
	F.3 = Mastery of work and equipment

The research path diagram illustrates the structural and measurement model used to assess the influence of project managers' hard competencies, soft competencies, and work experience on the success of fiber optic projects in Indonesia. Latent variables are represented by circles or ellipses, indicators by rectangles, and relationships between variables are shown with arrows. Measurement model evaluation was conducted using Confirmatory Factor Analysis (CFA) to test convergent validity, discriminant validity, and the reliability of reflective indicators, while formative indicators were evaluated through weight significance using bootstrapping.

The structural model was assessed using R^2 values and path coefficients to test the hypotheses, with t-statistics serving as the basis for significance. The PLS-SEM results showed an R^2 value of 0.648, approaching the good category, indicating that the model has strong explanatory power. Path analysis showed that hard competencies had a positive and significant effect on project success, while soft competencies had a positive but not significant effect. Project managers' work experience had a negative coefficient for project success, but this effect was not statistically significant. Thus, work experience was not found to influence project success directly nor to moderate the effect of hard or soft competencies.

Table 6. Path Coefficients

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Hard Competencies (X1) -> Project Success (Y)	0,679	0,643	0,160	4,244	0,000

Soft Competencies (X2) -> Project Success (Y)	0,133	0,227	0,169	0,787	0,432
Work Experience (Z) -> Project Success (Y)	-0,109	-0,096	0,131	0,838	0,403
X1 * Z -> Project Success (Y)	-0,080	-0,064	0,226	0,356	0,722
X2 * Z -> Project Success (Y)	-0,103	-0,077	0,206	0,498	0,619

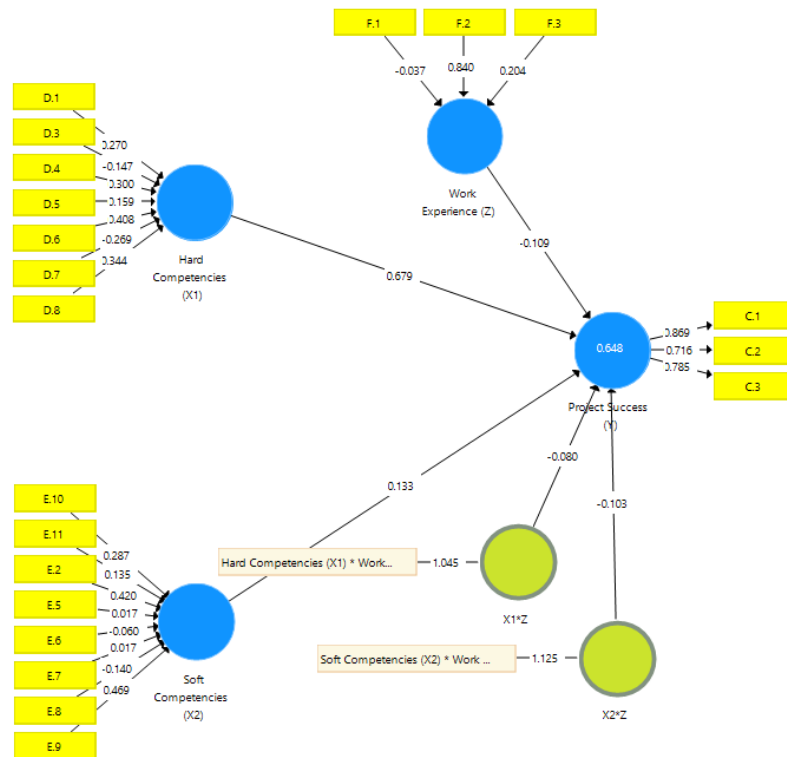


Figure 2. Final Research Model

Table 7. Variables and Indicators

Variable	Indicator
Project Success (Y)	C1 = Time
	C2 = Cost
	C3 = Scope
Hard Competencies (X1)	D.1 = Project integration management
	D.3 = Project schedule management
	D.4 = Project cost management
	D.5 = Project quality management
	D.6 = Project human resource management
	D.7 = Project communication management

	D.8 = Project risk management
Soft Competencies (X2)	E.2 = Leadership
	E.5 = Personal communication
	E.6 = Relationship and engagement
	E.7 = Teamwork
	E.8 = Conflict management
	E.9 = Cognitive ability
	E.10 = Negotiation
	E.11 = Results orientation
Work Experience (Z)	F.1 = Length of time or tenure
	F.2 = Level of knowledge and skills
	F.3 = Mastery of work and equipment

The results of this study support project management theory and practice, emphasizing the importance of project managers' hard competencies in the success of fiber optic projects in Indonesia. Hard competencies, which include project integration, schedule, cost, quality, human resource, communication, and risk management, were found to have a positive and significant impact on project success, consistent with findings by Zwikael (2009) cited in Zhang et al. (2013), as well as the views of Laksamana (2011) and Azimi (2025) regarding the importance of integrated scheduling and time management. Technical competencies, such as cost, time, and stakeholder management, are considered essential skills for project managers (Ahsan et al., 2013; Zhang et al., 2013; Ganancias, 2025) and are supported by Moradi et al. (2020), who highlight team management, integration, cost, and schedule as key factors in IT project success.

Soft competencies including leadership, personal communication, relationships and engagement, teamwork, conflict management, cognitive ability, negotiation, and result orientation have a positive but not significant effect, aligning with some previous studies (Gruden & Stare, 2018; Sampaio et al., 2022; Fareed et al., 2021), although experts consider their contribution contextually important. Meanwhile, project managers' work experience, including length of time or tenure, knowledge and skills, and proficiency in tasks and tools, was not only insignificant but tended to have a negative effect on project success, indicating that it is not a primary determinant compared to hard competencies, even though some studies suggest that experience can enhance knowledge and skills (Moradi et al., 2020; Wahedy & Faqiri, 2021). Overall, theory, previous research, and expert opinions support the finding that hard competencies are the main factor in fiber optic project success in Indonesia, soft competencies have a positive but not significant effect, and work experience has a negative and insignificant effect.

Conclusion

Based on the research findings, it can be concluded that project managers in Indonesia's fiber optic projects generally possess both hard and soft competencies, although their contributions to project success differ. Hard competencies, which include project integration, schedule, cost, quality, human resource, communication, and risk management, were found to have a positive and significant effect on project success, particularly in achieving project targets related to time, cost, and scope. This indicates that technical and managerial mastery remains a crucial determinant in ensuring that fiber optic projects are implemented effectively. In contrast, soft competencies, such as leadership, personal communication, relationship building, teamwork,

conflict management, cognitive ability, negotiation, and result orientation, showed a positive but not significant effect. This suggests that while soft competencies still contribute to project implementation, their role is more supportive and contextual rather than decisive.

The study also found that project managers' work experience does not moderate the relationship between either hard or soft competencies and project success. In other words, the influence of these competencies tends to remain consistent regardless of whether a manager has more or less work experience. Hard competencies continue to show a significant direct effect, whereas the contribution of soft competencies remains positive without being significantly strengthened or weakened by experience. These findings confirm that hard competencies are the most dominant factor influencing the success of fiber optic projects in Indonesia. Expert evaluation further reinforces this conclusion by showing that project success in practice is not primarily determined by the length of work experience, but rather by the manager's motivation to learn and the ability to apply clear procedures and appropriate work methods. Therefore, hard competencies can be regarded as the primary driver of project success, while soft competencies function as complementary factors whose influence may vary depending on field conditions.

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