



Research Article

A Framework for Assessing Competency of Site Supervisors in Construction Projects

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ABSTRACT: *The construction industry in India is growing rapidly, and with it comes the need for highly competent supervisory staff to ensure quality and safety on construction sites. However, there is currently a lack of standardized methods for assessing the competency of these staff members, leading to inconsistencies in performance and potentially putting workers and the public at risk. This research paper aims to fill the gap by proposing a framework for benchmarking the competency of supervisory staff on construction sites in India. The proposed framework builds on existing research on competency assessment and is tailored to the unique needs and challenges of the Indian construction industry. By providing a standardized method for assessing supervisory staff competency, the proposed framework shall have the potential to improve the quality and safety of construction projects in India. It can also help construction companies identify areas for improvement and provide targeted training to enhance the skills and knowledge of their staff.*

KEYWORDS: *Competency, Supervisory staff, Supervisor, Supervision, Skill, Construction Project.*

INTRODUCTION

Construction supervisors play a crucial role in overseeing construction activities at the construction site and managing the contractors and staff involved in the process. The competence of a construction supervisor is an essential factor for achieving higher performance levels in any working condition, which includes a cluster of abilities, knowledge, and skills. According to (Agrawal, 2017), (Wang, 2008), and (Zheng, 2016), the competence of a supervisor is critical for effective planning, implementation, and oversight of construction efforts. The ability of a construction supervisor can be divided into general and special abilities. General ability encompasses basic activities, such as observation, memory, and thinking abilities, which are essential for all kinds of activities. Special ability, on the other hand, refers to the ability demonstrated in a particular professional activity (S.K. Yaman, 2015). (Dziekonski, 2017) identifies four factors that impact the competency of construction project managers, including basic managerial skills, interpersonal abilities that support managerial skills, emotional intelligence, and formal skills. Hence, it is essential for the construction industry to invest time, money, and effort in enhancing the competency of construction workers to improve productivity and the quality of construction work.

On global level countries such as US has developed Competency management model (CMM) that looks after skills, knowledge & abilities of the supervisors, UK has Construction Industry Training Board (CITB) which has developed Construction Site Supervisor (CSS) certification.

In India with the increase in construction projects there is shortage of skilled supervisors, there is inconsistencies in the quality of supervision. On exploring the industry, few companies in construction industry does follow different evaluations with different key performance indicators but every company had their own sets of KPIs. So, there is no standard KPIs common for all to assess the competency of construction on-site supervisors. Therefore, this research aims to develop few major KPIs for their performance evaluation.

METHODOLOGY

This study is a mixed research; at first, a comprehensive understanding of the on-site supervisors, their responsibilities & performance expectations is done through literature review. Followed by their qualification, level of skills they have and the best practices for benchmarking supervisors' performance been identified through literature and expert interviews and survey in the construction industry qualitatively. Further, a survey was floated to the experts for rating on Likert scale the importance of the KPIs and performance of the supervisors based on all the KPIs. Data analysis is done to remove the outliers using SPSS tool, then Importance Performance Analysis is done based on these ratings to conclude the major important KPIs.

LITERATURE REVIEW

(Jerald L. Rounds, 2011) In his books states that the construction supervisor is a person who organizes, directs, and coordinates on-site operations that result in transforming designs and specifications into reality. On a construction project as well as within a construction company, supervisors act as the operational link between the management team and the craft workers (Jerald L. Rounds, 2011).

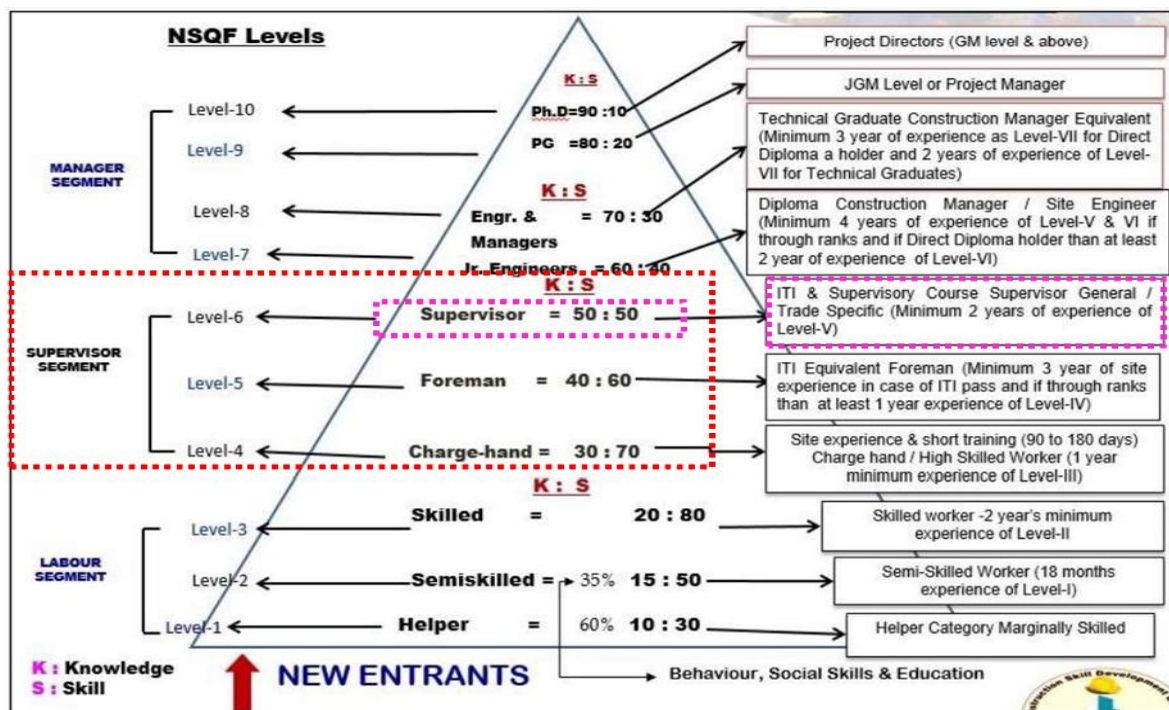


Figure 1: The Construction Skill Pyramid (N.S.D.C.)

Figure 1 shows that out of 10 levels of NSQF, level – 4 (Charge-hand), level – 5 (Foreman) & level – 6 (Supervisor) comes under “supervisor segment”. Level 6 is designated for Supervisors who should have knowledge to skill ratio as 50:50.

ROLES AND RESPONSIBILITIES

As per the National Building Code of India (NBC, 2016), a construction supervisor is responsible for the following:

- a. Ensuring that the construction work is executed in compliance with the approved plans and specifications, and in accordance with the relevant laws, codes, and standards.
- b. Coordinating and supervising the work of construction workers and ensuring that they have the required skills and training.
- c. Ensuring that the construction site is safe and that appropriate safety measures are implemented.
- d. Ensuring that the materials used in construction meet the relevant standards and specifications.
- e. Ensuring that the construction work is carried out efficiently and on schedule.
- f. Maintaining proper records and documentation related to the construction work.

QUALIFICATIONS

As per (N.S.D.C.), a supervisor must have an ITI degree and have completed a supervisory course with a supervisor general or trade specialized and have at least two years of experience at level 5, or as a foreman. According to (CPWD, 2022), the minimum qualification required for a construction site supervisor is a diploma or degree in civil engineering from a recognized institution. A government organization called the Delhi Development Authority is in charge of creating and maintaining Delhi's housing stock and infrastructure. According to (DDA, n.d.) a diploma or degree in civil engineering from a reputable university is the minimal need for a construction site supervisor.

COMPETENCY

(Silvius, 2009), states competence as the demonstrated ability to apply knowledge and/or skills, and, where relevant, demonstrated personal attributes. In other words, competence indicates a cluster of related abilities, commitments, knowledge, and skills that enables a worker to act effectively in a wide variety of working situations.

As per (ISO 9001, 2015) the organization shall:

- a. Determine the necessary competence of person(s) doing work under its control that affects the performance and effectiveness of the quality management system;
- b. Ensure that these persons are competent on the basis of appropriate education, training, or experience;
- c. Where applicable, take actions to acquire the necessary competence, and evaluate the effectiveness of the actions taken;
- d. Retain appropriate documented information as evidence of competence.

Table 1: A competency-based model for construction supervisors in developing countries (Alfredo Serpell, 2014)

COMPETENCY PROFILE	
Education and training	<ol style="list-style-type: none"> a. Understand the concepts and elements of the tactical and operational planning of a construction project b. Distinguishes and evaluates construction materials and equipment frequently used in construction projects

	<ul style="list-style-type: none"> c. Recognizes the different construction techniques d. Distinguishes and applies quality, safety and environmental procedures
Abilities and performance	<ul style="list-style-type: none"> a. Leads operational working teams and involves them in operational planning b. Involves people in safety, quality and environmental practices c. Plans construction projects at the operational level d. Applies management tools to evaluate the progress of construction projects and evaluates quality
Attitudes	<ul style="list-style-type: none"> a. Oriented to the mission and vision and strategic goals of the project b. Committed to the organizational values of the company c. Committed to the safety of personnel and the security of material resources d. Flexible and able to adapt in the face of aggressive environments and situations

(Alfredo Serpell, 2014) summed up the competency profile under three categories, namely, education & training, abilities & performance, and attitudes, of the site supervisor in the developing countries which can be seen below in Table 1.

DIFFERENCES BETWEEN EFFECTIVE AND INEFFECTIVE SUPERVISORS

(Carroll, 1996), highlighted further potential differences between efficient and inefficient supervisors, listed in Table 2.

Table 2: Overview of possible differences between effective and ineffective supervisors (Carroll, 1996)

Effective Supervisors	Ineffective Supervisors
Structure supervision appropriately	Over- or under-structure supervision
Help trainees find their way of being counsellors	Substitute counselling for supervision Insist their way of counselling is the only way
Are good teachers	Are poor teachers
Are flexible across roles	Lock into specific roles
Contract clearly	Are poor negotiators
Evaluate fairly and according to agreed criteria	Have few clear criteria for evaluation
Adapt to individual differences in supervisees	Supervise all supervisees in exactly the same way
Train as supervisor	See no reason why they should train as supervisors
Have access to a variety of supervisory interventions	Have a limited number of supervisory interventions

Give feedback clearly, directly, and constructively	Give no feedback, vague feedback, or come across as punitive with feedback
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FACTORS AFFECTING THE PERFORMANCE OF SUPERVISORS

Supervisor engineers are the primary source of supervision in the construction sector. Unfortunately, the supervising engineers' substandard work resulted in numerous urban buildings lacking adequate quality and strength (Hashemi, 2010).

There are many factors affecting the poor performance of supervisors (Abbasi, 2007). Few factors are listed below.

- Supervisor skills (leadership, management, and communication skills)
- Lack of appropriate and formal training (knowledge)
- Lack of sufficient experience in supervisor engineer
- The supervisor engineer has no understanding of the project and how to monitor it.
- Maybe the supervisor engineer is not responsible.
- Availability of appropriate supervisory tools
- There is no complete standards and guidance for supervision.
- Technical documentation and access to documents may not work well
- Lack self-confidence and decisiveness
- The ability to use modern techniques in supervision
- Being not committed and conscientious
- Promotion of supervisors based on their working years
- Ethical and professional stability
- Discontinuous presence of supervisor engineers

The above-mentioned factors are further classified into four categories by (S. Shahraki, 2018): Legal, Ethical, Technical and skilful, Economic. By emphasizing on these four categories, effective solutions might enhance the quality of a supervision thereby, improving the quality of the construction industry.

STRATEGIES FOR BENCHMARKING

In the construction sector, benchmarking is a crucial method for evaluating the performance of any staff. It facilitates the discovery of best practices, enhances functionality, and boosts competitiveness (Liu, 2018). However, benchmarking in the construction sector is still in its early stages and the methods used to conduct it are not standardized (Ahmed, 2017). In this situation, it is critical to identify techniques for efficiently gauging the effectiveness of site supervisors. Benchmarking site supervisor performance generally calls for a combination of strategies, including the use of KPIs, benchmarking databases, and performance evaluation systems, utilizing technology tools, peer benchmarking. By utilizing these techniques, construction firms may identify areas for development and create customized training programmes that increase the knowledge and abilities of their site supervisors.

METHODS FOR CHECKING COMPETENCIES

There are various methods for evaluating the competencies of a supervisor, such as:

- Performance evaluation (Society for Human Resource Management): conduct regular performance reviews to evaluate the supervisor's performance in areas such as leadership, communication, and team management.
- Skills assessments (International Coach Federation): suggests that tests, simulations, and behavioural interviews can be used to assess the supervisor's technical and soft skills.
- Observation (Harvard Business Review): observe supervisors in different situations, such as managing conflicts, delegating tasks, and providing feedback to employees.
- Feedback from employees (Society for Human Resource Management): gathering feedback from employees on the supervisor's performance can provide valuable insights into the supervisor's communication style, leadership ability, and approach to problem solving.
- 360-degree feedback (Centre for Creative Leadership): gathering feedback from multiple sources, including the supervisor's peers, subordinates, and superiors.

These methods can be used individually or in combination to provide a comprehensive view of the supervisor's competencies and help identify areas for improvement.

DATA COLLECTION AND ANALYSIS

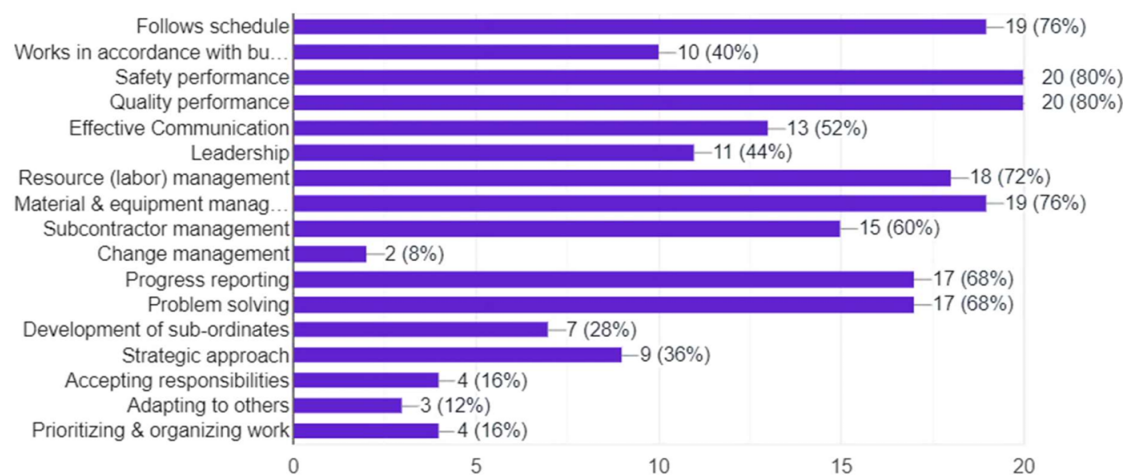


Figure 2: KPI's on which supervisor should be assessed on (Author)

1. Safety performance
2. Quality performance
3. Follows schedule
4. Material & equipment management
5. Resource management
6. Progress reporting
7. Problem solving
8. Subcontractor management
9. Effective communication
10. Leadership
11. Work in accordance with budget
12. Strategic approach, etc.

Supervisors can be assessed on these KPI's. As from above collected responses, for prioritizing various KPI's further, a closed ended questionnaire was circulated among the experts. Experts were asked to rate KPI's importance and supervisor's performance on Likert scale considering the mentioned Key Performance Indicators.

For rating Importance of the KPI's, experts were to answer how important is it for the construction supervisor to ensure following:

1- Not Important, 2- Somewhat important, 3- Neutral, 4- Important, 5- Extremely Important.

Table 3: KPIs and their respective goals

KPIs	GOALS
Safety	All safety measures are in place and followed by the workers
Quality	Work done to a high standard of quality and that the construction materials used are of the right specifications and
Time mgmt.	Manage time efficiently, meet deadlines, and have a plan in place for unforeseen delays or issues
Team mgmt.	Manage the team effectively, create a positive work environment, and motivate the team to work towards success
Documentation	Maintain accurate records of the project, including daily logs, progress reports, and other necessary documents
Compliance	Ensure that all work on the site is compliant with relevant regulations, codes, and standards, and be aware of potential legal or regulatory issues
Communication	Communicate effectively with the workers and other stakeholders on the project, convey instructions and provide feedback
Problem solving and Decision	Solve problems and make quick decisions when issues arise on the site, and identify potential problems before they occur
Leadership	Provide clear direction and guidance to the team
Material and Equipment mgmt.	Materials and equipment are properly managed, maintained, and used efficiently on the project
Behavioral	Exhibit positive behaviors and attitudes on the project site, such as being respectful, approachable, and professional
Risk Appetite	Willingness to take calculated risks on the project in order to achieve project objectives

Each KPI based on their importance level is rated on a Likert scale of 1 to 5 so that they can be prioritized, where:

1- Not Important, 2- Somewhat important, 3- Neutral, 4- Important, 5- Extremely Important.

Further rating Performance of the supervisors based on the KPI's which states:

1. Safety

- Follows safety guidelines and procedures to prevent accidents and injuries
- Provides adequate training to team members to ensure safety
- Maintains a clean and organized work site to minimize hazards

2. Quality

- Ensures quality of work is in accordance with ISO 9000 or as per organization's specifications
- Identifies and addresses quality issues promptly
- Maintains accurate and complete records to track quality control

3. Time Management

- Meets project deadlines and schedules
- Manages time effectively to maximize productivity
- Identifies and addresses time management issues promptly

4. Team Management

- Builds a strong team and fosters teamwork
- Delegates tasks effectively to team members
- Provides constructive feedback and coaching to team members

5. Documentation

- Maintains accurate and complete documentation for the project
- Keeps project documents organized and easily accessible
- Follows proper procedures for document retention and disposal

6. Compliance

- Ensures compliance with all relevant laws, regulations, and standards
- Maintains accurate and complete records to demonstrate compliance
- Identifies and addresses compliance issues promptly

7. Communication

- Communicates effectively with team members, stakeholders, and clients
- Listens actively and responds appropriately to feedback
- Uses clear and concise language to avoid misunderstandings

8. Problem Solving

- Identifies and addresses problems promptly and effectively
- Analyses problems thoroughly to determine root causes
- Develops and implements appropriate solutions to address problems

9. Leadership

- Demonstrates strong leadership skills and inspires team members
- Sets clear goals and expectations for team members
- Provides guidance and support to team members as needed

10. Material & Equipment Management

- Manages materials and equipment effectively to avoid shortages and delays
- Identifies and addresses material and equipment issues promptly
- Maintains accurate and complete records to track materials and equipment

11. Behavioural

- Demonstrates positive and professional behaviour at all times
- Treats team members, stakeholders, and clients with respect
- Maintains a positive attitude in the face of challenges and setbacks

12. Risk Appetite

- Takes calculated risks to achieve project goals
- Identifies and evaluates risks and develops appropriate risk management strategies
- Demonstrates willingness to take responsibility for risks and their consequences

Total 22 responses were collected for rating the KPI's importance & their respective performance by supervisors. So, at first responses were tabulated and then outliers were identified based on interquartile range (figure 3, 4) by SPSS tool and then removed.

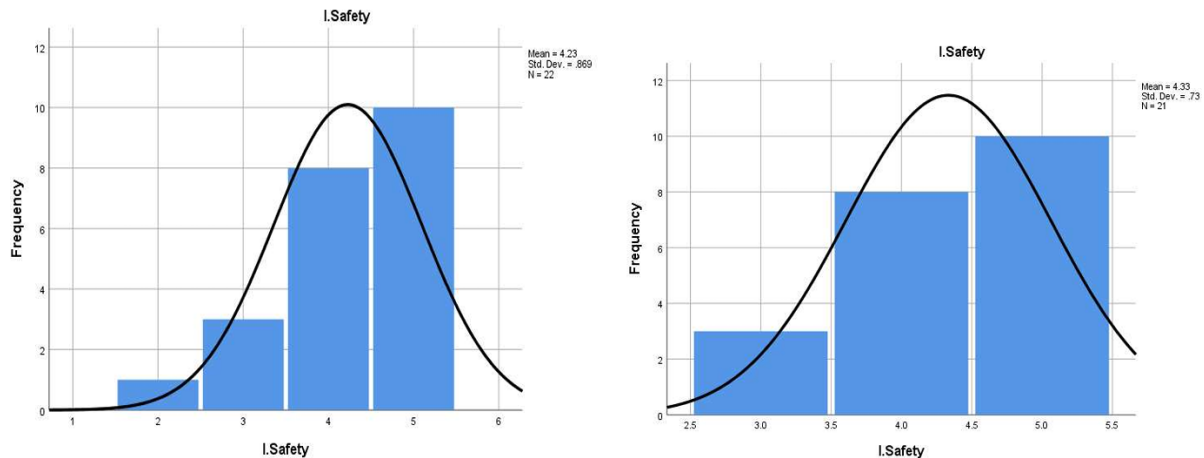


Figure 3: Response data before & after removal of outliers respectively (Author)

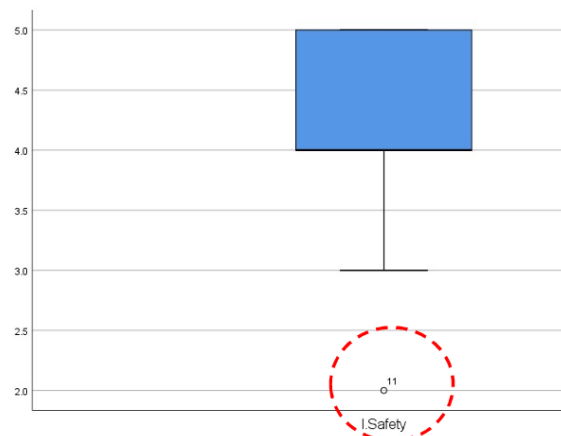


Figure 4: Outlier by SPSS tool (Author)

Considering the above graphs, Mean value has been considered more appropriate measure of central tendency to use in an IPA chart as data is normally distributed & it provides an average score for each KPI and takes into account all the individual scores.

As per the Importance-Performance Analysis (IPA) mean of the ratings given by the experts is plotted keeping Performance on x-axis & Importance on y-axis (Figure 5). The graph shows 4 quadrants which indicates as following:

Quadrant 1 (High Importance, Low Performance): High priority and need improvement.

Quadrant 2 (High Importance, High Performance): Are critical success factors and should be maintained or improved to continue meeting stakeholder expectations.

Quadrant 3 (Low Importance, High Performance): Low priority but can still be maintained or improved to exceed stakeholder expectations.

Quadrant 4 (Low Importance, Low Performance): Low priority and can be deprioritized/ eliminated Important KPIs are ranked based on the importance rates as can be seen in table 4.

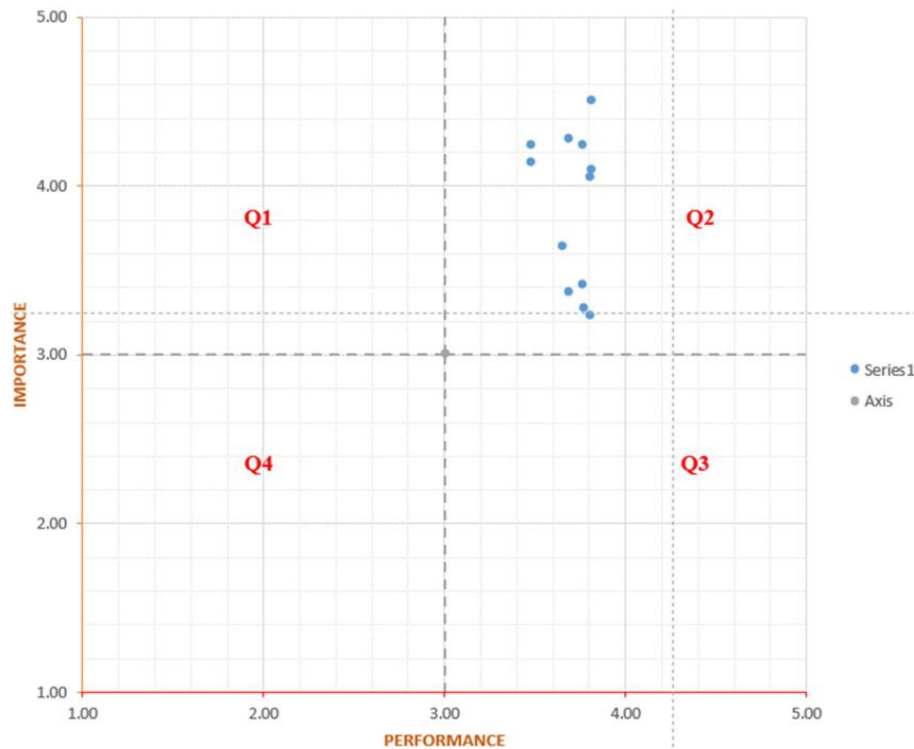


Figure 5: Importance-Performance Analysis Chart-Mean (Author)

KPIs having importance rating above 4; i.e. in between Important to Extremely important are considered as most important KPIs.

Further these KPIs can be sub divided into following 3 parameters:

1. Education and training - Knowledge
2. Abilities and performance – Skill / Performance
3. Attitude

Evaluation matrix for the supervisors (Table 4) shows the marking of the performance of the on-site supervisor out of 1000 marks which can further be converted to 100.

Table 4: Ranking of KPIs based on their importance level (Author)

RANK	KPIs	IMPORTANCE	PERFORMANCE	WEIGHTAGE
1	Quality	4.50	3.81	15.2%
2	Compliance	4.27	3.81	14.5%
3	Safety	4.24	3.76	14.4%
4	Time Management	4.24	3.48	14.4%
5	Documentation	4.14	3.48	14.0%
6	Communication	4.09	3.81	13.9%
7	Behavioral	4.05	3.80	13.7%
		29.52		100%

Table 5: Evaluation matrix (Author)

Knowledge				
40%				
Needs Improvement	Satisfactory	Outstanding	Total	
50%	75%	100%		
	2		114.3	
		3	144.7	
1			71.8	
	2		107.7	
		3	140.1	
1			69.3	
	2		102.75	
Skill				
40%				
Needs Improvement	Satisfactory	Outstanding	Total	
50%	75%	100%		
	2		114.3	
	2		108.525	
	2		107.7	
	2		107.7	
	2		105.075	
	2		103.95	
	2		102.75	
Attitude				
20%				
Needs Improvement	Satisfactory	Outstanding	Total	Grand Total
50%	75%	100%		
1			76.2	106.68
		3	144.7	130.23
	2		107.7	93.34
1			71.8	100.52
		3	140.1	126.09
	2		103.95	90.09
1			68.5	95.9
				742.85

Table 6: KPIs and Their Task List

Key Performance Indicator (KPI)	Knowledge	Skill Set	Attitude
Safety Performance	Knowledge of safety procedures and regulations	Ability to implement and enforce safety protocols	Demonstrates a commitment to safety
Quality of Work	Knowledge of industry standards and best practices	Ability to ensure work meets quality standards	Takes pride in producing high-quality work
Productivity	Knowledge of the construction process and project timeline	Ability to manage time and resources to maximize productivity	Maintains a positive attitude towards completing tasks efficiently
Communication	Knowledge of effective communication techniques	Ability to convey information clearly and effectively	Demonstrates active listening and seeks to understand others' perspectives
Leadership	Knowledge of leadership principles and styles	Ability to motivate and inspire workers	Demonstrates a positive attitude and leads by example
Decision-making	Knowledge of project goals and constraints	Ability to make informed decisions quickly and confidently	Demonstrates a willingness to take responsibility for decisions
Time Management	Knowledge of project timeline and priorities	Ability to prioritize tasks and manage time effectively	Demonstrates a sense of urgency towards completing tasks on time
Planning and Organizing	Knowledge of project requirements and constraints	Ability to plan and organize resources effectively	Demonstrates attention to detail and proactive planning skills
Budget Management	Knowledge of project budget and financial constraints	Ability to manage expenses and resources within budget	Demonstrates a responsible and careful approach to financial management
Continuous Improvement	Knowledge of industry trends and new technologies	Ability to identify areas for improvement and implement changes	Demonstrates a growth mindset and a willingness to learn

CONCLUSION

So, from this study it can be concluded that we can focus on major seven KPIs i.e; Quality, compliance, safety, time management, documentation, communication and behavioural on

which an on-site supervisors' performance can be evaluated. Overall, the evaluation of supervisors should be based on their knowledge, skill set, and attitude towards each 7 KPIs to ensure they are capable of effectively managing the construction project while maintaining a safe and productive work environment. Further, this study can be more explored by applying it in a real time construction project and validating it to make it more concrete.

REFERENCES

- [1] Abbasi, A. A. (2007), Evaluation and quality control of residential buildings in Tehran.
- [2] Agrawal, T. A. (2017), Vocational education and training in India: A labour market perspective, *J. Vocational Education Training*, 69 (2), 246-265.
- [3] Ahmed, S. A. (2017), Benchmarking construction project performance using the Balanced Scorecard: A case study, *Built Environment Project and Asset Management*, 58-72.
- [4] Alfredo Serpell, X. F. (2014), A competency-based model for construction supervisors in developing countries. *researchgate*, 585-602.
- [5] Carroll, M. (1996), *Counselling Supervision: Theory, Skills and Practice*, London: Cassell.
- [6] CPWD, C. P. (2022), *Quality Assurance Manual for Building Works*. New Delhi: Government of India.
- [7] DDA, D. D. (n.d.), Retrieved from <https://dda.gov.in/>: <https://dda.gov.in>.
- [8] Dziekonski, K. (2017), Project Managers' Competencies Model for Construction Industry in Poland 7th International Conference on Engineering, Project, and Production Management, 174-181.
- [9] Hashemi, M. (2010), *Civil rights and urban planning rules*. Majd publications.
- [10] I. S. (2015), *ISO 9001 Quality Management Systems-Requirements*. Switzerland: International Organization for Standardization.
- [11] Liu, Y. L., (2018), Measuring the construction project performance based on balanced scorecard and fuzzy set theory, *Journal of Construction Engineering and Management*, 144.
- [12] N. S. D. C., N. S. (N. D.), *Affiliation Protocol for Training Providers*. Retrieved from Construction Skill Development Council of India.
- [13] NBC. (2016), *National Building Code of India 2016*, New Delhi: Bureau of Indian Standards.
- [14] S. Shahraki, E. S. (2018), Identification and Classification of Factors Affecting the Performance of Building Supervisor Engineers for Construction Industry. *Journal of Engineering, Project, and Production Management*, 65-74.
- [15] S. K. Yaman, E. A. (2015), Technical competency of construction manager in Malaysian construction industry, *Applied Mechanics and Materials*.
- [16] Silvius, A. J. (2009), *Project Mangement 2027: The Future of Project Management*. Netherlands.
- [17] Wang, Y. P. (2008), Craft training issues in American industrial and commercial construction, *J. Constr. Eng. Management*, 795-803.
- [18] Zheng, W. J. (2016), Prompted self-regulated learning assessment and its effect for achieving ASCE vision 2025, *Journal of Civil Engineering Education*, 143 (2), 1-10.



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