

Priority setting for competency development training topics for road construction site managers to reduce the risk of construction failure

Yosritzal^{1*}, Purnawan¹, *Elsa Eka Putri*¹, *Evita Kartika Ratu*²

¹Civil Engineering Department, University of Andalas, Main Campus Limau Manis, Padang, 25166, Indonesia

²Office of Public Works - Human Settlements and Spatial Planning, Padang, 25138, Indonesia

Abstract. Problem in road construction project could be triggered by employing a less competent Site Manager either in terms of knowledge and skills or in attitudes in the project. Therefore, an evaluation of the competency of the Site Managers and seeking the required development training to improve the relatively weaker items of competency is needed. This paper presents an evaluation of the competency of Site Manager of road construction project in the West Sumatera Road Construction Project 2014. The evaluation was conducted using expectation and performance analysis and the evaluated items of competency were extracted from Indonesian Standard of Competency for Labour especially for Site Manager of Road Construction. The study found that construction management system, project administration, and resource procurement are among competency factors that fall under average and should be improved in the future. Therefore, development training on those items could be initiated by the owner to reduce the risk of road construction project failure in the future.

1 Introduction

Road construction engineering failure due to the incompetence of the response team for the job may result in a disaster either to the workers, road users, and those who are around the construction site. In order to reduce the risk, Indonesian Standard of Competency for Labour especially for Site Manager of Road Construction (hereafter will be named Site Manager) has been regulating since 2013 [1]. As a consequence, all of the site managers will be assessed based on the standard and those who failed to satisfy the requirement would not be allowed to stay at their position in the future project. In fact, as the standard has just been launched, only a few people who have been passed the assessment and been certified. It is much challenging to find a person who has been certified in a region far from the state capital such as West Sumatera Province – Indonesia and if the assessment being conducted now, the number of Site Managers who will pass the assessment cannot be predicted. Running some competency development training might be very useful in increasing the competency level of the person. However, a limited available budget encourages the authorities to determine what training is in priority to run.

This paper presents the use of Expectation-Performance Analysis (EPA) in evaluating the competency of the site managers who involved in West Sumatera Provincial Road Project - Indonesia during 2014 and determine the gap between the expected and

the perceived performance of them in the owner point of view. Site Managers were the object of this study. Further, this study identifies items of competency to be improved in a competency development training.

2 Literature review

2.1 Indonesia standard of competency for labour

The establishment of the ASEAN Economic Community in 2015 increases the opportunity for Indonesian workers to work in any ASEAN countries as long as they satisfy the requirement for the job and win the competition. In order to promote fairness in the competition for finding a job between local, and foreign labor, Indonesian Minister of Labour regulates Indonesian Competency Standard for Worker on many job titles. Included in this standard, the minimum level of knowledge, skills, and attitudes to be mastered by every labor.

In road construction work especially for the position of Site Manager, the standard has been regulated since 2013 namely Indonesian Standard of Competency for Road Construction Site Manager 2013 [1]. In terms of knowledge, there are at least 41 items of competency mentioned in the standard which grouped into 9 categories i.e. competency in managing project to satisfy the requirement of the contract, organising site work activities, managing all of available resources,

* Corresponding author: yosritzal@eng.unand.ac.id

controlling the working method, evaluating effectivity and efficiency of the works, implementing administration procedures, implementing management system, negotiation technique for community relationship and procurement of goods and services. Similarly, in terms of skills, there are 42 items grouped into 8 categories. The selected items of the standard will be used in our questionnaire to assess the expected and the perceived performance of the Site Managers in owner point of view.

2.2 Expectation-performance analysis

Expectation - Performance Analysis (EPA) is a modification of the Importance-Satisfaction Analysis or ISA [2] and the Importance-Performance Analysis or IPA [3]. The ISA and IPA have been used in many studies such as in tourism studies [4,5], supplier performance [6], and in assessing the services of public transport [7-12].

The used of IPA in management and employment services has also been published such as by Chang [13]. Modification of the IPA namely Requirement-Satisfaction Analysis (RSA) has been implemented in assessing the competency of personnel of the site staff of the Road Infrastructure, Spatial, and Housing Agency of West Sumatera [14] and in assessing the competency of supervision consultant personnel in West Sumatera Provincial Road Construction Project [15]. Despite Sever [16] proposed an improvement to the IPA and [11] discusses the limitation of the IPA, the used of RSA in both Juwita [14] and Yosritzal [15] revealed that the ISA or its modification such as IPA, RSA, and EPA could be used for the perceived competency assessment. Therefore, the method was used in this study without having many problems.

The first step in carrying out EPA is to generate a list of attributes of the services that are relevant to the objective of the study. The second step is to collect data on the expectation level and perceived performance level of site manager on the assessed attributes using a Likert-scale type of questionnaire. The third step is to calculate the statistical properties of the rating for each attribute. The fourth step is to plot either mean or median on a four-quadrant graph separated by a hairline which was set based on the universal mean of the Expectation and Performance. The graph is two-dimensional where the Expectation scale represents the vertical axis and the Performance constitutes the horizontal axis as shown in Fig. 1. Attributes residing in the first quadrant (top right) exhibit a higher expectation and higher performance. This quadrant is labeled "keep up the good work" which means that level of service provision or response to consumer issues should continue to be maintained. The second quadrant is labeled as "overkill" because the attributes in this quadrant have a lower level of expectation and a higher level of performance. The lower expectation of the attributes in this quadrant may be because the expectation for this service is met and costumers are satisfied. The attributes in the third quadrant are considered of lower expectation and lower

performance and labeled "low priority." The last quadrant is labeled as "concentrate here" as the attributes have a higher expectation but lower performance. To obtain maximum benefit, items in this quadrant should be given a top priority.

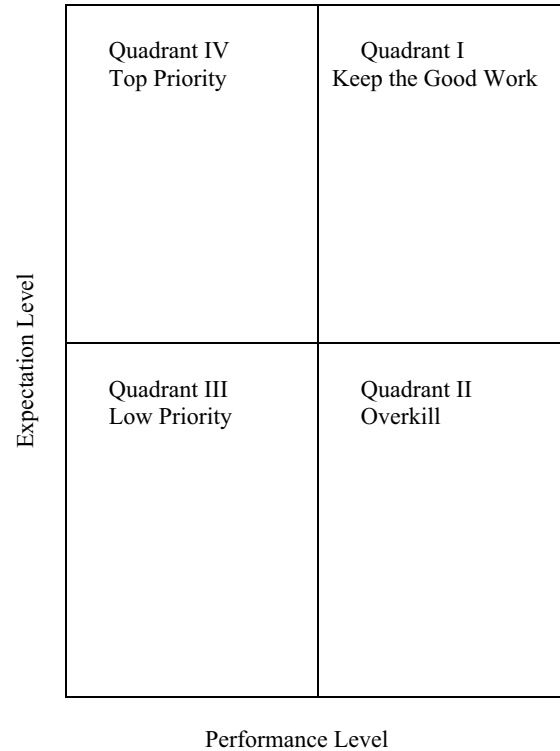


Fig. 1. Expectation-performance matric (modified from [2])

2.3 Customer satisfaction index

In order to estimate the overall satisfaction of the owner to the work of the Site Manager, a Customer Satisfaction Index (CSI) was used. The CSI was measured based on the following steps [17]:

1. Calculate the mean important score (MIS) for all evaluated factors and calculate the sum of MIS (Total MIS).
2. Calculate weight importance factor (WF) as a percentage of MIS over Total MIS.
3. Calculate the weighted score (WS) as multiplication of WF by mean satisfaction score (MSS) for each factor.
4. Calculate weighted average total (WAT) as a sum of all weighted score (WS).
5. Calculate customer satisfaction index (CSI) as the ratio between weighted average total (WAT) and high scale (HS) where HS is the maximum rating score.

In order to obtain the qualitative meaning of the CSI, we adopted the criterion of the qualitative academic score used in Academic Regulation of Andalas University [19] as shown in Table 1.

Table 1. Interval of qualitative scale satisfaction

Score in Academic Regulation			Score in Satisfaction Level
Quality rate	Interval	Predicate	
E	$\leq 40\%$	Failed	$0\% \leq X < 40\%$ (Very Un-satisfied)
D	$40\% \leq X < 50\%$	Not Adequate	$40\% \leq X < 50\%$ (Un-satisfied)
C-	$50\% \leq X < 55\%$	Nearly Adequate	$50\% \leq X < 65\%$ (Almost Satisfied)
C	$55\% \leq X < 60\%$	Adequate	
C+	$60\% \leq X < 65\%$	More than Adequate	
B-	$65\% \leq X < 70\%$	Almost Good	$65\% \leq X < 80\%$ (Satisfied)
B	$70\% \leq X < 75\%$	Good	
B+	$75\% \leq X < 80\%$	Very Good	
A-	$80\% \leq X < 85\%$	Almost Perfect	$80\% \leq X < 100\%$ (Very Satisfied)
A	$85\% \leq X < 100\%$	Perfect	

Source: [19]

2.4 Classification of contractors

Contractors in Indonesia are classified into Small Enterprise and Non-Small Enterprise Contractor [18]. The characteristics of each are shown in Table 2.

Table 2. Classification of contractors and its characteristics

No.	Criteria	Small Contractor	Non-Small Contractor
1	Business Capital	Less than 1 Billion Rupiahs	Greater than 1 Billion Rupiahs
2	The requirement for the Agency	-PJBU -PJT	-PJBU -PJT -PJB
3	Job specification	- Low Risk - Using Low Technology - Low Budget	- High Risk - High Technology - High Budget
4	Fundamental Capacity	-	KD = 3 NPT Estimated based on achievement year

This study focuses on the Non-Small Contractors which involved in provincial road project during 2014.

2.5 Indonesian standard of competency (SKKNI) of site manager

The items of competency in terms of knowledge are shown in Table 3 [1].

Table 3. Knowledge items of the Indonesian standard of competency

No.	Knowledge
<i>I Contract Document</i>	
01	Contract Agreement
02	Contract Requirement
03	Technical Specification
04	Engineering Drawing
05	Construction Services Regulation
<i>II Site Engineering</i>	
01	Analysis and Evaluation of Survey Result of the Site
02	Analysis and Evaluation of Survey Result of the Site Entry Point
03	Analysis and Evaluation of Survey Result of the Location and Quality of Raw Material
04	Knowledge of Social, Culture, and Security
05	Value engineering
06	Re-design
<i>III Road Construction Methods</i>	
01	Flexible pavement construction methods
02	Rigid pavement construction methods
03	Construction methods for complementary building and retaining wall
04	Construction methods for Health and Safety in the work zone
05	Controlling of Environment impacts and security
06	Traffic management in the work zone
<i>IV Bridge Construction Methods</i>	
01	Construction methods for the bridge foundation
02	Construction methods for the lower structure of the bridge
03	Construction methods for upper structure of a bridge
04	Construction methods for the complementary building of a bridge
<i>V Road construction cost estimation</i>	
01	Estimation of road construction cost
02	Optimisation of road construction cost
<i>VI Bridge construction cost estimation</i>	
01	Estimation of bridge construction cost
02	Optimisation of bridge construction cost
<i>VII Controlling Quality, schedule, and cost</i>	
01	Quality control of road construction work
02	Schedule control of road construction work
03	Cost control of road construction work
<i>VIII Construction management system</i>	
01	The concept of construction management system
02	Resources management
03	Process management of quality and schedule
04	Leadership in ethics and work culture
05	Information and communication system
<i>IX Project administration</i>	
01	Project administration
02	General administration
03	Financial administration
04	Administrating and reporting
<i>X Negotiation and public relation</i>	
01	Negotiation techniques
02	Social, cultural and public relation
03	Implement good corporate governance
<i>XI Resources procurement</i>	
01	Construction service procurement
02	Goods procurement

3 Methodology

Data for this study was collected in 2015 by distributing a questionnaire to officers from Road Infrastructure and Settlement Agency who involved in provincial road construction on behalf of Owner of the project. The questionnaire was designed to obtain respondents' identity and their perceived level of expectation and level of performance of Site Managers of the 2014 Provincial Road Construction Project regarding every item of competency evaluated. The statements were compiled based on the items in the Indonesian Standard of Competency of Site Manager. Respondents rated their perceived level of the expectation and the performance in a Five-point Likert-scale where 1 represented the lowest and 5 represented the highest. Data were analyzed using descriptive analysis and Expectation-Performance Analysis as discussed in Section 2. Cronbach Alpha Test was performed in order to test the reliability and validity of each item.

The scores used for the EPA were the average score per group of competency items for all respondents. For example, a contract document in the first group consists of five items. All respondents answered all the items. The average of the score for each item was calculated across all respondents and then was the average of the average was calculated across the item in the group. A group of competency items for bridge construction in Table 3 was omitted from our questionnaire, therefore, in the EPA.

4 RESULT

4.1 Description of the object study

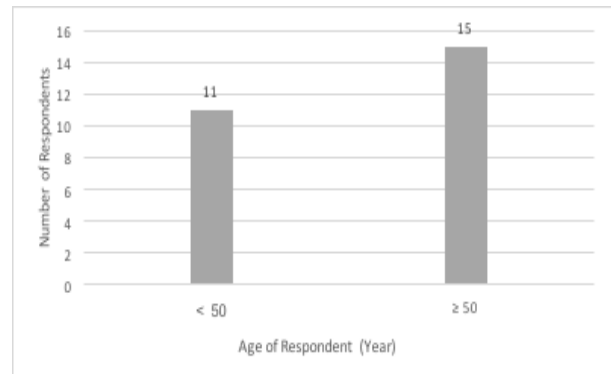
The object of the study is the competency of contractor personnel who involved in Provincial Road Project in 2014 as Site Manager. During 2014, there were 9 projects separated in 25 packages for Non-Small and 7 packages for Small Contractors. The study focuses on the non-small contractors as it involved in large-scale projects. In total, 22 Non-Small Contractors were involved, 2 of them were involved in more than one packages.

4.2 Respondents' characteristics

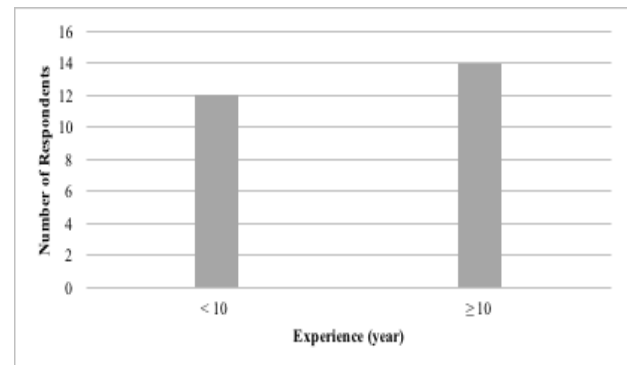
Respondents for this study are the persons who are responsible for the 2014 Provincial Road Project and acted as the owner of the project on behalf of the West Sumatera Road Infrastructure and Settlement Agency. In total, there were 26 people involved which consisted of 8 Top Executive Officers, 9 Head of Technical Affairs (KAURs) and 9 Inspectors.

In terms of age, 57 percent have aged 50 years or more and 43 percent under 50 years old. In term of work experience, 54 percent has more than 10

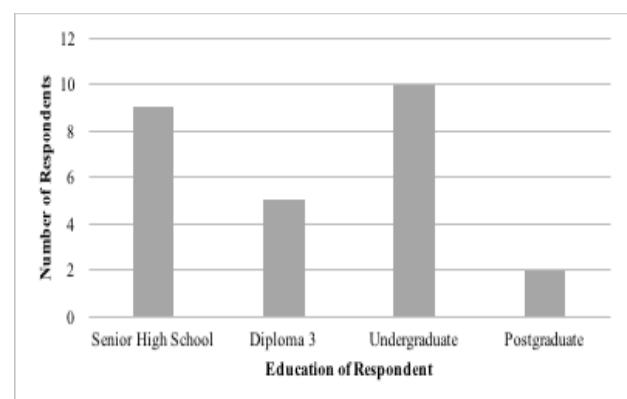
years of work experience. In terms of education, our respondents are educated people with 66% have a university degree and 34% graduated from a senior high school with 10% graduated from a postgraduate program. These profiles showed that the respondents are worth believing as they are educated and experienced in their field(Fig. 2.).



(a)



(b)



(c)

Fig. 2. The characteristics of respondents. (a) by age group. (b) by experiences and (c) by educations.

4.3 CSI score

The CSI is 69% as shown in Table 4 and fall into level 4 at the interval of $65% < CSI \leq 80%$ which is categorized as Satisfied. This means that the owner is satisfied with the performance of the contractors who did the road provincial road construction.

Table 4. CSI scores

No.	Description	M. E	W. E	M. P	W. P
A	Contract Document	3,91	10,5%	3,38	0,353
B	Site Engineering	4,01	10,7%	3,50	0,376
C	Road Construction Methods	4,21	11,3%	3,48	0,392
D	Road construction cost estimation	4,02	10,8%	3,60	0,387
E	Controlling Quality, schedule, and cost	4,22	11,3%	3,51	0,396
F	Construction management system	4,25	11,4%	3,36	0,382
G	Project administration and documentation	4,47	12,0%	3,31	0,396
H	Negotiation and public relation	4,04	10,8%	3,50	0,378
I	Resources procurement	4,25	11,4%	3,22	0,366
Total =		37,38	100%		
Weighted Total Score =					3,427
Satisfaction Index =					69%

Note: M. E = Mean of Expectation
 W.E = Weighted Expectation
 M. P = Mean of Performance
 W. P = Weighted Performance

4.4 Requirement satisfaction analysis

Prior to the EPA, a Cronbach Alpha reliability test was conducted to ensure all of the questions are reliable. It was found that the reliability for the performance and the expectation were 0,930 and 0.886 respectively. As the Cronbach Alpha is higher than 0.70, it can be concluded that both data groups are reliable to be analyzed further with EPA. The quadrant analysis result of EPA is shown in Fig. 3.

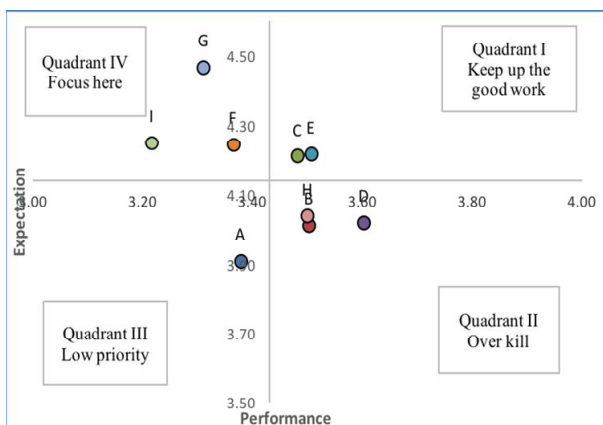


Fig. 3. Expectation-performance analysis

Fig. 3. shows the map of the 9 points of competency on four quadrants. The first quadrant is for items with high expectation and very well performed; second quadrants is for items with low expectation but performed very well; the third quadrant is for items with

low expectation and low performance, and the fourth quadrant is for items with high expectation but not well performed.

The items for each quadrant are as follows:

- Quadrant I (keep up the good works). Items in this quadrant are C (Road Construction Methods) and E (Controlling Quality). This finding suggests that contractors are managed to implement a good construction method for road constructions for all aspects of such as rigid and flexible pavement; complementary building and retaining wall; maintaining traffic management, health and safety at work zone with always control the impact to environment and security. Furthermore, contractors were performed very well at the ability to control the quality, schedule, and cost of the construction project. These items are considered as the most important factors in road construction and owner expect a high competency in them. Contractors should keep up their good works for these items.
- Quadrant II (Overkill). Items in this quadrant are item B (Site engineering), D (Road construction cost estimation) and item H (Negotiation and public relation). Site engineering, estimation of construction cost, negotiation and public relation of contractors were considered by the owner as not so importance competency for Site Managers. However, the contractors maintain a good performance for these items. No action need to take for these items.
- Quadrant III (Low priority). Items A (Contract document) is in this quadrants. The conformity of the structural organization of the contractors with the contract was considered by the owner as not so important for contractors. Even though contractors were perceived not performed well, this item is in a lower priority to improve.
- Quadrant IV (Focus here). Three items are in this quadrant, i.e. F (road construction management system), G (administration and documentation) and item I (Resources procurement). Contractors were performed relatively low but the owner expects a high competency in these items. Contractors were expected to understand the concept of the road construction management system, therefore, they can manage their resources, enhance quality, to uphold ethics and work culture and use a clear information and communication system. Contractors were perceived to have lower skills and knowledge in procurement and project administration and documentation, even though these items are important in road construction. Contractors should increase their ability in these items and the owner should coach the contractors through competency training or in site coaching.

4.5 Detail items need to improved

The mean scores for each item in the point F, G and I are shown in Table 5.

Table 5. Gap Between Expectation and Performance on Point F, G and I

Point	Description	P	E	Gap
F	Road construction management system			
1	The managerial ability of Project Leader verbally and nonverbally.	3,46	4,31	0,85
2	Conformity of time schedule	3,29	4,35	1,06
3	Ethics and working culture	3,38	4,08	0,70
4	Availability of information of project schedule.	3,34	4,08	0,74
5	The decision was made based on data dan information	3,41	4,23	0,82
6	Coordination during the project execution.	3,54	4,27	0,73
7	The effectiveness of the equipment	3,50	4,46	0,96
8	Delivery of material is properly calculate	3,37	4,35	0,98
9	The carefully handling material in the site	3,43	4,15	0,73
10	Demand-based worker distribution	3,28	4,19	0,92
G	Administration and documentation			
11	Completeness of the organization structure of the project team	3,37	4,12	0,75
12	Routine and orderly in administration	3,22	4,65	1,44
13	Conformity of the project reports with the actual conditions in the site	3,51	4,65	1,14
14	Integrated documentation system	3,31	4,42	1,11
15	The availability of complete project documentation of contractor	3,32	4,50	1,18
I	Resources			
16	The provided staff meets the requirements	3,36	4,27	0,90
17	The equipment provided meets the needs	3,35	4,42	1,08
18	Material available on time and in good quality	3,26	4,27	1,01
19	Ownership of reserved fund and ready to use	3,06	4,04	0,98

In Point F, the top three of the highest gap belongs to item conformity of time schedule, the effectiveness of the equipment and delivery of material. It seems that

these items are related to each other and could be associated with the competency in scheduling equipment, material, and worker. In point G, the top three are routine and orderly administration, availability of complete project documentation, and the conformity of the project report with the actual condition. These three items might be a confirmation of the lack of knowledge, skills, and attitude in making the right report regularly.

5 Conclusions and recommendations

The evaluation of the competency of Site Managers of the 2014 West Sumatera Road-Construction-Projects has been conducted using the expected and performance analysis. The study found that in general, the Customer Satisfaction Index (CSI) for the competency of the Site Managers is 69% suggesting that the Owner satisfied with their performance. However, there are a lot of things to be improved to rich the highest level of satisfaction (80% to 100%) such as in the construction management system, project administration and resource procurement. The largest gap between the expected level of competency and the performance is the competency in the project administration and documentation. Therefore, a training on the project administration could be initiated by the owner for a better quality of the road construction works in the future and to avoid construction disaster.

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