



DISCRIMINANT ANALYSIS FOR CONTRACTOR TECHNICAL ASSESSMENT (7 TECHNICAL EVALUATION VARIABLES THAT DISTINGUISH CONTRACTOR CLASSES)

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Abstract

Company performance is an important thing in the business world so that service provider companies always try to improve their performance in order to gain the trust of consumers. Carrying out work beyond the targeted time period will disappoint the service user and harm the reputation of the project implementer. This research was conducted to determine the factors that differentiate performance between contractors who complete projects on time with contractors who experience delay in completing construction services procurement projects at BPJS Ketenagakerjaan. Sampling based on purposive sampling with the criteria of the implementing contractor is an active partner in the social security agency, only for construction works with procurement values above Rp. 1 billion and the appointment is based on the auction method. Discriminant analysis is used to identify variables that are able to distinguish between contractors who are able to complete work on time with contractors who experience delays in completing work. The results showed that the assessment of the equipment used (Tools), the list of personnel carrying out the work (manpower), and knowledge of workers (Knowledge) were the distinguishing factors of contractor performance.

Keywords: Performance, contractor, procurement, discriminant analysis, project management

INTRODUCTION

The economic turnover of a country impacts on the need for facilities and infrastructure to support activities, such as the construction of highways, public facilities, and office buildings. Construction work is a major factor in the implementation of a development, it is necessary to have a service provider who is able to work on projects with timely and quality results. Construction work is carried out by service providers engaged in construction. During the selection process of service providers, service users carry out open auction activities, each contractor fulfilling the criteria set by the owner can participate in the auction process.

Selection of a competent contractor affects the quality of the building and timeliness of construction completion. Therefore the selection of the right contractor needs to be done. Determination of service provider selection is usually influenced by a number of technical requirements such as work methods, work timelines, organizational structure, equipment, personnel, technical specifications offered, and a list of similar work experience in the past 4 (four) years. The client evaluates by giving an score. The selection of vendors or service providers is a common thing to do in the process of procuring goods and services. Users has the authority to choose and obtain competent service providers in terms of performance and competitive bidding.

With this in mind, evaluation of prospective service providers in the bidding process, is one of the keys to contractor support. Many things can improve contractor performance such as system dynamics that generate the enthusiasm and commitment needed to support collaboration and cooperation within and between project teams (Walker, 2002), human capital (Brown et.al, 2007), intellectual capital (Dženopoljac and Janošević, 2016), competence and performance (Winarni et al, 2016), technical skills needed and so on. Considering the importance of the contractor's work provisions, this research was conducted to find out what attributes distinguish the group of contractors who complete the work on time with those who are not on time.

LITERATURE REVIEW

Performance

The process of carrying out construction work carried out by the contractor has two criteria to measure the success of the construction, namely the quality of the building in accordance with the specifications listed in the Rencana Kerja dan Syarat-syarat (RKS) and completed on time or on schedule. In a social security agency the performance of a contractor is measured by the timeliness of completing work by not ignoring the quality of the building, so time management is a priority in performance appraisal.

Performance appraisal according to Widodo in Purwaningrum (2014) is a process to measure work performance based on established regulations, by comparing targets with job description requirements namely job standards that have been set during a certain period. Performance evaluation according to Mondy and Noe in Purwaningrum (2014) is a formal system that is periodically used to evaluate individual performance in carrying out their jobs.

Penilaian kinerja or performance appraisal is a key function to effectively manage human resources. Sometimes the performance appraisal is not considered by the company, so to increase trust or trust in the employer, service providers carry out the performance to the maximum and best possible.

Method

The method is a process or a systematic way that is used to achieve certain goals efficiently. Job method is the procedure for completing a job. In completing work there needs to be a work method that will direct how physically the individual in completing the task. With work methods expected to appear comfort and safety at work.

Timeline

According to the large Indonesian dictionary (KBBi) timeline is a certain measure of the time the work must be completed, the time period is divided into two, namely long when long and short when short.

In completing the project the time period is very important especially if the contractor is a service provider. The time set by the client to complete the work becomes a major concern after the quality of the product ordered.

Organizational

Organizational structure is the arrangement and relationship between each part and position in an organization or company in carrying out operational activities to achieve the expected goals. The organizational structure clearly illustrates the separation of work activities from one another and how the relationship of activities and functions is limited. Because the project is a teamwork, the role of the leader and the ability of subordinates is very important. Leaders play an important role and have a significant influence on the knowledge management process that is applied in project development and most importantly in project implementation there is the support and commitment of top management (Norshima and Asarani. 2012; Asa et.al, 2008; Haq et.al, 2016).

Equipment

Equipment is a collection of tools or can be shaped where the function is to support the work running. In the construction work equipment to support the completion of work is needed, especially heavy equipment in large projects.

Personnel

Personnel according to the Big Indonesian Dictionary is defined as employees or subordinates. In the field of construction, in addition to organic personnel, there are also contract personnel, where contract personnel carry out their work for a predetermined period of time. Contractors for building construction work usually enter the field directly, such as foremen, supervisors, builders, and workers.

Labor is an important resource in construction projects and can cause delays in project completion (Chasanahdan Sulistyowati, 2017; Hargono, and Nurcahyo. 2012)

Specification

Specification is one of the choices in determining the type of goods or activities to be carried out, the determination of specifications is done as a comparison with other similar things. The higher the specifications offered, the higher the score.

Experience

In the Indonesian General Dictionary it means that experience is something / what has been felt (known, done, and so on). Someone who has experience has a more detailed and complete way of thinking than someone who does not have Tayylor and Tood's experience in Purnamasari (2005). The experience referred to in this study is the experience of contracting companies working on similar projects.

RESEARCH METHODOLOGY

This research is a case study on procurement of construction services at BPJS Ketenagakerjaan. Data used is secondary data obtained directly from the eProcurement database. eProcurement is a procurement database that is in the object of research, including procurement of building construction services.

As the dependent variable in this study is the contractor's performance evaluation as seen from the timeliness of project completion. Timeliness is divided into two categories namely those that complete projects on time and late.

The independent variable in the discriminant analysis consisted of seven attributes of technical assessment, including: the method of carrying out the work in completing the work, the period of implementation and completion of the job, the organizational structure of the executor of the work, the equipment used, the list of personnel implementing the job, the technical specifications offered, and a list of experiences similar work in the last 4 (four) years.

Sampling based on purposive sampling with implementing contractor criteria is an active partner in social security institutions, only for construction works with procurement values above Rp. 1 billion and the appointment is based on the auction method. The sample is also limited to procurement of construction services at the BPJS Ketenagakerjaan with a procurement time span from 2015 to 2018.

Discriminant analysis is used to identify variables that are able to distinguish between contractors who are able to complete work on time with contractors who experience delays in completing work. From the identified variables, an index can be calculated which will explain the differences between the two contracting groups. the difference explains the dependency relationship (the relationship between variables that have been distinguished assessment variables and explanatory variables).

ANALYSIS AND RESULTS

The contractor's performance can be measured after carrying out construction work, in this empirical study using a case study of procurement of construction services at one of the social security agencies. The results of the contractor's work can be seen from the technical documents submitted at the time of the auction, proposals that cover various technical aspects serve as the benchmarks for assessing the performance of the contractor.

Table 1 shows the average and standard deviations of each contractor group based on the characteristics of the method of carrying out the work, the duration of the implementation and completion of the work, the organizational structure of the executor of the work, the equipment used, the list of work implementing personnel, the technical specifications offered, and the list of similar work experiences in within the past 4 (four) years.

Table 1. Group Statistics

Kinerja		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Tepat Waktu	Methode	89.9000	15.94432	15	15.000
	Time	86.8647	12.95225	15	15.000
	Organization	80.2713	17.28683	15	15.000
	Tools	87.8467	13.47892	15	15.000
	Manpower	89.3133	8.70327	15	15.000
	Spesification	80.3460	17.98282	15	15.000
	Knowledge	92.8667	13.10325	15	15.000
Telat	Methode	82.8810	16.25973	21	21.000
	Time	79.8448	13.04706	21	21.000
	Organization	81.5624	9.07017	21	21.000
	Tools	77.1357	12.57314	21	21.000
	Manpower	74.4524	12.10119	21	21.000
	Spesification	76.9276	12.19352	21	21.000
	Knowledge	76.0876	20.45076	21	21.000
Total	Methode	85.8056	16.28125	36	36.000
	Time	82.7697	13.29270	36	36.000
	Organization	81.0244	12.92133	36	36.000
	Tools	81.5986	13.84512	36	36.000
	Manpower	80.6444	13.00731	36	36.000
	Spesification	78.3519	14.73890	36	36.000
	Knowledge	83.0789	19.44358	36	36.000

Tepat Waktu groups have an average of more positive perceptions of contractor performance, this is indicated by the average value for each characteristic greater than the group telat. Of all aspects of the assessment only in the aspect of organizational groups that are telat have higher scores than groups that tepat waktu. The assessment of organizational aspects refers to an assessment of the organizational structure of the company and the personnel responsible for it. But apparently this ability still distinguishes the achievements of the two groups.

The group that was late in completing the work had low assessment results from the manpower aspect. The manpower aspect is related to the list of job implementing personnel. In this list will be known specifications of the ability to carry out work that is known from the contractor's bidding document. The list of job implementing personnel contains information about job descriptions, authorities and responsibilities, certificates of expertise, experience in similar work during the past 4 (four) years, complete with references.

One that must be agreed in the discriminant analysis is the homogeneity variant. The homogeneity value of variance can be seen from the value of the Statistic Box's M.

Table 2. Test Results

Box's M		65.646
F	Approx.	1.793
	df1	28
	df2	3170.293
	Sig.	.006

Box's M test results show a sig value smaller than 0.05, which means the null hypothesis is rejected. Thus it is said that the variance between timely groups and late groups is not identical / heterogeneous. However, discriminant analysis can still be done by looking at the value of canonical correlation.

Table 3. Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.497 ^a	100.0	100.0	.774

a. First 1 canonical discriminant functions were used in the analysis.

From Table 3 the canonical correlation values are known. Canonical correlation is used to measure the degree of relationship between the results of discriminant scores and group performance or the amount of variability that can be explained by the independent variables on the dependent variable. From the above table, we get a canonical correlation value of 0.774. From these values it can be seen that the R² value of 0.599 means that 59.9% of the variance of the dependent variable (performance group) can be explained from the discriminant model that is formed.

Table 4 shows the results of testing of the two groups to find out whether there are differences between the two groups studied.

Table 4. Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.400	27.911	7	.000

In Table 4 there is a significance of the Chi-square statistical value of 0.000 (<0.05) meaning that there are significant differences about the behavior of performance groups that are timely and late in the discriminant model.

To find out the factors that influence differences in performance between the two contracting groups, we see the value of the Wilks' Lambda.

Table 5. Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
Method	.954	1.657	1	34	.207
Time	.930	2.548	1	34	.120
Organization	.998	.085	1	34	.772
Tools	.850	5.982	1	34	.020
Manpower	.674	16.470	1	34	.000
Specification	.987	.463	1	34	.501
Knowledge	.814	7.778	1	34	.009

Based on the research error rate of 5%, from Table 5 it is known that tools, manpower and knowledge are aspects of the assessment that distinguish the performance of the two groups of contractors. In terms of methods, the promised time, the organization and product specifications promised by the two groups have no difference.

The equipment used is one of the resources that influences the achievement of project objectives. Appropriate use of equipment will impact on the efficiency and effectiveness of the work. The use of various heavy equipment in construction work, for example, will be very expensive. Therefore careful selection of equipment is very necessary. By carefully determining the type and specification of heavy equipment, it is expected that cost planning, time planning, method planning and other resource planning can be carried out more precisely. In the end, it is expected to obtain efficiency in financing the use of heavy equipment (Sobirin, 2016).

Equipment as a differentiator in contractor performance in project completion also supports research from Ghaffar (2004) which states that quality performance is influenced by knowledge of design, contractors have big names, and equipment availability. Project work requires a variety of equipment, where in Indonesia only companies with strong capital will be able to have sufficient supporting equipment. Therefore the criteria for determining the contractor to complete the project will always be related to the funding owned by the contractor.

The difference in contractor performance is also determined by the use of human resources (manpower). To improve project performance the main handling priority is human resources (Sobirin, 2016). Human resources are one of the determining factors in the delay in project completion (Hargono, and Nurcahyo. 2012). The results of this study indicate that the resources owned by the contractor who succeeded in completing the project on time with those experiencing different delays. A project usually has special characteristics, so that one project

with another project can require different resource capabilities. Human resources who play an active role in the process of building a construction project are structural experts, experts, architecture, mechanical mechanical experts, foremen, drafter, and administration. Because the ability of resources influences the completion of the project, it can be said that the lower capability of the contractor makes the contractor experience delays in project completion.

In addition to the resources mentioned above the role of the project manager for the successful achievement of objectives is very important. Project management is team management. In this performance the manager's experience in managing personnel and the ability of the resources that are his responsibility is the key to the achievement of work performance.

Another variable that distinguishes the contractor's performance is knowledge. In the project environment, knowledge is important and must be shared by everyone involved in the project (Humaidi and Asarani, 2012). Projects are managed not by individuals but by working teams.

The success of the team is supported by the ability of members and leaders. Here a condition or system needs to be created that can motivate team members to produce the enthusiasm and commitment needed to support collaboration and collaboration within and between project teams. Enthusiasm and commitment enable them to be nimble, adaptable and responsive. According to Walker (2002) enthusiasm and commitment can be achieved in construction projects provided that a collaborative and collaborative work environment is maintained and carefully crafted, which not only supports the drive for enthusiasm and commitment, but also overcomes obstacles that impede the values.

Get knowledge and skills need to invest in human resources. Investment in human resources through education and experience will improve performance. Individuals who are specifically educated and trained in the subject of project management will provide better performance (Brown et al, 2007).

Another efficiency of human capital is very important in increasing company productivity (Gan and Saleh in Dženopoljac et.al, 2016). Individual experience in the construction industry without special project management education will reduce the initial potential for successful performance, and vice versa that individuals who are specially educated and trained in the subject of project management will provide better performance (Brown et.al, 2007).

The alignment of IT and organizational strategy enables companies to maintain a sustainable competitive advantage by providing services that are more effective, more reliable, and faster to Customers Yuliansyah (2016). But this opinion does not apply in this field of

construction research. The difference in the contractor's performance in fulfilling the promise of contract completion is apparently influenced by the knowledge they have.

From the known variables, it can be used to differentiate contractors who finish work on time and not in sequence, are manpower, knowledge and tools.

Tabel 6. Structure Matrix

	Function 1
Manpower	.569
Knowledge	.391
Tools	.343
Time	.224
Method	.180
Specification	.095
Organization	-.041

Table 6 above shows the sequence of characteristics that most distinguish the behavior of the two contractor performance groups. Manpower characteristics are the characteristics that most distinguish the behavior of the contractor's performance group.

Table 7. Canonical Discriminant Function Coefficients

	Function 1
Method	.028
Time	.028
Organization	.028
Tools	.013
Manpower	.071
Specification	.027
Knowledge	.046
(Constant)	-19.675

Unstandardized
coefficients

Table 7, the canonical discriminant function coefficient explains the formed discriminant model, namely:

$$-19.675+0.028X_1+0.028X_2+0.028X_3+0.013X_4+0.071X_5+0.027X_6+0.046X_7$$

This equation of discriminant model is used to produce discriminant scores which serve to predict the classification of contractors with timely performance and contractors with late performance.

From the results of the function of group centroids table, the critical cutting score is formulated as follows:

$$Z_{CU} = (N_A Z_A + N_B Z_B) / (N_A + N_B)$$

Where,

Z_{CU} = critical cutting score

N_A = Total tepat waktu

N_B = Total telat

Z_A = Value centroid tepat waktu

Z_B = Value centroid telat

$$Z_{CU} = \frac{((15 \times 1.407) + (21 \times (-1.005)))}{(15 + 21)}$$

$$Z_{CU} = 0.00000$$

Table 8. Classification Results

Original	Count	Kinerja	Predicted Group Membership		Total
			Tepat Waktu	Telat	
		Tepat Waktu	11	4	15
		Telat	1	20	21
	%	Tepat Waktu	73.3	26.7	100.0
		Telat	4.8	95.2	100.0

a. 86.1% of original grouped cases correctly classified.

The Classification Result table shows that there were 5 contractors that were misclassified, namely 1 contractor who was originally a group on time then predicted by the late group and 4 contractors who were actually late in the group predicted on time. Overall the discriminant model that was formed had a fairly high level of validation, amounting to 86.1%.

DISCUSSIONS

The contractor's performance can be measured after carrying out construction work, in this study using a case study of procurement of construction services at one of the social security agencies. The results of the contractor's work can be seen from the technical documents submitted at the time of the auction, proposals that cover various technical aspects serve as benchmarks for assessing the performance of the contractor.

From the results of the study were divided into 2 aspects that made the difference between the right and late contractor seen from 7 technical assessment categories. There are 3 significant criteria for being a distinguishing contractor who is on time with a late contractor. These 3 criteria will be used as the determining parameters for the selection of the contractor.

Ghaffar's previous research (2004) states that in the selection of the most dominant contractors is the availability of funding, contractor expertise, and offerings, but the results of the study but the selection criteria for contractors that affect quality performance are influenced by knowledge of design, the contractor has a big name, and the availability of equipment.

Meanwhile, according to the results of Alkaf's research (2003) of 51 variables that affect the profit plan, there are 4 variables tested as determinants of the contractor's financial performance, namely: conditions for prequalification, tender method, familiar / understanding the project site conditions, and relationship with the owner.

CONCLUSION

There is a difference in the technical assessment between the contractor who is completing the project on time and the contractor who is late or not in accordance with the specified time period. Based on the analysis conducted on the Test of Equality of Group Means table, researchers can conclude from the 7 technical assessment criteria there are three factors that distinguish between the contractor's performance on time and late, namely: equipment used, list of work personnel, and similar work experience in within the past 4 (four) years.

RECOMMENDATIONS

Preventive action is needed so that construction work does not experience delays. Efforts that must be made are during the procurement process, technical appraisal must have the highest weight compared to price assessment. Prospective service provider proposals make reference to the performance of the contractor, an appropriate assessment will minimize the selection of incompetent service providers.

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