



A Model for Engineering, Procurement, and Construction (EPC) Organizations Using Vendor Performance Rating System

Sujit Kumar Panda¹, Sukanta Kumar Baral², Richa Goel^{3,4}, and Tilottama Singh⁵(✉)

¹ Department of Computer Science and Engineering, GIFT Autonomous College, Bhubaneswar, Odisha, India
sujit.panda@gift.edu.in

² Department of Commerce, Faculty of Commerce and Management, Indira Gandhi National Tribal University (A Central University), Aamarkantak, Madhya Pradesh, India
sukanta.baral@igntu.ac.in

³ SCMS, Noida, Noida, India
richasgoel@gmail.com

⁴ Symbiosis International University Pune, Pune, India

⁵ Department of Management, Uttarakhand University, Dehradun, Uttarakhand, India
tilottamasingh2101@gmail.com

Abstract. Assurance in Quality deals beardsly with multi sourcing as well as vendor expansion undertakings. The vendors present in the system are reviewed for extension of their agreement. There are fairly a big number of suppliers available for various items distributed as per directorates, by means of limited number of resources; it turns into hard to prepare review report in time. For requirement of transparent structure, different cases need to deal or handle equivalently as well as visits are being systematized. The dealer assessment device may offer with a transparent device by using that; selection can be done to allocate with ground visits for re-evaluation. The preferred additionally specify that require for improvement of supplier assessment system need to be categorical with retaining cost of vendor rating gadget against expected returns as well as other aspects in assessment. Consequently, the rating gadget primarily centered on four vital elements viz. Quality, Service, Delivery in addition to Machine might be well enough to achieve the necessity. The rating device can be employed in different decision-making equipment additionally.

Keywords: Vendor · Performance Rating · Engineering · Procurement and Construction

1 Introduction

The term vendor rating (or rating of vendor) as it from time to time mentioned in a EPC business used to define the procedure of measuring a firm's vendor abilities as well as performance (Asadabadi et al., 2020). Rating of vendor formulates a portion of a firm's

vendor relationship management program. Such schemes use to vary in the standards that are to be measured; this generally comes under quantitative as well as qualitative categories which may use as when conducting vendor rating. The procedure differs from one firm to another firm. The method of rating i.e. alternative common standards often include: Quality (for example number of right time deliveries and good raw materials), Service, Delivery (schedule adherence), Cost/Price and Capability.

Outcomes of respective variables are then weighted into a concluding score generally in a percentage form, permitting vendors to rank. Vendor rating is a continuing action; vendors are time and again evaluated constantly or occasionally (i.e. evaluating the last year's trading). Numerous measures can examine within vendor rating systems as a common method that is to be used Cost Quality as well as delivery procedures in addition to apply weighting against standards in agreement with company necessities. Firms then frequently group providers rendering to effects which can obviously use to highlight poor performing providers in sequence that they can remove from use (Tsaramirsis, 2010). Vendor score consequences may generate development programs on providers that score low. Trend analysis is frequently applied to vendor score which permits agencies to observer adjustments in provider complete performance during the time horizon. Both vendors as well as buyers have to follow vendor ratings device to force performance as well as develop the business relationship.

Actual vendor rating calls for a constant as well as goal method wherein rating standards are open to interpretation inaccuracy can be added. This is especially wherein particular complaint from shoppers is added into the score procedure. History isn't constantly a manual to future performance in addition to vendors ought to be referred as a part of the evaluation.

2 Literature Review

Operating in surroundings of risky, uncertain, complex and ambiguous conditions, EPC corporations are going through unsustainable degrees of stress.

From onerous contracting models that discourage collaboration, to unpredictable commodity fees that undermine the splendor of the world as an organization, the motives are many and complex. Combined, those stressors are the forces to be able to reshape the enterprise over the next decade (Chavan et al., 2020).

This situation leaves a lot of thought for innovators—the subsequent era of ambitious engineers and managers who need to work on alternate methods and enhance overall performance within their companies and throughout the industry? Studies have identified five characteristics to be able to define the successful EPC companies of the future. These key developments will assist agencies effectively manual investment and spur innovation all through the virtual transformation journey (Ara et al., 2021). Striving to embody these characteristics will pressure nice adjustments in careers, groups and the industry, making the EPC phase of 2030 stronger, extra innovative and increasingly more worthwhile (Niayeshnia et al., 2020).

Viable gain of critical firm is based deeply upon the routine of the providers. Efficacy of choosing, and gauging movements of providers is a considerable aspect in reaching corporations' desires ((Kabirifar and Mojtabedi, 2019)). In commonplace, supply recital,

which relies upon on deliver behavior, has the possessions of multi size in addition to multi-scales, regarding to numerous dimensions. So, the performance evaluation of a seller is not handiest inclusive, however is also problematic beneath a steady scale (Wang et al., 2009). Evaluation strategies provide an output essential to the carriers' recital, but a number of the providers' behaviors can degree explicitly rendering to its description (consisting of unit rate as well as defect). Some cannot represent with an in-depth numeric fee (which include functionality on R & D in addition to quality), conversely, tons of the information related to vendor performance evaluation is not quantifiable further to detailed with crunchy limitations. Somewhat, this evidence is offered in expressions or words in normal language then without precision (Asher et al., 2021). The winds of alternate had been blowing inside the EPC enterprise since 2014. If there may be one component of which we may be positive, it's far that the pace of trade will handily accelerate over the next decade (Tsaramirsis, et al., 2016).

Much of discussion about the future is focused on new technologies and digitalization (Wagner et al., 2020). Certainly, using technology to higher manage methods and records is a prerequisite for advancement. However, even as the beyond decade has been more centered on records acquisition and optimization inside silos, the following may be focused on connecting statistics threads across events, databases and challenge levels—and leveraging that statistics to optimize average outcomes for a mission (Kantaros et al., 2022).

Untapped price will pressure a exchange in the nature of the connection between proprietors and EPC firms toward one that is extra collaborative. The end result can be higher designs and facilities, and a extra comprehensive expertise of project economics across the lifecycle, with fewer surprises for all parties.

Customers and contractors provide various weights to different success criteria, with contractors giving more emphasis to cost and duration minimization than their clients, and clients giving more weight to stakeholder satisfaction than contractors (Bryde & Robinson, 2005).

Finally, via 2030, younger, pragmatic engineers will see the potential to help acquire significant and vital change in an industry that embraces era, innovation and collaboration to help society meet its strength and cloth needs in a manner that is more sustainable for future generations (Eke et al., 2020).

3 Objectives of the Study

The study envisaged on the following objectives-

1. The dealer assessment device may offer with a transparent device by using that; selection can be done to distribute with field visits for re-evaluation,
2. The rating device can be employed in different decision-making equipment additionally

4 Research Methodology

Execution assessments of provider are difficult; numerous standards and norms that are included ought to be measured. In actuality, provider choice is the quintessences' of inventory network the executives; meanwhile, appraisal of supply execution turns

into the fundamental action of provider choice (Lau et al, 2002). Choi and Hartley assessed “providers dependent on consistency, unwavering quality, relationship, adaptability, value, administration, innovative capacity and funds and furthermore tended to 26 provider determination criteria” (Choi, Hartley, 1996). Verma and Pullman positioned the significance of the provider characteristics of value, on time conveyance, cost, lead-time as well as adaptability (Verma, Pullman, 1998). Vonderembse and Tracey portrayed that provider in addition to assembling execution were controlled through provider choice standards in addition to provider association (Vonderembse, Tracey, 1999). It was presumed that the provider choice standards can be assessed by quality, accessibility, dependability and execution. Provider contribution could assess by item R&D and development, in addition to provider execution can assess by stoppage, conveyance, harm as well as quality. Moreover, fabricating execution can assess by cost, quality, stock in addition to conveyance. Tracey and Tan created provider determination criteria, including quality, conveyance, dependability, execution and value (Tracey, Tan, 2001).

The criteria are likewise used to survey consumer loyalty dependent on value, quality, assortment and conveyance. Besides, Kannan and Tan decided provider choice dependent on responsibility, needs, ability, fit and trustworthiness, and built up a framework for provider assessment dependent on conveyance, quality, responsiveness and data sharing (Kannan, Tan, 2002). Kannan and Tan additionally assessed provider determination and execution dependent on the loads of assessment qualities or criteria with fresh qualities that rely upon emotional individual decisions. Muralidharan et al analyzed the points of interest and confinements of nine recently created strategies for provider rating, and joined various criteria dynamic and applied investigative progressive system procedures to build multi-criteria cooperative choice making model for provider rating (Muralidharan et al, 2002) The traits of value, conveyance, value, strategy capacity, funds, mentality, office, adaptability and administration were utilized for provider assessment, and the characteristics of information, aptitude, demeanor and experience were utilized for singular appraisals. Anyway, numerous variables have been considered in provider choice and assessment, including operational, culture, innovation, relationship, cost, quality, time and adaptability. Right now, criteria are grouped in six classes as appeared in Table 1 and are utilized in the introduced model. It is the way toward estimating, breaking down and dealing with the provider execution to exceed expectations on the serious parameters of the business (Tables 2, 3 and 4).

Table 1. Importance of Criteria

	Criteria	Relative	Importance
1	Quality	C1	1
2	On time delivery	C2	0.6
3	Technological ability	C3	0.4
4	Competitive cost & Financial situation	C4	0.8
5	Product design Ability	C5	0.9
6	After sale services	C6	0.7

5 Importance of Vender Management

- Forthcoming competitiveness can determine by firm's capability to create policies to optimally line up as well as manage a large network of vender relationships.
- Firm's performance will be progressively determined through (as well as reliant upon) the performance of external supply partners.
- The real management of these large supply network requires firms to apply approaches for gauging well as refining the performance of network.

In this study, a model has developed by taking vender performance rating system into consideration with differ criteria. The different criteria are explained as follows: Vendor Performance Rating System-Model.

A supplier can be rated based on the below four Parame through a Point Rating Model.

- Adherence to Delivery
- Adherence to Technical Specifications
- Landed Price
- Responsiveness & Customer Satisfaction

The Vendor Rating is proposed to be done Based on the criteria:

1. Quality performance of vendor: Based on Quality Products produced during period under consideration
2. Delivery Performance of Vendor: Based on sup performance of vendor against orders within delivery Perio
3. Service & System performance of vendor: Based General Performance Such as reassessment, Upda infrastructure etc. and maintenance of Quality control system
Point rating system – an illustration
4. Adherence to Delivery 35 points
5. Adherence to Technical Specifications 30 points
6. Landed Price 15 points
7. Responsiveness & Customer Satisfaction 20 points

Total 100 points

Vendor rating is the sum total of the points scored out of 100.

Adherence to Delivery

- Maximum Points - 35
- Compare Actual Delivery vs. Contractual for each item in the PO.
- If the delivery is within contractual period and within grace period, supplier to get 35 points.
- For every day delay beyond grace period, supplier lose 1 point
- (Max. 30)
- For everyday early before grace period, supplier lose 0.5 point
- (Max. 15) - Optional

Adherence to Technical Specifications & Quality

- Maximum Points - 30
- Outright Rejection - 0 points
- Complete Acceptance - 20 points
- Acceptance with deviation – 0 - 15
- Rejection points for rework is 0 - 15.
- Calibrated Equipment with calibration history – 5 points (max)
- Trained employee with training hour history – 5 points (max)

Table 2. Acceptance with Deviation

Rejection Code	Description	Rejection Points
C - 01	Machining: Undersize	8
C - 02	Machining: Oversize	4
F - 01	Fabrication: Welding defects	10
F -02	Fabrication: Not meeting requirements	15
M- 01	Material: Lamination observed	10
M - 02	Material: Excessive Pitting	10
M- 03	Material: Not meeting specification	12
M - 04	Material: Received in damage condition	5
M- 05	Material: Dimension deviation	5
M - 06	Material: Poor Workmanship	8
M- 07	Material: Improper Packing	2
M - 08	Material: Damage Packing	5
M - 09	Material: Physical Test Failed	15
M - 10	Material: Chemical Analysis Failed	10
M - 11	Material: HT not done as required	10
M - 12	Material: Stamping not matching	3
M - 13	Material: Original stamping not available	6
M - 14	Material: 3rd party stamping not available	2
PRV	Provisionally cleared	5

Rework

- **For every 20 shop/field man-hour spent on rework - 1 point to be deducted**

Landed Price

Maximum Points - 15

- Lowest quoted landed price - 15 points
- Higher than the lowest bid up to 5% - 12 points
- Higher than the lowest bid up to 10% - 9 points
- Higher than the lowest bid up to 15% - 6 points
- Higher than the lowest bid > 15% - 3 points

Table 3. Landed Price Categorization

Code	Description	Points
Type-1	Rate Contract & L1	15
Type-2	Rate Con-tract & L2	12
Type-3	Rate Contract & L3 & Onwards	9
Type-4	L1 on quotations received	13
Type-5	L2 on quotations received	10
Type-6	L3 on quotations received & Onwards	7
Type-7	Repeat Order & L1	15
Type-8	Repeat Order other than L1	12
Type-9	Initiator / Customer Recommendation	10
Type-10	OE Item	12
Type-11	Monopoly Supplier/Controlled price	10
Type-12	Emergency buying on single offer	5

Customer Satisfaction

- Maximum Points – 20
- ISO certification / Registered Exporter - 5 points
- Customer satisfaction (Buyer) - 5 points
- (Vendor responsiveness)
- Local Supplier/Vendor from SC/ST/Backward classes/Physically challenged - 5 points
- Customer satisfaction (Accounts) – 5 points
- Customer satisfaction (Inspection) – 5 points
- Customer satisfaction (Stores) – 5 points
- Adherence to Delivery 35points (20)
- Adherence to Technical Specifications 30 points (25)
- Landed Price 15 points (12)
- Responsiveness & Customer Satisfaction 20 points (15)

Vendor inclusion criteria

- Minimum order value or Minimum orders is the criteria for a supplier to be included in VPRS

- Applicable for all the suppliers of Service as well as non-service items
- Categorization of vendors

Table 4. Categorization of Vendors

Supplier Category	Description	Supplier Category	Description
CAT - 1	Raw Material	CAT - 16	Gearboxes
CAT - 2	Forging	CAT - 17	Drive components
CAT - 3	Pipe - Manufacturers	CAT - 18	Pulleys & Idlers
CAT - 4	Pipe - Stockiest	CAT - 19	Conveyor & Components
CAT - 5	Pipe - Fittings	CAT - 20	Sub- Contracting
CAT - 6	Fasteners	CAT - 21	Piling
CAT - 7	Electrodes	CAT - 22	Pile - Capping & Concreting
CAT - 8	Paints	CAT - 23	Civil- Foundation
CAT - 9	Gases	CAT - 24	Heavy Fabrication
CAT - 10	Cement	CAT - 25	Medium & Light Fabrication
CAT - 11	Rebar	CAT - 26	Shot Blasting & Painting
CAT - 12	Structural	CAT - 27	Electrical Services
CAT - 13	Refractory	CAT - 28	Erection
CAT - 14	Instruments & Values	CAT - 29	Commissioning
CAT - 15	Motor	CAT - 30	Misc Services

Benefits

- Provided valuable inputs for Internal Analysis
- Individual Supplier rating
- Average Rating for all Suppliers
- Reinforcement

6 Conclusion

This research creates an assessment strategy to assess vendor performance in vendor rating form. Various factors used in the vendor assessment procedure are as well as problematic to quantify. There are great advantages in the usage of the model provided by the paper which is contemporary. It is also relatively flexible, permitting the decision maker to apply a comprehensive range of linguistic factors further to modifiers for better judgment or to make versions to membership standards and vendor overall performance categories. Lastly, it's far an ideal device while the decision maker is tackled with a chain of sub-decisions anywhere where obtainable data is based on ambiguity, uncertainty, as well as opinion. These sub-decisions are then mixed into an average device for provider

performance assessment. The flexibility of the model permits the decision maker to introduce vagueness, uncertainty, and subjectivity into the provider overall performance evaluation system. This examination points out an elective strategy for the provider execution assessment framework.

7 Future Implications

Future implications of this research study is expected to build up a technique for relating provider execution esteems to etymological factors in provider execution assessment, just as testing the affectability of provider execution esteems and their effect on the result and helps industry professionals become more aware of the important aspects that affect a project's effectiveness and suggests practical methods for preserving optimal alignment between project and product objectives as well as encouraging end-user involvement including vendors.

References

- Asadabadi, M.R., et al.: Hidden fuzzy information: Requirement specification and measurement of project provider performance using the best worst method. *Fuzzy Sets Syst.* **383**, 127–145 (2020)
- Ara, R.A., Paardenkooper, K., van Duin, R.: A new blockchain system design to improve the supply chain of engineering, procurement and construction (EPC) companies—a case study in the oil and gas sector. *J. Eng., Design Technol.* (2021)
- Asher, S.W., Jan, S., Tsaramirsis, G., Khan, F.Q., Khalil, A., Obaidullah, M.: Reverse engineering of mobile banking applications. *Comput. Syst. Sci. Eng.* **38**(3), 265–278 (2021)
- Baldwin, J. F., “Fuzzy Logic”, John Wiley & Sons, New York, (1996), N.Y
- Bryde, D.J., Robinson, L.: Client versus contractor perspectives on project success criteria. *Int. J. Project Manage.* **23**(8), 622–629 (2005)
- Choi, T.Y., Hartley, J.L.: An exploration of supplier selection practices across the supply chain. *Journal of Operation Management* **14**(4), 333–343 (1996)
- Chavan, G., Chaudhuri, R., Johnston, W.J., Garner, B.: Purchasing performance of engineering procurement and construction companies using a fuzzy quality function deployment approach. *J. Bus. Indust. Market.* **36**(5), 849–66 (2020)
- Eke, J., et al.: The global status of desalination: An assessment of current desalination technologies, plants and capacity. *Desalination* **495**, 114633 (2020)
- Kannan, V.R., Tan, K.C.: Supplier selection and assessment: their impact on business performance. *J. Supply Chain Manag.* **38**(4), 11–21 (2002)
- Klir, G.J., Yuan, B.: *Fuzzy Sets and Fuzzy Logic*. Prentice-Hall, Upper Saddle River, NJ (1995)
- Muralidharan, C., Anantharaman, N., Deshmukh, S.G.: A multicriteria group decision making model for supplier rating. *J. Supply Chain Manag.* **38**(1), 22–33 (2002)
- Niayeshnia, P., Damavand, M.R., Gholampour, S.: Classification, prioritization, efficiency, and change management of EPC projects in Energy and Petroleum industry field using the TOPSIS method as a multi-criteria group decision-making method. *AIMS Energy* **8**(5), 918–934 (2020)
- Tracey, M., Tan, C.L.: Empirical analysis of supplier selection and involvement, customer satisfaction, and firm performance. *Supply Chain Manag.* **6**(3–4), 174–188 (2001)
- Verma, R., Pullman, M.E.: An analysis of the supplier selection process. *Omega* **26**(6), 739–750 (1998)

- Vonderembse, M.A., Tracey, M.: The impact of supplier selection criteria and supplier involvement on manufacturing performance. *J. Supply Chain Manag.* **35**(3), 33–39 (1999)
- Wang, S.Y., Chang, S.L., Wang, R.C.: Assessment of supplier performance based on product-development strategy by applying multi-granularity linguistic term sets. *Int. J. Manage. Sci.* **37**(1), 215–226 (2009)
- Wagner, R.F.: EPC 4.0: The quest for reducing CAPEX in EPC projects. *Org., Technol. Manage. Construct.: an Int. J* **12**(1), 2245–2255 (2020)
- Yao, F., et al.: Evaluation of informatization performance of construction industrialization EPC enterprises in China. *Advances in Civil Engineering* (2020)
- Tsaramirsis, G., Karamitsos, I., Apostolopoulos, C.: Smart parking: An IoT application for smart city. In: 2016 3rd International Conference on Computing for Sustainable Global Development (INDIACom), pp. 1412–1416. IEEE (2016, March)
- Tsaramirsis, G.: Bridging the Divide: Transforming Business Requirements into Component-based Architectures (Doctoral dissertation, University of London), (2010)
- Kantaros, A., et al.: 3D printing: Making an innovative technology widely accessible through makerspaces and outsourced services. *Mater. Today: Proc.* **49**, 2712–2723 (2022)