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Mining Construction Management Dimensions to Influence Sustainability: Reasoning and Rationalization

Dr. K.T. Vigneswara Rao

Assistant Professor Grade-1,National Institute of Construction Management & Research (NICMAR), N.I.A. Post Office, 25/1, Balewadi Road, Ram Nagar, Baner, Pune, Maharashtra 411045. India
(Corresponding author: ktvrao@nicmar.ac.in[1])
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ABSTRACT

The major objective of present study is to construct a MCDM model to address the structure of construction dimensions through literature review and identify the most significant factors, which help Construction Company to more focus on high degree of customer's satisfaction. Construction Management (CM) dimensions is extracted from the sources of literature review to influence sustainability. An evident discussion from the experts under Indian origin is done for understanding the priority importance of the dimensions for locking sustainability. Eleven technical factors are evaluated to define the crucial dimensions. 10 pointlinkert scale is adapter to understand the ranking of the dimensions based on DEMATEL methodology. The study can be fruitful for the suppliers for planning evident strategies for catching intense orders of the stakeholders. It is found that "Agile arrangement of resources" have received the weight vector of 0.1045with first priority ranking, which is followed by "Health & safety conditions" and "Subcontracting Domain" in the second state of priority ranking.

Keyword: Construction Management (CM), CM Dimensions, Indicators, MCDM, Decision-Making Trial and Evaluation Laboratory (DEMATEL) approach

1. Introduction:

Construction Management (CM) is found as a significant field for managing the construction operations as well as practices oriented to complete the construction task. CM dealt with issues at both levels/spheres such as macro and micro. The macro sphere of CM can generally cover all management related issues i.e., the industry wide statistics, analysis and projections on codes and standards, building information management, procurement and contracts, supply network, workforce productivity, and workplace health and safety, etc, at national, regional and/or international level. The micro sphere of CM covers the specific issues relating to project delivery at various work stages such as project specific study on feasibility, cost plan, design justification, process schedule, risk assessment, quality and traceability assurance, productivity analysis, post occupancy evaluation, and service level agreements, etc. It is found that the CM work is classified as: *Light construction*: Light construction work is dealing with light structural members. Heavy machinery usually not required for these works i.e., residential buildings, schools, village roads, light industry sheds etc. *Heavy construction*: Heavy construction works dealing with heavy structural members on massive foundations, requires heavy machinery and equipment and large quantities of material, labour and finances i.e., Bridges, railways, hydroelectric power generation plants, etc. *Industrial construction*: Industrial construction works are dealing with special equipment and skill i.e, Oil refineries, Steel mills, Atomic reactors, etc. It is observed that there are five main functions, which need to be performed by of CM teams in order to achieve its aims. (i) Planning. (ii) Organising. (iii) Directing. (iv) Controlling (v) Coordinating. To perform the five functions in construction area, the Men i.e., skilled and unskilled, Material such as cement, steel, bricks, aggregates, etc., Machines such as trucks, cranes, etc., are required.

In today's era, it is observed that CM tasks need to be addressed with limited resources in a given time to maximum benefit in terms of construction output due to completive scenarios or high competition at construction market. It is possible if CM operations as well as practices are assessed properly intermediately, CM indicators/factors/dimensions are analysis and suggested to focus or improve, performance is assessed for future improvement etc,.

As we know the concept of Supply Chain Management (SCM) is never deprived from CM field also. It links the consumers to vendors or it is a network, which connects the end user to firm and firm to supplier and vice-versa. In the context of CM, the customers solicited the best service from its construction firm such as right time delivery of houses or construction project, effective construction, quality in building construction project etc. It can be managed by CM teams.

It is found that today's CM researchers are looking for approaches or tool, which can help them to identify the most influencing CM indicators/factors/dimensions so that they can more focus on that CM indicators/factors/dimensions to shape and moulding its future performance. It is sensed that Decision Making Process (DMP) help the construction companies to assess the CM operations as well as practices, identifying the most significant CM operations and operations factor as well as practices need to be focused for future improvement

* *Corresponding author*. Tel.: +917045093703; fax:020-27390057
E-mail address: ktvrao@nicmar.ac.in

etc,. DMP is an intellectual procedure (cognitive process), which result in the evaluation of classes of CM action amongst numerous options in scenarios. DM is the procedure to achieve the target or goal in the context of CM operations. The decision-making procedure uses the decision criterion/factors/indicators/measures which are rated by each judgment maker (or decision group) (Sahu et al., 2019b; He et al., 2021). It is evident that MCDM framework or model can assist in better envisaging the plan for the acquisition of system performance and allow them to expand more speedily by rationalizing the right thing(Sahu et al., 2020; Kang et al., 2022).

Thus, in the present study, the author attempted construct a MCDM model by address the structure of construction dimensions by literature survey and identifying the most significant factors, which influence or help Construction Company to more focus on that and also obtain the high degree of customer's satisfaction in future. First to all, the authors attempted to conduct the relevant literature review for recognizing CM dimensions and advanced method to find the indicator has most influence over customer satisfaction.

2. Literature review:

Porter and Parker (1993) the authors stated that in managing the quality of construction operations to be performed in projects, the construction organizations focus on specific areas such as training, leadership, and benchmarking construction management tools. Haupt and Whiteman (2004) the authors conducted a study in the USA through a literature review and identified the factors such as management commitment and involvement, customer satisfaction, planning, participative management style, continuous improvement measurement, rewards for quality contribution, and training of workers. The authors suggested the operations of a construction job site are affected by aforesaid suggested factors. Jung and Wang (2006) the authors argued that it is the role of management to ensure the achievement of established requirements in a construction project as competition increases and changes occurs in the business world. The authors stated that there is need to understand how closely the construction project conforms to its requirements, a high quality construction project can be achieved in the terms of ease understanding drawings, level of reducing conflict in drawings and specifications, construction economy, ease of construction operations and maintenance, and energy efficiency as well. Ofori, G. (2006)the authors presented a state of affairs in the development of construction industry. The reasons for the lack of advancement in the field are proposed with measures, which can be taken to improve upon the situation. It is suggested that key changes in approach are necessary.

Haseeb et al. (2011) the authors suggested that construction firms have a few deficiencies in getting the stability in a quality of construction operations when their construction's business structures employs the temporary labours and change in their organizations. Saeed and Hasan (2012) the authors stated that the quality in the construction industries can be achieved by meeting the requirements of the designers, constructors and regulatory agencies as well as the customers. The authors extended their glance to argue that construction industries and its quality presently are facing urgency of shaping a sustainable construction process. Ghosh and Bhattacharjee (2013) the authors identified the major research topics of interest in the discipline of construction management. The authors also provided the scholars and practitioners with a baseline for understanding of the current research trends as well as under-researched topics in said discipline. Jraisat et al., (2016) the authors identified the relative importance of factors affecting the quality of construction operations. An exploratory approach is employed by authors, where six interviews are initially conducted with construction experts and then a simple survey of 328 questionnaires was administrated through structured personal interviews among contractors and architects in the Jordanian housing sectors to highlight the factors, can improve the performance of construction firms. Gastelum (2017) the authors proposed a academic/industry research work using actual project data may have more impact on improving industry performance than traditional survey-based research. The authors utilized the CIB and CIB W117 platforms to proliferate the concept of academic/industry test results to increase the impact on the construction industry at global platform. Farooque et al., (2019)the authors systematically analyzed and identified the causal-effect relationships among the barriers to develop a theoretical framework for identifying significant barriers for integrating circular economy in the context of circular food supply chains in China. The Fuzzy Decision-Making Trial and Evaluation Laboratory (DEMATEL) approach is applied to examine the causal-effect relationships among evaluated barriers. Malik et al., (2019) the authors conducted the literature survey to identify the difference between the effect of internal agents and external agents i.e., customers, suppliers and government for development of Sustainable Supply Chain Management (SSCM). The authors also extended their glance over dynamic or interactive relationship between the two types of agents.

Kamal and Vikas(2020) the authors proposed a hybrid MCDM tools, constructed by fuzzy-analytic hierarchy process (AHP) merged with DEMATEL to shortlist the Industry 4.0 in HCSC. The Fuzzy-AHP prioritized the Industry 4.0 in HCSC factors and cause–effect relationships among the factors are evaluated by fuzzy-DEMATEL. It is concluded that HC Logistics Management (HCLM) is the most prioritized factor in case of industry 4.0. Singh and Sushil (2021) the authors recognized the vital relationship between the waste management practices and sustainability. Linked is found as a reference to guide the future of firm. The authors also evaluate the cause and effect relationship between them using Decision-Making Trial and Evaluation Laboratory (DEMATEL) approach. Binder et al., (2022) the authors investigated the types of slab showed a similar deflection after 50 years, while the development of the deflections over time. The CLT slab has a smaller overall stiffness at the beginning but a smaller decrease in stiffness over time than the investigated TCC slab. Bag et al., (2022) the authors investigated a few momentous digital manufacturing barriers as a part of case study in purpose to develop the sustainability and future circular economy of manufacturing industries. The Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique along with Fuzzy Performance Important Index (FPII) towards bifurcating and suggesting the weak and strong barriers to companies to be improved for future circular economy and sustainability is highlighted. Bhattacharya and Chatterjee (2022) the authors proposed an integrated framework for digital project-driven supply chains (PDSC) to address multiple objectives in Architecture, Engineering, Construction and, Operations and Maintenance (AECOM) value chain. Additionally, the following sub-objectives were also to be addressed: to assess emerging themes of Fourth Industrial Revolution (4IR) technologies in AECO and to identify lacunae in existing project supply chains. Mukherjee et al (2022) the authors probed the fifteen significant barriers against the adoption of block chain in GSCM by using Integrated Fuzzy-DEMANTEL approach. It is determined that lack of management vision and cultural differences among SC partners are the mainly impactable barriers. Mitropoulos and Tajima (2022) the interactions and interrelationships among the key participants such as the client, the architect, and the contractor is

largely evaluate the overall performance of the construction project.

3. Methodology:

The decision-making trial and evaluation Technique (DEMATEL) is used for understanding the priority importance of the dimensions under consideration (Sahu et al., 2018b). The DEMATEL is utilized in this study as found it an effective technique for the identification of cause and effect elements of a composite system. The technique can be utilize to evaluate interdependent relationships among dimensions and can assist in determining the critical ones through a visual structural model. DEMATEL is used in this study to define the quality dimensions under CM.

4. Dimensions for evaluation:

The wide dimensions for understanding the intensions of the customers related to construction sites and projects are identified from the sources of literature review and exposed in Table 1 with citations and descriptions of CM dimensions/indicators are shown in Table.2.

Table 1: Construction management dimensions for modelling and evaluation

S.no	Dimensions	Indicators	Sources
1	Coordinating skills	COOS	Farooque et al., (2019)
2	Accepting lean thinking during construction	ALTC	Gastelum (2017)
3	Cost sinking elements	CSES	Farooque et al., (2019)
4	Quality issues	QUIS	Gastelum (2017)
5	Subcontracting Domain	SUDO	Malik et al., (2019)
6	Health & safety conditions	HASC	Singh and Sushil (2021)
7	Technical & professional capability	TPCB	Malik et al., (2019) ,
8	Agile arrangement of resources	AARS	Singh and Sushil (2021)
9	Good communication	GOCO	Singh and Sushil (2021)
10	Team members Competency	TMCS	Bhattacharya and Chatterjee (2022)
11	Financial ability	FIAB	Bhattacharya and Chatterjee (2022)

Table 2: Descriptions of CM indicators

S.no	Indicators	
1	COOS	This indicator measures the interaction ability among the cross-functional team of CM during the construction operations.
2	ALTC	This indicator measures the productivity of construction operations along with minimising the several waste within a construction operations.
3	CSES	This indicator measures the reduction or minimization of all associated costs of construction operations.
4	QUIS	This indicator measures the attainment of high degree of effectiveness along with defect free construction within construction operations.
5	SUDO	This indicator measures the capacity as well as capability of construction organization to accumulate or hire the ventures to accomplish construction operations.
6	HASC	This indicator measures the safest and healthiest working condition as well as environment of construction organization for its employees.
7	TPCB	This indicator measures the involvement of internet of things (IoTs) and digital technical & professional capabilities to carry out the operations smoothly.
8	AARS	It is one of the chief headaches for construction organizations. This indicator measures the quick and expedites arrangement of required resources to carry out the construction task so that customer's satisfaction in terms of fast service can be achieved. .
9	GOCO	This indicator measures the interpersonal communication ability among the cross-functional team during the construction operations.
10	TMCS	This indicator measures the ability of Team members to short out the problems associated with construction operations.
11	FIAB	This indicator measures the Financial capability of construction organization to sustain during disasters or any contingency.

5. Evaluation and Discussion:

The five decision makers are contacted under Indian origin to report the crucial statistics related with the study. For the same, aggregated direct relation matrix as shown in Table 3, Normalized direct relation matrix as shown in Table 4, Total Relationship Matrix as shown in Table 5 is determined for understanding the rank of the dimensions or indicators.**Table 6**: showed the determined values of prominence and relation vectors. Here the prominence and relation values are calculated to define the ranking of the construction sustainable dimensions. A modelling of dimensions is done in this study to understand business intelligence, reporting, query and analysis (Sahu et al., 2017; Wang et al., 2019). The same is done to disclose a schema which is appropriate for high performance (Sahu et al., 2018a; Bag et al., 2021a). it is found that the dimensional model is easier to understand and more intuitive (Sahu et al., 2018c; Bag et al., 2021b) and thus motivation is received by the authors for present modelling. The present study will help in understanding the enablers that can drive a system for sustainability (Sahu et al., 2019a; Guo et al., 2022).

Table 3: Aggregated initial direct relationship matrix

Dimensions	COOS	ALTC	CSES	QUIS	SUDO	HASC	TPCB	AARS	GOCO	TMCS	FIAB
COOS	0.000	7.200	3.600	3.600	6.800	4.000	7.000	6.600	2.600	7.400	4.800
ALTC	5.800	0.000	6.800	4.400	4.400	3.600	5.000	7.400	5.200	3.000	8.400
CSES	6.400	8.200	0.000	6.400	5.800	6.200	7.400	3.800	7.200	6.400	4.800
QUIS	7.200	2.800	4.800	0.000	4.800	8.800	3.600	5.400	5.400	6.400	3.200
SUDO	8.600	5.200	6.000	8.200	0.000	7.400	7.800	7.000	7.200	6.000	4.800
HASC	4.200	6.400	7.000	5.800	7.800	0.000	8.800	5.200	6.200	7.200	5.600
TPCB	4.400	3.200	3.800	4.600	4.600	7.400	0.000	7.800	4.200	5.200	3.200
AARS	7.200	7.800	6.000	8.000	7.400	7.400	9.000	0.000	7.200	5.800	7.200
GOCO	6.800	5.000	6.400	5.600	3.200	6.400	5.200	7.800	0.000	5.200	5.600
TMCS	3.800	4.000	6.600	4.400	6.400	4.800	4.000	4.000	5.000	0.000	4.800
FIAB	8.800	5.400	5.200	4.800	5.200	6.000	4.400	7.400	6.800	3.800	0.000

Table 4: Normalized direct relationship matrix

Dimensions	COOS	ALTC	CSES	QUIS	SUDO	HASC	TPCB	AARS	GOCO	TMCS	FIAB
COOS	0.000	0.099	0.049	0.049	0.093	0.055	0.096	0.090	0.036	0.101	0.066
ALTC	0.079	0.000	0.093	0.060	0.060	0.049	0.068	0.101	0.071	0.041	0.115
CSES	0.088	0.112	0.000	0.088	0.079	0.085	0.101	0.052	0.099	0.088	0.066
QUIS	0.099	0.038	0.066	0.000	0.066	0.121	0.049	0.074	0.074	0.088	0.044
SUDO	0.118	0.071	0.082	0.112	0.000	0.101	0.107	0.096	0.099	0.082	0.066
HASC	0.058	0.088	0.096	0.079	0.107	0.000	0.121	0.071	0.085	0.099	0.077
TPCB	0.060	0.044	0.052	0.063	0.063	0.101	0.000	0.107	0.058	0.071	0.044
AARS	0.099	0.107	0.082	0.110	0.101	0.101	0.123	0.000	0.099	0.079	0.099
GOCO	0.093	0.068	0.088	0.077	0.044	0.088	0.071	0.107	0.000	0.071	0.077
TMCS	0.052	0.055	0.090	0.060	0.088	0.066	0.055	0.055	0.068	0.000	0.066
FIAB	0.121	0.074	0.071	0.066	0.071	0.082	0.060	0.101	0.093	0.052	0.000

Table 5: Total relation matrix

Dimensions	COOS	ALTC	CSES	QUIS	SUDO	HASC	TPCB	AARS	GOCO	TMCS	FIAB
COOS	0.286	0.345	0.306	0.305	0.347	0.335	0.375	0.369	0.296	0.353	0.305
ALTC	0.369	0.263	0.348	0.320	0.323	0.337	0.357	0.384	0.334	0.306	0.353
CSES	0.408	0.393	0.296	0.374	0.371	0.402	0.419	0.377	0.388	0.379	0.339
QUIS	0.371	0.291	0.317	0.254	0.322	0.388	0.332	0.348	0.326	0.341	0.281
SUDO	0.464	0.385	0.398	0.423	0.327	0.448	0.456	0.444	0.415	0.404	0.363
HASC	0.393	0.381	0.393	0.378	0.405	0.336	0.447	0.404	0.387	0.398	0.356
TPCB	0.321	0.279	0.289	0.299	0.303	0.356	0.268	0.360	0.297	0.309	0.267
AARS	0.472	0.436	0.419	0.441	0.439	0.470	0.492	0.381	0.437	0.421	0.412
GOCO	0.392	0.339	0.357	0.346	0.323	0.384	0.374	0.402	0.279	0.347	0.331
TMCS	0.311	0.284	0.318	0.291	0.318	0.319	0.313	0.310	0.302	0.237	0.281
FIAB	0.421	0.348	0.346	0.341	0.351	0.383	0.370	0.403	0.368	0.334	0.264

Table 6: Determined values of prominence and relation vectors

Dimensions	d_i	r_j	Weight vector	Ranking
COOS	3.6214	4.2074	0.0908	5
ALTC	3.6935	3.7443	0.0863	9
CSES	4.1447	3.7850	0.0920	4
QUIS	3.5710	3.7712	0.0852	10
SUDO	4.5296	3.8287	0.0970	3
HASC	4.2779	4.1583	0.0979	2
TPCB	3.3471	4.2043	0.0876	7
AARS	4.8198	4.1823	0.1045	1
GOCO	3.8735	3.8281	0.0894	6
TMCS	3.2851	3.8296	0.0826	11
FIAB	3.9280	3.5525	0.0868	8

6. Conclusion:

In present study modelling of CM dimensions is carried out to expose the crucial facts related with the stakeholder's perceptions. Here, the weight vector of 0.1045is reported with the "Agile arrangement of resources" and fix the first priority importance ranking. After investigation, it is found that the customers at the stage of construction are willingly want construction resources at any cost to avoid halt of other dependent resources and machinery. Thus, the supplier should focus on managing their delivery mechanism in such a way that will provide the construction resources to the customers agile and confidently. The next two other ranking orders in chronological order are found as "Health & safety conditions" and "Subcontracting Domain", which are disclosing that the customers are also concentrating on health safety issues and the extent domain of the supplier working in the directions of supply of construction resources.

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