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Developing adaptive cost model for complexes construction projects in Iraq

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ABSTRACT

The complexity of projects, which is still a young field of study, has a lot of challenges for modern problems that more traditional scientific viewpoints have had difficulty addressing. In addition, as the variety of cost components increases, the complexity of the estimating technique grows, making it more challenging for users who directly perform cost estimation to apply the latest findings of academic research to real-world construction projects. for that, when making decisions on how to achieve a challenging goal in the midst of uncertainty, an adaptive management plan is necessary. The present thesis identifies the effective parameters for adaptive cost estimation, including the influence factors and factors that affect the building cost. then, apply this method with BIM model. The author of this thesis was successful in creating 31 variables for challenging assignments, and then evaluated these elements using the entropy approach. The entropy technique was used to each individual cost component to identify the elements that influence project costs. The results of the entropy method were used to assess the importance of these characteristics.

Keywords: *entropy method, adaptive concept, complex project, effective factors*

INTRODUCTION

the variety of cost components increases, the complexity of the estimating technique grows, making it more challenging for users who directly perform cost estimation to apply the latest findings of academic research to real-world construction projects. Each construction project needs accurate cost estimates[1]. It's a measure of how much time and money will be spent on completing the project. Because to improvements in cost estimate, project management has emerged as a vital skill for finishing projects on time and under budget, respectively[2]. To achieve this, the project manager need to strike a balance between the project's working progress and its budget. This information should be used to describe what the most effective strategy is for assessing the cost of monitoring and diagnosis. Recently, the project managers used a Building Information Demonstrating (BIM) as a computational method to enhance their project control. Building Information Demonstrating (BIM) is being industrialized in almost altogether construction sectors in the Czech Republic. For Cost Organization , referred to as BIM 5D, this transports many opportunities then challenges associated by the need of local workflows alteration in accordance to information modeling wants [3]. Using BIM (Building Information Modelling) is a cutting-edge method that can be used to every facet of construction. The information model is updated as the construction project progresses, and ideally includes all data pertaining to model parts. BIM 5D is a routine progression toward more extensive information modeling for cost control [4]. The information gathered and disseminated by the project team throughout the procedure's development is mapped out in great detail in the procedure map [5]. Due to BIM's rising profile, several studies have been conducted on the topic's potential benefits in the building industry, and BIM-based construction management and cost estimation systems have been developed and made widely accessible to the industry [6]. Consequences of risk variables have been proven by the research, too. Scheme delays, cost overruns, and unsuccessful presentations are just a few examples of the kind of risks that might work against a project's success [7]. Using construction cost estimates, this study aims to examine the accuracy of three approximation approaches (reversion analysis (RA), neural net (NN), and support course machine techniques (SVM). Using a database of past prices, he compared the NN model's approximation results to those of the RA and SVM models and found that the NN model was more accurate[8]. Since then, we've come to the conclusion that the NN model is the most effective way to estimate the price tag on proposed school construction projects[9]. The cost of various construction projects at universities was estimated using a combination of RA, NN, and SVM in this course of study. Ninety-seven containers were utilized for research and development and authentication, while the remaining twenty bags were employed for quality assurance testing. There was a strong correlation between the estimated and real costs provided by all three models[10].

Related works

In order to keep construction costs down without losing durability, affordability housing must rely on accurate cost estimates and the use of eco-friendly building techniques. Two-bedroom, two-bathroom house plans have remained popular. Structural and non-structural components make about half of the entire residential building. In order to reduce the overall cost of construction, the research substituted fly ash for glue at the percentages of 30%, 40%, and 50%. Compressive, split, and flexural tests, among others, are designed to measure forte [11]. Cost estimating and costing are crucial for all engineering projects. The whole effort's estimated costs include everything from materials to transportation to wages to support staff to equipment to materials to overhead to profits for the contractor. Overall, the estimating and costing processes in Bangladesh are carried out manually, and as a result of the sloppy method in which they are carried out, many errors persist in the costing phase, making accurate forecasting impossible [12].
The analysis is complete by using the

software Statistical Set for Social Disciplines Software Version 20. The education is helping to identifying life-threatening factors destined for timing by way of healthy costing overruns formerly , by too finding explanations through recommending which issues are considered to controlling [13]. The building industry is unique of the main sectors that deliver important ingredients for the development of country's economy. The numerous factors are recognized for this drive and these dangerous factors are formerly categorized into proprietor , contractor, consultant, physical , design, labor, gear and external issues [14]. About fifty six responses are received for the analysis purpose. SPSS software is applied to do the analysis. The survey is concentrated on the frequency of incidence of this issues and what is the severity of this factors in the five opinion scale [15]. The part of life cycle costing (LCC) in the preparatory and application phase of housing projects. An innovative technique of evaluating the life cycle of buildings is labelled in the object[16] . This technique was tested in selected residential schemes realized by Skanska in the Czech Republic. The LCC control tool has remained designed to perfect life cycle prices of individual alternatives of construction projects with different contribution parameters [17]. Cost of reduction is achieved by selection of more efficient material or by an improved design. Construction of low cost housing by using the low cost construction materials increases the access to buildings by low income group peoples. Advantages of low cost building materials are pollution prevention, Reducing Energy Consumption and use of Natural materials, Use of Local material, Energy Efficiency, Use of non-toxic building materials, Longitivity, durability and maintenance of building material, Recyclability and reusability of building material and Biodegrability. The reviews on various low cost building designs and management are presented in this paper [18].

FACTORS AFFECTING BUILDING PROJECT COSTS

Adaptive Scheme Management is unable to survive on its own. It is frequently the only form of portfolio management that is consistently effective in governments, but Gartner cautions that without combining Adaptive Scheme Management with Strategic Collection Management, governments will lack the top-down, strategy-ambitious management necessary to guarantee optimal performance[19]. Governments frequently utilize a number of tools to handle different parts of an endeavor, but they frequently lack the knowledge necessary to merge the data obtained by separate aptitude systems. The aforementioned inability is exacerbated by the difficulty of effectively evaluating performance and putting required modifications into place due to inconsistent metrics across work types[20]. Designing, enhancing, and enabling a system to test data from industrial processes was done using integrated techniques with the aim of identifying manufacturing problems as they happen in real time[21]. The essential parameters are found in the next section. Finding the traits that truly impact construction project costs is, in fact, one of the most important challenges in building the neural network model. These characteristics were carefully sought for using a variety of methods due to the significance of their existence in Iraqi construction projects[22].

Table 1: Organizational complexity factors

FA1	Organizational complexity.
SFA1	Technically complex role that requires locally available special skills.
SFA2	Technically complex role due to the sophistication of the equipment or method.
SFA3	Technically complex role that requires special skill, knowledge, and equipment.
SFA4	Role that has no known procedure.

SFA5	Physically difficult role that requires the use of complex equipment.
SFA6	Conducting or managing a role for the first time.
SFA7	Physically difficult role that requires simple or no equipment.

Table 2: Uncertainty Factors

FA2	Uncertainty.
SFA8	Unpredictable work in a defined new structure.
SFA9	Unpredictable subsurface.
SFA10	The effect of weather or climatic conditions.
SFA11	Undefined structure or poor buildability assessment (e.g. refurbishment works of old buildings).

Table 3: Inherent Complexity factors

FA3	Inherent complexity.
SFA12	High degree of overlap of construction phases.
SFA13	High degree of interrelationship between activities in the different overlapping parts.
SFA14	High interdependencies between the roles of various trades in a task.
SFA15	High degree of overlap of design and construction.

Table 4: Project Monitoring and control factors

FA4	project monitoring and control.
SFA16	Lack of working drawings.
SFA17	Lack of uniformity due to continuous change in material or other resource.
SFA18	Poor channels of communication.
SFA19	Lack of uniformity due to lack of working space and or access.
SFA20	Lack or uniformity due to mechanical or other resource breakdown.
SFA21	Lack of experienced local workforce.
SFA22	Poor generation and use of information.

Table 5: Rigidity of sequence factors

FA5	Rigidity of sequence.
SFA23	Rigidity of sequence between the various packages within a phase.
SFA24	Rigidity of sequence between the various operations within a package.
SFA25	Rigidity of sequence between the various tasks within an operation.

Table 6: Environmental factors

A6	Environmental effect.
FA26	Technical core environmental layer
FA27	underwater construction layers
FA28	chemical layers component
FA29	social environmental influence

FA30	cultural environmental influence
FA31	legal environmental layer

Entropy Weight method

A common weighing approach in decision-making that assesses value dispersion is the entropy weight methodology, or EWM for short. The degree of differentiation increases with the degree of dispersion, suggesting that more information may be extracted from the data. The index should be given more weight, and vice versa, instead[23]. The entropy weights methodology, sometimes referred to as EWM, is a method of information weighing that is frequently applied throughout the decision-making process. In-depth assessment studies using a variety of evaluation markers have frequently used it[24]. The relative importance of a number of different variables is assessed in these types of analysis depending on their dispersion. The index will have a higher impact on the overall evaluation if the entropy value is low since this will cause the index's dispersion to be high. It should be signed using a heavier pen because of this.

Results and discussion

Although complexity is a wide topic that may be applicable to any industry, the building industry is currently lacking in published content in this area. Complexity of projests, which is still a young field of study, has a lot of potential for addressing modern problems that more traditional scientific viewpoints have had difficulty addressing. Given this, it is logical to investigate other industries that use complexity science to determine if there are any lessons that can be applied to the construction sector. History demonstrates that the construction industry has a poor track record of project performance in terms of quality, health and safety, and even budget and schedule overruns. A common theory regarding the cause of the subpar performance is the complexity of the design and construction processes. Early project complexity measurement may aid managers in developing a deeper understanding of the task, which in turn may enable them to more effectively manage the difficulties that come with complicated projects. The conclusions of the Delphi research and the entropy weight technique can both be extrapolated from the table, which also shows that all of the elements have a significant impact. Prioritizing indicators evaluated on Likert-type scales is effectively accomplished by the study of the relative relevance index. This is so that the majority of pertinent criteria may be identified in the participants' responses. This makes it a great tool for sorting indicators according to importance. The criteria may be ordered and the relative weight of each component could be ascertained by an analysis of the relative index. The tables that can be seen below for each category present the results of the relative index study. By selecting the relevant link, one may view these tables. These rankings led to a high grade being assigned to risks in the assessment of construction project cost overruns based on the effects they caused.

Table 7: Entropy weight of complex project factors

	very high effect	high effect	medium effect	low effect	very low effect	no effect
FA1	0.146	0.233	0.153	0.158	0.175	0.135
FA2	0.293	0.137	0.004	0.142	0.113	0.311
FA3	0.261	0.063	0.008	0.117	0.447	0.104
FA4	0.166	0.124	0.484	0.067	0.048	0.111
FA5	0.165	0.119	0.289	0.067	0.361	0.000
FA6	0.169	0.102	0.040	0.091	0.283	0.314

The most important aspects in an intelligent structure are the number of stores, kind of design, and size of the shadow cast by the building's façade. The Entropy Weight Method (EWM) is a well-liked weighting approach in the evaluation of water quality since it assigns weights based on the discriminatory strength of indicators. Weight needs go up when the discrete degree goes up, and vice versa.

Table 8: the entropy method ranking results

	entropy method	mcdm
SFA1	0.69	0.70
SFA2	0.74	0.75
SFA3	0.72	0.75
SFA4	0.73	0.74
SFA5	0.72	0.73
SFA6	0.73	0.71
SFA7	0.71	0.73
SFA8	0.71	0.80
SFA9	0.81	0.77
SFA10	0.71	0.78
SFA11	0.76	0.80
SFA12	0.56	0.77
SFA13	0.72	0.76
SFA14	0.76	0.77
SFA15	0.78	0.75
SFA16	0.54	0.73
SFA17	0.59	0.72
SFA18	0.55	0.71
SFA19	0.56	0.73
SFA20	0.63	0.70
SFA21	0.79	0.71
SFA22	0.71	0.71
SFA23	0.81	0.88
SFA24	0.91	0.90
SFA25	0.76	0.87
SFA26	0.73	0.75
SFA27	0.65	0.73
SFA28	0.74	0.74
SFA29	0.76	0.75
SFA30	0.69	0.76
SFA31	0.72	0.73

in order to compare the results of MCDM effective factors rank and entropy factor ranks, table 4.2 present the main effective factors.

Table 9: Comparison between the effective factors results between the entropy method and MCDM method

entropy effective factors	rank	MCDM effective factors	rank
SFA4	.732	SFA3	.747
SFA9	.807	SFA8	.804
SFA15	.776	SFA14	.771
SFA21	.791	SFA19	.730
SFA24	.913	SFA24	.899
SFA29	.759	SFA30	.756

CONCLUSION

As a part of this thesis, a method for calculating the weights of complex project components using an entropy-weighted approach has been developed. The quantity of information has expanded as a result of the employment of this method, going from a single attribute vector to the full decision matrix. An attribute vector that was used to determine the relative significance of components was the focus of the investigator's attention. The author of this thesis was successful in creating 31 variables for challenging assignments, and then evaluated these elements using adaptive principles. The goal of this study is to provide a unique way for evaluating project performance in southern Iraq by creating a model that may help parties involved in building projects identify obstacles and performance in the early stages of the project. The purpose of this study is to develop a technique that may be applied in the area. The following tactics and methods were applied in order to achieve this goal:

a) A variety of techniques, including surveys, expert opinions, interviews with members of the construction industry, and exploratory research based on prior studies, were used to assess effective performance characteristics and the extent to which they have an impact on building projects. Five different categories of activities that have an impact on construction projects were chosen as a consequence of the selection process.

b) Many other variables had to be taken into consideration when creating an entropy model, the first of which was choosing the best software to be utilized in the model's creation. The components that have been utilized for fundamental performance evaluation were chosen to be used to ascertain the level of effect that each type of performance has due to their ease of application and ability to draw conclusions.

c) Once the system was reviewed, the findings were found to be highly favorable, and the performance projection was shown to be extremely accurate.

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