A LITERATURE REVIEW: ESTIMATES OF BUILDINGS BY SOFTWARE BASED TECHNIQUES

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Abstract : the adaption of technologies in various industries are fast, and growing and construction industry is grasping it very quickly and effectively. the process of drawing quantity manually from hard copy to cad and now bim is changing the lengthy process and making it more simple. this paper aims to provide a comprehensive literature review on the stages of using bim in the construction industry and how it is being used for quantity takeouts (qto). while it is widely accepted that various softwares are used to take out estimates in various levels of construction industry, there are new and various approaches are being made to simplify it more and more.in this literature review, it is found that there is a lack of simplification when bim is took into consideration for drawing estimates. the recent development and growing popularity of building information modelling (bim) also indicates that a new generation of tools for qto will emerge. this research paper summarizes the major issues related to the current status of estimates through bim in the construction industry and proposes a research agenda for using bim to facilitate more efficient way to draw estimates using bim based softwares.

indexterms **- bim, construction projects, qto, programming language.**

I. INTRODUCTION

The construction industry involves diverse and complex procedures. Cost estimation in construction projects is an important factor for decision making in both the early phase and the detailed design phase (choi etal. , 2013)(24). construction cost estimation for tendering is important for both tenders and bidders in construction projects and needs to be strictly complied with corresponding standards so that quantities and prices from different bidders are comparable(liu etal., 2015)(16). there are various types costs are related with a particular project like labour cost ,operation and maintenance cost,life cycle cost etc.

in earlier days quantities are drawn from drawings manually then reports are made in microsoft excel but now a days various softwares are used to draw quantities. examples of these packages are navisworks, costx, innovaya, itwo, d-profiler, vico, projectwise navigator, bentley construcsim, balfour technologies, etc.(hani alzraiee 2020)(7).

BIM has been widely used for information management and communication in architecture, engineering, and construction . it was defined as a 'way of working, where the spatial building element framework is being set up within a digital building information model and a building or structure's spaces, aec elements and technical assets are specified by their distinctive properties and their reciprocal relationships.(husam sameer etal., 2020)(21).

II. Role of surveyor

Each industry has a specific person that deals with cost. The role a surveyor is very important because it connected directly with feasibility of the project

As cost being an important parameter. Construction technology and environmental services, computer literacy ethics and professional practice, leadership and management and measurement and costing as areas in which competencies of quantity surveyors need to be given consideration in sustainable approaches and sustainable techniques. Quantity surveyors possessing these competencies will enhance sustainable construction (P. B. S. Chamikara etal., 2018)(18). Either using software or by manually the cost of a project should be correct and that is why role of a surveyor is very imp and hence the person taking this role must be experienced and well educated. And the need for Project Cost Managers to embrace and evolve with BIM is inevitable but the rate of adoption and implementation remains to be seen (Smith Peter 2014) (6).

III. BIM and Cost estimates

3.1 Early design phase

Construction cost estimation for tendering is important for both tenders and bidders in construction projects and needs to be strictly complied with corresponding standards so that quantities and prices from different bidders are comparable. (Zhiliang Ma etal., 2014)(14).various approaches are being made to calculate this early cost using programming languages. The authors developed a QTO prototype system for the schematic estimation of building frame, which is an important factor for decision making in early phases. This system, InSightBIM-QTO is divided into two modules. Additional functional modules are the Pre-check Option for selecting structural elements and the Calculate Option module for modifying the ratio of concrete. Thus, the methods are helpful not only to increase accuracy in QTO, but also to verify quality in the IFC model. QTO results can improve the schematic estimation task and improve the reliability of the estimate. In this study, the scope of the applied QTO methods was limited by building frame (Choi etal., 2013) (24).

Clash detection is one of the major factors to be considered in early stage. Chahrour etal., 2021(4) studied cost benefit analysis of design through BIM which help to detect clashes and help in early design decisions and avoid conflict between different consultants and stakeholders. Abanda Fonbeyin Henry etal. 2017(23), explores the development of an ontology based on New Rules of Measurement (NRM) for cost estimation during the tendering stages.

What if the energy cost of building becomes higher than actual cost of construction? Terrifying isn't it? Alshibani Adel etal., 2017(5) prepared a model using BIM which will help architects to finalize model consuming least energy cost.

3.2 Real time cost

Generally, the construction projects will take a long duration to complete. In this context predicting price escalation and estimating construction costs are major steps for project estimators, contractors and owners. K.S.V.S. Pujitha etal., (13)(2020) calculated cost of column, beam and slab using real time data i.e how many labours are required for casting that particular element and concluded that this cost will help in decision making about cost expenditures. The ability to simulate a range of design options with real-time cost advice and continue that real-time cost advice throughout the detailed design, construction and operational stages will arguably place the project cost manager at the top of the 'value chain' for project clients (or at the very least provide a 'must have' service for the client) Smith Peter 2014(6). Guerra Beatriz etal. (2019)(10) calculated drywall and concrete waste during construction by subtracting purchased quantity from the quantity calculated through BIM. The results show that there is 1.95% concrete waste and 13.78% of Drywall waste. Huang Chien etal., 2020 (22) developed method to minimize the error in calculating the labor cost through simple linear regression.

3.3 Life Cycle cost

Natural disasters like flood, earthquakes, landslides etc affects life cycle cost of a building. In earthquake prone areas necessary changes are made in designs and because of that cost of building increases. Revit API is used to create model and resiliency factor is used to draw cost of a building (Beatriz C. Guerra etal., 2021)(9). Swei Omar etal. ,2017(15) concluded that probabilistic LCCA is an increasingly used tool amongst the pavement community to evaluate the merits of alternative investments.

3.4 Operation and maintenance cost

The operation and maintenance (O&M) is the longest and costliest phase during the entire building lifecycle. Revit software is used to create a 3D model and a programme is created using vico office software which can draw quantities from model. The outcome of this study not only implement the idea of narrowing the knowledge gap between maintenance theories and practical maintenance applications by a consistent and sustainable information flow based on BIM, but also link the maintenance stage with the design and construction phase which BIM is mainly applied into for exploring the potential BIM value in the O&M phase. (Chao Chena etal., 2019)(2). Espinsosa-Garza etal., 2017 (17) proved that a project's PV plays an important role in the control of middle and final costs of a project and find out more improved values of planned values.

IV. BIM AND NEW PROGRAM'S

Michael Lawrence etal.,(2014)(1)studied how changes in design can affect the estimates to solve this problems they created 3D model using revit and using programming language query is generated and attached to estimated items so that if there are any changes in design the system will let you know.

Estimators also helps to find out the best items with least cost and maximum performance but this role is also can be eliminated by using BIM. Seul-Ki Lee etal.,(2013)(3) developed a program using archicad, vico estimator etc which will select most appropriate work item based on inputs like room size thus further elemates the role of a estimator but this program is only tested for tiling work.

Hani alzraiee used structured query language which will calculate cost based on item work using Revit and naviswork.(2013)(7).

Project design goes through many changes on daily basis but keeping the record of this changes is difficult, for this HeeSung Cha etal., 2018(19) linked this data with 3D model which will further minimize risk associated with loss data.

Zhiliang etal.,(2016)(8) studies different specifications which will help to saves time during calculating the cost. Using NLP author developed algorithms that extracts specification data and matches it with materials in the database and extracts the prices of the matched material .The proposed algorithms were only tested for wood construction(Akanbi Temitope etal.,2021)(11).

V. BIM AND SMALL SCALE INDUSTRIES

According to Fortunatus Moo etal.,(2019)(20) various factors which affects the growth as per contractors and consultants are payment delay, political influence, price fluctuations, geographical location, education level, firm age etc. In India most small firms use Auto CAD for 2D drawing and estimate while 3D max is used for 3D modeling and Microsoft excel is used for making reports.

1. Summary

Point	Auther	Study parameters	Key Findings
Role of surveyor	1)P. B. S. Chamikara etal.	Interviews ,Questionnaire Survey ,.Cronbach's Alpha and Archicad	computer literacy ethics and professional practice, leadership are very important
	2)Smith Peter	Project cost mangers	Adoption of BIM and evolve with BIM.
Early Design Phase	1) Zhiliang Ma etal.,	Tendering Cost, quota items	Elaborated specifications In BIM
	2) Choi etal.,	IFC model, QTO model	InSightBIM-QTO
	3)Chahrour etal.	Clash detection	Early clas detection
	4)Alshibani Adel etal.	Energy cost	BIM model
Real Time Cost	1) K.S.V.S. Pujitha etal.,	No of labours	Daily cost of construction
	2) Smith Pete	Project cost mangers	Adoption of BIM and evolve with BIM.
	3) Guerra Beatriz etal.	drywall and concrete waste	Construction waste
Life Cycle cost	1)Beatriz C. Guerra etal.	Resiliency factor	Improved designs
	2) Swei Omar etal.	LCC	Alternative investments
Operation and maintenance cost	1) Chao Chena etal.	Revit,Practical and theoretical maintenance	Improved cost models
BIM and new program's	2)Espinsosa-Garza etal.	PV	Improved values of PV
	1)Michael Lawrence etal.	Changes in design and Revit	programming language
Small scale industry	2) Seul-Ki Lee etal.	Item work and Archicad	Automatic slection of material based on inputs
	3)Hani alzraiee	structured query language and Archicad	Cost based on item work
	4)HeeSung Cha etal.	Loss of data,3D model	Documents linked with 3d model
	5)Zhiliang etal.	specifications	Time saving in cost estimation

6)Akanbi Temitope etal.	algorithms	Extraction of specificationdata based on inputs
1)Fortunatus Moo etal.	Interviews and case study	Different factors

VI. CONCLUSIONS

For estimating the difference items of a building different softwares are used. By Table no. 1 from above study it is found that Revit and Archi CAD is used for 3D, Vico Softwares used for finding the quantities. No any auther used autocad revit for estimating

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