

Recent Advances in Mobile Applications For Construction; A Search for Cost Management of Projects

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Abstract:- Construction industry is information-oriented industry and the increasing demands for cost effectiveness, process efficiency, and apt conveyance of information for management action resulted to several innovations in the industry. Mobile technology is one of the new trends of industrial innovations which has altered present day business operations for good and construction business is not an exception as it has assisted greatly in construction project management and performance. It has therefore become an indispensable tool during project execution as the use makes information transmission and retrieval among construction professionals and participants more effective and efficient. Cost management in construction is a process and its operation need innovation, automation, learning, involvement and commitment from people. The ingredients of construction cost and the activities involved in managing construction cost is obtainable from all the construction participants which include the consultants, the contractors, and the client. Integrating these ingredients and the activities becomes very paramount in delivering effective cost management practice. Hence, developing and adopting new ways to save time and reduce costs of construction can help construction firms to have a competitive edge in the construction market and mobile technology offers construction companies the prospect to get to that level. There are so many construction related mobile applications currently in the market ranging from simple calculations to full rendering of construction facilities. This paper presents recent innovations in the use of mobile technology in construction with emphasis laid on the use of the technology for construction cost management in real time. The paper reveals the basic uses of mobile applications in construction, and their potentials for effective monitoring and control of construction cost.

Keywords:- Mobile Technology, Real-Time Cost, Construction Innovations, Cost Management, and Construction Mobile Apps.

I. INTRODUCTION

One of the biggest recent developments in the management of construction projects is the integration of mobile technology. One of the numerous innovations that has made great impact on the global society is the use of mobile phones [1]. The basic project management tools that supports in thwarting or eradicating kickbacks in the different phases of construction projects which include planning, designing, and building are being decoded and built in tablets, smartphones, and other mobile devices. Whether the construction project is a simple structure or complex edifice, there are a number of different professionals and project participants involved, ranging from project consultants to site supervisors and artisans, whose interest is to ensure effective management of the project to avoid undue time and cost overruns. The construction industry is facing a new-fangled and revitalized period with the support of technology through new applications and tools. These applications generated by technology start-up companies are changing how construction companies are designing, planning and executing their projects [2].

The major challenges of construction industry are how to reduce costs, improve productivity and have a competitive edge in when it comes to quality of service and customer satisfaction. This challenge is communication-based challenges among project participants because of the dynamic features of the construction industry. [3] articulated the major factors that lead to these challenges. According to them, these challenges can be attributed to:

- The huge measure of data that is required to be exchanged and traded amid the construction phase of a project
- The dispersion of construction project team and construction works as well as recurrent changes of site locations.
- The way the industry is fragmented that involve many different stakeholders which creates gaps in data stream.
- The separation of site offices from work sites.

- The need for apt transmission of information as the construction industry has rigid deadlines and costly delays characteristics.
- The amplified dependence on subcontractors to execute construction work as it was reported that at least 80% of the activities performed on a typical construction site is delegated to specialty contractors which in turn expounds the fragmentation of the industry.

These challenges are being addressed as communication has been made easy and transmission of information is done effortlessly with the use of mobile devices. Inadequate communication and management of construction programs results into cost overruns and imprecise construction schedule forecasts [4]. Mobile project management has taken a rapid pace with the introduction of the mobile devices, which is quickly becoming an indispensable tool in construction project sites. Every participant in a project site performs a task that has cost related implications. This means that the sources of all the cost ingredients which include materials, labour, plants and equipment, are traceable to the project participants who practically cannot effectively deliver their services in the present age without the use of mobile devices. The management of construction cost is the most vital determinant of project success, and the performance of any construction project is generally expressed in terms of cost and its deviation from the initial budget. Different innovations in construction have been in play especially in this current day industrial revolution to ensure efficient and effective project performance. When adequate control is taken, even a well-thought-out and scheduled construction system can lead to hitches, delays and cost overruns [5]. For precise and resourceful information management, information and communication technology (ICT) tools are used in the construction industry [6]. The construction industry long known as slow adapters of technology is catching up at 5G speeds [7].

There are so many construction applications currently existing. [8] cited that it is estimated that there may be approximately 13,000 construction related development and design mobile applications currently in the market. New technologies and innovations are still being invented and adopted in executing construction related activities in recent times. The available mobile apps used in construction sector are used for different range of activities including project management, calculations, construction safety, integrated construction cost and accounting, site operations, computer aided design, 2D and 3D designs and drawings, estimating, and building information modelling (BIM). These applications are developed to increase productivity and efficiency and to manage workflow [8]. This paper explored the recent advances in construction mobile applications with

emphasis laid in cost management mobile applications in real time. The key benefits of mobile applications in construction were highlighted, recent innovations were explored, with a proposed real time cost management model using integrated mobile application.

II. AREAS OF MOBILE APPLICATION IN CONSTRUCTION

The era of mobile technology is in full swing, and construction companies are gradually but assuredly making the switch [9]. Though the construction industry is long known as slow adapters of technology, the industry is catching up at 5G speeds [7]. Mobile devices are practically used in all phases of construction project development. The smartphone, as well as mobile computing technology, provides a flexible and enabling environment for on-site construction management and it is anticipated to champion the paradigm shift of the conventional construction management practices [10]. Construction industry related applications presently obtainable in the market offer numerous functionalities ranging from simple calculations to detailed architectural renderings [8]. The basic areas of mobile application in the construction industry includes but not limited to;

- Project planning
- Project designs
- Cost management and control
- Construction safety
- Project management and control

Mobile technology enables quick communication between all stakeholders in any construction outfit. This means that every project Participant will be acquainted on how a project is going to be completed. Most construction projects entail frequent communication among multiple parties and slight break can be unfavorable to the productivity of the project. [11]. Mobile technology gives the parties the opportunity to resolve any information transmission issues instantly via mobile email, or submitting documents in real-time. Real-time access to information means less expensive mistakes [12].

III. RECENT INNOVATIONS AND APPLICATIONS IN CONSTRUCTION

A number of trends in the construction industry are technology-related, either driven to a large extent by digitalization and other emerging technologies, or impacted by technology [13]. [14] highlighted the recent innovations in the construction industry from the year 2016 and beyond (see figure 1 below) and mobile technology is one of the areas of the recent innovations:

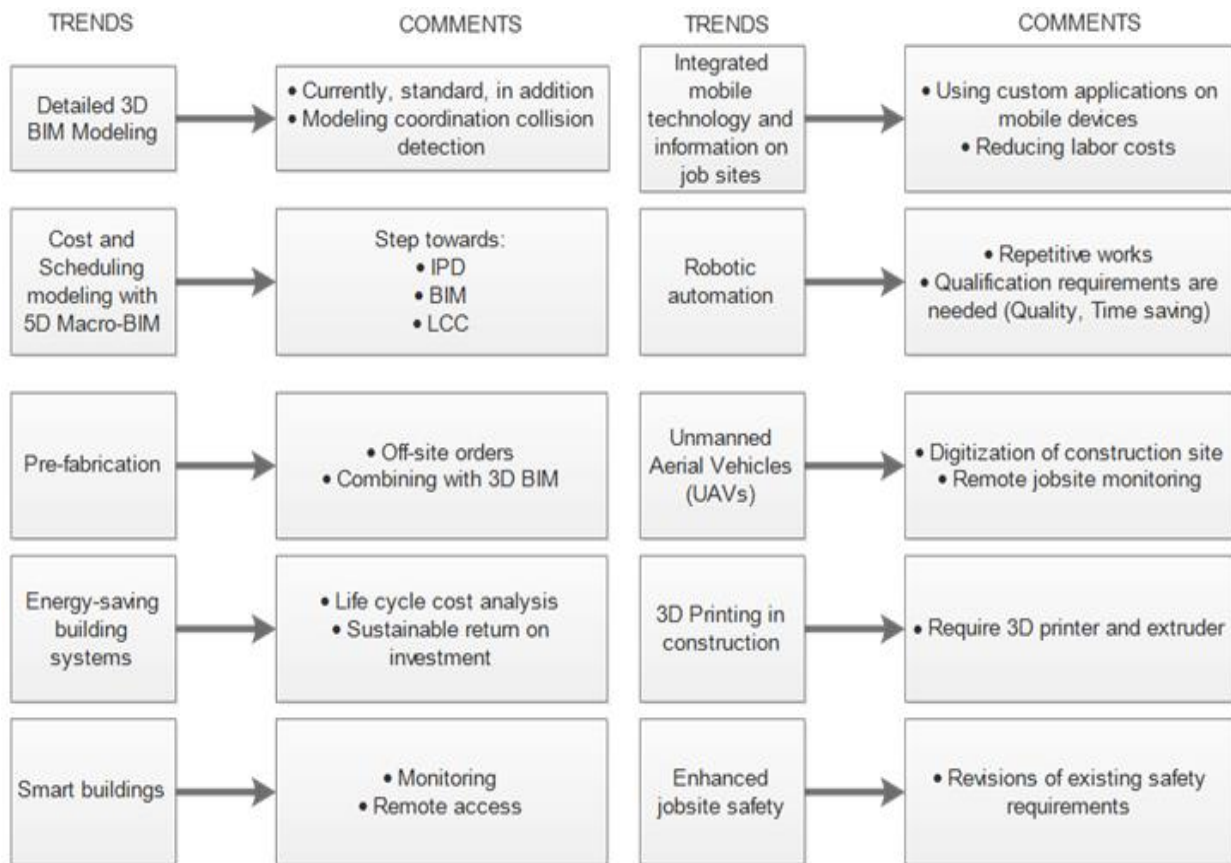


Fig 1:- Construction trends shaping the industry in 2016 and beyond; Adopted from [14]

Currently there are software and mobile solutions that can assist in managing different aspects of construction project. Ranging from preconstruction to work scheduling, from project management and field reporting to managing back office, there is already an existing software solution that can help to streamline construction processes and improve productivity. Construction process entails adequate management and harnessing of construction resources such as the materials, labour, plants and equipment to ensure the achievement of the proposed project as designed within the predetermined budget, not compromising quality, utility nor appearance. The key determinant of a project performance is

cost. This is why virtually all developed mobile applications and softwares have capabilities of performing an integral part of cost management function directly or indirectly. These Apps and softwares have made construction processes including management of cost and schedules easy. Most software solutions are cloud-based, that allow making changes and up-to-date documentation, scheduling, and other management functions in real time, facilitating better communication and collaboration [15]. Top 15 mobile solutions used in construction are as listed in Table 1 below, and their areas of applications.

S/N	Technology	Type	Uses	Areas Applicable
1	BIM 360 Docs	Mobile application	Used to manage all project files and project designs	Project Design, Cost Management, Project Management
2	Construction Master Pro App	Mobile application	useful for making construction related calculations like length, area and volume conversions.	Cost Management [Quantity Measurement and Estimating], Project Planning
3	DroneDeploy	Mobile application	DroneDeploy is used for site plans development, monitoring of job progress, and comparing BIM models with actual site conditions for safety improvement and to keep projects on track.	Project Management, Project Planning, Construction safety
4	eSUB	Mobile application	fused exclusively for subcontractor’s workflow and needs.	Project Management, Cost Management, Project planning
5	Fall Safety Pro	Mobile application	actively monitors for falls and tracks location of falls in construction sites	Project Management
6	GasBuddy	Mobile application	Used to compare gas prices within a site location	Cost Management, Project planning

7	PlanGrid	Mobile application	Enables users to share plans, markups, photos, and reports with the whole project team from their mobile device	Project Design, Project management, and Cost Management
8	SafetyCulture iAuditor	Mobile application	Provides a great checklist app. Paper checklist are digitized to enable project team conduct inspections faster	Project Management, Construction safety
9	SmartBid	Mobile application	SmartBid provides a cloud-based platform to send invitations to bid, share project documents, and work together with subcontractors. SmartBid enables users to securely access their network of subcontractors for E-tendering	Cost Management, Project Management, Project planning
10	TrueLook	Mobile application	Used to view construction sites in real-time, save and share webcam images.	Project Management, project planning
11	JobFLEX		This is an estimating and tender management application that gives estimates on the spot, with or without internet connections.	Cost Management, Project Management, project planning
12	e-Builder	Available in all platforms including mobile device	This is a construction project management tool that enables real-time monitoring of project performance.	Project Management, project planning
13	DEWALT Mobile Pro	Mobile application	DEWALT Mobile Pro is used fully for construction calculations and as a reference tool	Cost Management
14	Bridgit Closeout	Available in different platforms including in mobile devices	Bridgit Closeout is a cloud-based job management solution for scheduling work, reporting, and note-taking. With the Closeout app, task details can be shared among teams	Project Management, project planning
15	Canvas	Mobile application	Canvas makes reporting simpler and accessible. One can fill out estimates, forms, inspections, work orders, and audits using mobile devices.	Cost Management, Project Management, project planning

Table 1:- Top Mobile Technologies Used In Construction

It is evident that majority of the above mobile applications, are relevant for construction cost management. Among the numerous benefits of mobile application in construction, increase in efficiency and effectiveness of cost management processes is one of the key importance. The key components of cost management of construction projects include resource planning, cost estimation, cost budgeting, and cost control. Most of the recent mobile applications and software has features to handle at least one of these key components. The training effort in the present era should be geared towards improving the abilities of contractors and Cost Managers to adopt a new digital approach rather than focusing on using the old analog and parametric estimating, cost adjustments and earned value [16]. Having established that mobile application in construction cost management is an indispensable tool in this current trend, it is therefore recommended that cost managers should be enthusiastic in

getting relevant applications that are useful for any cost management role they have to perform. This will greatly increase efficiency and accuracy of cost reports.

IV. CONCLUSION

Cost management in construction is a process and implementing it demands innovation, automation, learning, involvement and commitment from people especially in the present era of digitization of processes. Integrating mobile technology to specifically address real-time construction cost will improve construction cost performance and drastically remove unnecessary bottlenecks faced by project participants especially project managers and cost managers. The numerous varieties of mobile applications currently available in the market as revealed in the paper should be well adopted and utilized for construction cost management.

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