Extent of Information Technology usage in Construction Project Management

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Abstract

Project management is both an art and a science. The processes presented in this document illustrate the science of project management. The science consists of a systematic approach using a standard methodology. The art consists of "soft skills" including leadership, trust, credibility, problem solving, and managing expectations. The art of project management is developed through experience, practice, and intuition. A project manager who is skilled in the art instinctively knows how and when to react to project problems. Project management is equally divided between the art and science and a successful project manager utilizes and refines both skill sets to effectively manage projects. Information technology (IT) can effectively promote integration in the construction industry. Recent advances in the field of IT, the increasingly global nature of the construction market and a renewed demand for quality and productivity in construction are making the issue of integration more critical than ever. Design and construction organizations can achieve integration of various construction activities by redesigning many of their organizational functions and processes and IT can facilitate redesigning of these processes.

Keywords — *Project management, Information technology.*

I. INTRODUCTION

In today's business environment, two factors have become common: change and complexity. The nature of business has incorporated these factors into our everyday lives. We work in an environment of constant change and increasing complexity, and must be competitive, productive, customer-focused, and profitable. Much has been written about change in the business community. Indeed, we all know the one constant is the existence of change. Marketing strategies, manufacturing strategies, service strategies - all must accept the realization that as soon as the details are spelled out, factors in the marketplace will demand that the strategy be revisited. Managing change has become a key ingredient for today's successful business. Business has also become extremely complicated. This complexity is related to the number of factors involved in the effort, the global scope of markets, and the sheer size of the efforts being undertaken. Even small decisions often involve the interplay of hundreds of variables.

The dynamic nature of construction processes, interdependence of various participating entities and the need for teamwork, flexibility and a high degree of coordination suggest that IT has great potential in the construction industry. The construction industry can make effective use of communication, data accessibility and common systems designed to process data, the three major categories of IT capabilities to achieve integration. We contend that appropriate IT investment and management's commitment and ability to provide leadership under the changed atmosphere are crucial for the successful implementation of IT in the construction industry. The impact of IT on the design and construction organizations must be managed with an understanding of external and internal factors that affect business organizations. It is essential that an appropriate environment that establishes suitable reward recognition procedures, encourages team-work and creativity and stimulates decentralization of decision-making activities be created. Thus, IT implementation is not just a technical enhancement but a managerial decision that involves re-engineering of organizational functions and operations.

To analyse the extent of Information Technology in construction project management and to understand and apply Information Technology techniques to plan, organize and control resources in Project Management effectively and efficiently in construction environment. Sustainability is a key issue in modern construction and people will develop an understanding of how effective site planning can minimize the impact of the project on the natural environment, the local community and wider stakeholders.

A. Research Objectives

- To analyse the usage of Information Technology in construction Project Management
- To understand the resources required to complete a construction project at each stage of the project

- To make recommendations to improve the efficiency of Project Management of construction companies.

II. LITERATURE REVIEW

A. *Theoretical Framework*

Projects have become the new way of accomplishing and managing business activities. Projects are the temporary assemblage of key personnel designed to accomplish specific business objectives with identifiable customers in mind. A project has a beginning and an end. The project team dissolves once the objectives are met. It is fluid and driven by the specific needs of that business. The project approach to managing business activities embraces change and complexity. Projects can be defined in many different ways. However, there are some traits that all projects have in common. Typically, these traits are used to identify what a project is. The most distinguishing feature is a specific time frame. All projects have a beginning and an end. Many efforts are called "projects" but actually become programs as they extend indefinitely and cover broader, less specific business objectives. Projects must have a clear, definitive goal or objective. The objective is specific, identifiable, and can be accomplished. A project usually involves varied activities, which produce quantifiable and qualifiable deliverables that when added together, accomplish the overall objective. The construction industry has been reluctant to embrace the benefits of IT. However, builders are now beginning to be dragged into the 21st century by the need to collaborate more closely with their more IT colleagues, the architects and engineers responsible for the ideas behind their work.

Key Characteristics of Projects

- A project has boundaries, so its extent is defined.
- A project is a one-time effort, usually requiring finite resources.
- There are distinct start and end dates for projects.
- You know when you have reached the end of the project.

B. *Project Management*

Project Management is the process of achieving project objectives (schedule, budget and performance) through a set of activities that start and end at certain points in time and produce quantifiable and qualifiable deliverables. Successful project management is the art of bringing together the tasks, resources and people necessary to accomplish the business goals and objectives within the specified time constraints and within the monetary allowance. Projects and Programs are linked directly to the strategic goals and initiatives of the organization supported.

C. *Project Management Life Cycle*

The process each manager follows during the life of a project is called the Project Management Life Cycle. A proven methodical life cycle is necessary to repeatedly implement and manage projects successfully. During the life cycle of any project, proven and tested project management processes or best practices are should be initiated. The types and extent of processes initiated depend on the nature of the project, i.e. size, probability of failure and consequences of failure. Strong and effective leaders apply process to protect all projects.

- Initiation
- Planning
- Executing
- Controlling
- Close-out

D. *Information Technology and Constructions*

The construction industry has been reluctant to embrace the benefits of IT. However, builders are now beginning to be dragged into the 21st century by the need to collaborate more closely with their more IT-savvy colleagues, the architects and engineers responsible for the ideas behind their work. Consequently, laptops are gradually making an incongruous appearance alongside the hard hats, mud and mayhem of the building site. So, is this just a case of keeping up with the times or are there other issues driving the industry from bricks to bytes?

E. *Reducing Risk*

One of the major factors for this change is that it is becoming increasingly difficult to maintain profit margins on building projects. For example, house builders are seeing a shift to mixed-use sites with fewer family homes and more flats, so multiplying the risk factor inherent in investing in building land. Mindful of high-profile project delivery delays, many commercial or public sector clients have introduced financial penalty clauses in case deadlines are missed. And on top of that, there are skill shortages combined with increased competition for land. Yet often, profits are eaten away by practical issues - delays in receiving drawings, use of outdated data, inaccuracies caused by human error. These are compounded by the rise of the global project - where an architect in London is liaising with contractors across Europe to build a new hotel in Dubai, for example.

As a result, the whole of the architecture, engineering and construction industry is looking for

ways to reduce risk and maintain its bottom line. On a day-to-day level it is also struggling with the need to communicate and review project drawings and share proliferating number of associated documents that are usually too large to send by e-mail.

F. Available on-demand

The answer is obviously a project management tool - yet with such a diverse selection of people needing to use it (from planners to plumbers) many on the market are just too enterprise-based and complex to be suitable. Therefore, many in the industry are opting for straightforward online project collaboration tools. Designed to keep projects on schedule and to budget, these tools allow project drawings and other documents to be made available online whenever they are needed, to whoever needs them, wherever they happen to be.

Communication with subcontractors is vastly improved, becoming more instantaneous, reliable and traceable. Integration with design software means builders can easily update and publish drawings and make them available to their subcontractors, resulting in a largely paperless process. The need to share with contractors who do not use Cad is addressed by the use of DWF files, which enable sharing and viewing of 2D and 3D files without their native programs.

An important issue of this part is leveraging IT for strategic advantage. In many sectors business and IT strategies have long been inseparable, while construction is lacking behind. Technology, such as hardware, protocols and data structures cannot be covered in any great detail

III. RESEARCH METHODOLOGY

A. Research Methodology

Research methodology deals with the objective of a research study, the method of defining the research problem, the type of hypothesis formulated the type of data collected, methods used for collecting and analysing data etc. In this study the primary data were collected using questionnaire and direct observation method. The secondary data were compiled from published journals, articles, company web site, annual report and internet.

B. Research Design

Descriptive research design was used for the study. A descriptive research design seeks to determine the bond that exists between variables, that is, to identify how one variable affects the other: it also seeks to provide a clarification to the cause or effects o one or more variables.

C. Target Population

Target population is the units of whatever nature that a researcher indents to study. A population element is therefore the subject on which the measurement is being taken. The population refers to the group of people or study subject who are similar in one or more ways and which forms the subject of the study. The study targeted 30 respondents drawn from the different employees in the construction companies.

D. Sources of Data

Secondary data were collected from company records and web sites and also from journals, books and periodicals etc. and the primary data were compiled from employees in the construction companies through a questionnaire.

IV. DATA FINDINGS AND DISCUSSIONS

A. Profile of the Respondents

The employees of the firm have been put under study to know the result of the study. Questionnaire having different questions relating to the study conducted was prepared and provided to these employees. Most of the questions involved the enquiry with related to the extent of IT usage in construction Project Management. Employees responded to the queries according to their views.

A total of 30 employees had been provided with the questionnaire and their responses have been obtained. As mentioned above a convenience sample was conducted. Thus from the responses of the employees the following analysis has been done with respect to the different area under the study.

B. Respondent's Gender

Table 1: gender composition of respondents
GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	17	56.7	56.7	56.7
	female	13	43.3	43.3	100.0
	total	30	100.0	100.0	

The Table.1 shows that the firm consists of 17 male and 13 female employees;56.7% and 43.3% male and female employees in the firm

C. Employee Category

Table 2: Showing the Category of Employees

Category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ENGINEEER	8	26.7	26.7	26.7
	MANAGER	4	13.3	13.3	40.0
	ARCHITECT	6	20.0	20.0	60.0
	OTHERS	11	36.7	36.7	96.7
	11.00	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

From the above statistics it is clear that the firm consist of 26.7 % Engineers, 13.3 % of Managers,20% of Architects and the rest 36.7 % consist of other employees including administration , purchasing and other internal management out of the total 30 employees

Table 3: IT Impact on Several Areas Due to Computerisation

Correlations

		General admin	design	Project management	Site management	Materials admin	computerisation
General admin	Pearson Correlation	1	-.062	-.034	-.102	-.125	.015
	Sig. (2-tailed)		.745	.856	.590	.512	.936
	N	30	30	30	30	30	30
Design	Pearson Correlation	-.062	1	-.062	-.184	-.020	-.246
	Sig. (2-tailed)	.745		.745	.331	.915	.190
	N	30	30	30	30	30	30
Project management	Pearson Correlation	-.034	-.062	1	-.102	-.125	.015
	Sig. (2-tailed)	.856	.745		.590	.512	.936
	N	30	30	30	30	30	30
Site management	Pearson Correlation	-.102	-.184	-.102	1	.062	.045
	Sig. (2-tailed)	.590	.331	.590		.743	.813
	N	30	30	30	30	30	30
Materials admin	Pearson Correlation	-.125	-.020	-.125	.062	1	.355
	Sig. (2-tailed)	.512	.915	.512	.743		.054
	N	30	30	30	30	30	30
computerisation	Pearson Correlation	.015	-.246	.015	.045	.355	1
	Sig. (2-tailed)	.936	.190	.936	.813	.054	
	N	30	30	30	30	30	30

From the above correlation table it is clear that the general admin ,design, project management, site management, materialization, all are having a significant value greater than .005 which says that the null hypothesis H0 is accepted;

There is a significant relation between the IT impacts on the project management areas in the construction field

Relation between the Designing of the Villas and the Category of Employees in the Firm
Hypothesis
H0: there is a relationship between the designing of villas and the category of employees using IT in the firm
H1: there is no relationship between the designing of villas and the category of employees using IT in the firm

Table 4 : Employee category and designing Anova

Descriptive
design

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
ENGINEEER	9	3.0000	.00000	.00000	3.0000	3.0000	3.00	3.00
MANAGER	14	2.5714	.85163	.22761	2.0797	3.0631	1.00	3.00
ARCHITECT	6	3.0000	.00000	.00000	3.0000	3.0000	3.00	3.00
OTHERS	1	3.0000	.	.	.	.	3.00	3.00
Total	30	2.8000	.61026	.11142	2.5721	3.0279	1.00	3.00

Table 5: Anova

design

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.371	3	.457	1.261	.308
Within Groups	9.429	26	.363		
Total	10.800	29			

From the above table the significant value is greater than .005 so we accept the hypothesis H0; there is relationship between the designing of villas and the category of employees using IT in the firm

Chi-Square Analysis

Hypothesis
H0: there is a significant relationship between the different category of employees and the usage of IT in different areas of construction
H1: there is no significant relationship between the different category of employees and the usage of IT in different areas of construction

Table 6: Chi-Square Analysis
Crosstab

Count

		Materials control			Total
		manual	partially computerised	fully computerised	
CATEGORY	ENGINEEER	3	5	1	9
	MANAGER	7	7	0	14
	ARCHITECT	2	4	0	6
	OTHERS	0	0	1	1
Total		12	16	2	30

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)

Pearson Chi-Square	16.354[a]	6	.012
Likelihood Ratio	9.028	6	.172
Linear-by-Linear Association	.398	1	.528
N of Valid Cases	30		

From the above table it clear that the significant level is .012 which is greater than .005.So we accept the hypothesis H0; there is a significant relationship between the different category of employees and the usage of IT in different areas of construction

Correlation between Client Demand and Usage of IT in the Firm

Hypothesis

H0: there is a significant relationship between the client demands with respect to the computerization of the firm

H1: there is no significant relationship between the client demands with respect to the computerization of the firm

Table 7: Correlation between client demands and IT usage

Correlations

		computerisation	IT in client demands
computerisation	Pearson Correlation	1	.058
	Sig. (2-tailed)		.761
	N	30	30
IT inclined demands	Pearson Correlation	.058	1
	Sig. (2-tailed)	.761	
	N	30	30

From the table the significant value is .761 which is greater than .005.So we accept the null hypothesis H0; there is a significant relationship between the client demand with respect to the computerization of the firm The data obtained from the questionnaire have been analysed and interpreted. The different extent of usage of IT in construction companies has been analysed for their effectiveness. The employee responses to the overall and their interest in IT applications have been analysed and interpreted.

V. CONCLUSION AND SUGGESTIONS

Summary

From the data obtained, the data analysis and interpretations has been conducted. A total of 30 employees' responses have been received and their responses to the various aspects relating to the IT in construction have been interpreted. Those employees of the firm have been queried with the questions from the questionnaire. The pattern of their responses to an extend shows some parity. Some of them were not ready to respond. Otherwise a hassle free study has been conducted. The data obtained have been analysed with different statistical methods and their overall results have been obtained and presented.

Findings

The findings of the study conducted are as follows

- Inside the Information Technology is having a considerable influence in guiding the employees to the right planning
- IT plays a major role in the client demands and responses
- IT have a good visibility and attention.
- A major share of the customers are very happy with respect to the ease of access to their builders
- Payment mode of the majority of the customers is cash so the introduction E-payment was an advantage
- Majority of the employees are satisfied with the overall usage of IT in different areas
- A large majority of the employees is very much willing to fully computerize the firm

Suggestions

The study gives us a clear idea that IT services are very good. The customer –employee relationship can be clustered easily. The recommendations based on the finding of the study are given below:

- Some of the customers are unaware of IT in construction companies. It is imperative that some methods can be adopted to support it.
- Usage of CAD and other agile soft wares could make project more effective
- Fully computerization of the firm should be considered so that it minimizes the time

wastage and make the project management efficiency better.

- Usage of Information Technology among the employees have been increased, so awareness programs should be provided for the employees who are unaware of IT

VI. CONCLUSION

Project management plays a significant role in a variety of industries and fields, such as software development, engineering, construction, marketing, research, IT operations and more. The study was conducted to find the effectiveness of IT in construction Project Management in construction companies. As implied above, an IT project can be any type of project that deals with IT infrastructure, information systems or computer technology. This can include software development activities, such as programming a simple mobile app or a programming large scale software system. IT projects sometimes involve Web development, including updating a web page, creating an online shopping site, or developing an entire Web infrastructure. Other common examples of IT projects include designing an organization's IT infrastructure, deploying systems and software, and employing IT security measures. Considered a more traditional methodology, Waterfall employs a sequential, top-down approach to IT project management with the goal of eliminating risk and uncertainty upfront. As a relatively new methodology for IT project management, Agile has grown in popularity with its change-driven approach that gives IT project teams the dynamic ability to quickly adapt to needed changes or course corrections. Since each IT project management methodology has its advantages, some IT project teams take more of a hybrid approach, using the methodology that makes the most sense for the specific IT project being considered.

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