

The Benefits of Information and Communication Technology Adoption in Construction Project Management for Small and Medium Enterprises

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Abstract - Nowadays Information and communication Technology plays an important role in the construction industry. The day today activities are carried out in the corporate offices and the project sites with the help of Information and communication technological tools and applications. Using the technology enhance communication strategy can help enterprises in the successful delivery of their projects. Currently, there is growing awareness among the enterprises to adopt the information and communication technology but in small and medium enterprises still using the conventional methods for the management of the project and within every phase of the construction. several construction organisations today might perceive that greater use of Information Communication Technology would enhance their performance and may well employ the technology to improve some specific processes of their endeavour, Information and communication Technology usage in most construction firms have often been described as relatively limited and ineffective compared to other sectors. This situation could probably be true for the small and medium enterprises in Pune. With the need for adequate information concerning the construction enterprises Information and communication technology platforms, this research paper on current levels use of Information Communication Technology and identifies the reasons hindering its usage by enterprises. A survey based on structured questionnaire was used to obtain the relevant data from the small and medium enterprises. all forty respondents completed the questionnaire. The data was analyzed using Frequency Analysis, Mean Score method. By doing such study there is a reasonable level of awareness among the enterprises about the potential benefits of Information and Communication Technology.

Key Words: Construction, Information and Communication Technology, Enterprises

1. INTRODUCTION

ICT development has influenced construction industry in the recent decades. New technologies have enabled construction organizations to process and store their information easily and huge amount of data can be transferred quickly. A variety of technology-based approaches have been recently proposed to improve the monitoring of construction materials. Heavy calculations are possible in little time and with high accuracy. Communication technology has provided fast communication tools for construction firms and the time

and costs have been saved by emerging of new ICT tools. Internet acts as an important data base and communication channel. Electronic archive can decrease paper works and improve accuracy and accessibility. However construction organizations face numerous barriers during ICT implementation in their companies. The construction industry facing issues concerning efficiency, productivity and quality in the delivery of its products. Contractors, Project managers, Engineers are blamed for this situation. In recent times, it has been reported that one of the fundamental issues contributing to the construction industries poor performance is ineffective communication and exchange of information and data amongst the project team (Dainty et.al, 2006). As observed in Lofgren (2006), a greater part of the production difficulties in the construction industry has strong relation to the communication and information exchange between the parties involved in the construction project. From the background information presented the importance and emerging roles of information and communication Technology (ICT) to the construction industry cannot be ignored. Now a day's majority of the construction process information and data continue to rely heavily on traditional means of documentation and communications such as face-to-face meetings and exchange of paper documents such as drawings, specifications and site instructions. The traditional information and communication flows within the construction industry are mostly characterize by manual and slow processes and hence,

- Producing numerous paper copies of documents and drawings.
- Management of loose documents is often time-consuming and tedious.
- Library archives of documents need to be maintained to effectively access data as and when required.
- The reliance on third parties, such as courier services, can lead to delays.
- The added expense incurred in the delivery of project documents to project Members who are geographically distributed.

2. LITERATURE REVIEW

ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically. Construction projects involve; clients, consultants, contractors, local authority; residents; workers and suppliers, all with differing interests in the project which demands heavy exchange of data and information. Thus the construction industry is one of the most information-intensive industries, and requires close coordination of a large number of specialized interdependent organizations / individuals to achieve cost, time and quality goals of a project. ICT can be broadly defined as technologies that provide an enabling environment for physical infrastructure and services development of applications for generation, transmission, and processing, storing and disseminating information in all forms. The sustainability of both the high economic growth and efficiency in operations of both private and public institutions, are dependent on the adoption and effective utilization of ICT. Information is a stimulus that has meaning in some context for its receiver while communication is a process whereby information is enclosed in a package and is discretized and imparted by sender to a receiver via a channel/medium. Communication requires that all parties have an area of communicative commonality [1].

Benefits of ICT adoption for managing building projects and improving overall organizational efficiency have been discussed in the literature. Some of the identified benefits are: richer information to aid decision making, project information obtained quicker, improved communication, closer relationships, improved information flow, and greater management control [2].

Table no.1 benefits of ICT adoption

1	Projects completion as per the estimated time.
2	Project completion as per the estimated budget.
3	project completion as per the specifications
4	Life cycle concept becomes a competitive factors
5	Projects information obtained in real time
6	Richer information made available to managers
7	Less time spent in query and approval process
8	Effective change management
9	Reduced risk of errors and rework on projects
10	Effective concurrent construction management
11	A complete log of all communications maintained for tracking purposes
12	Effective material procurement and management
13	Effective contract management
14	"One-Source" documentation archive maintained for clients
15	Client satisfaction
16	Reduced administrative costs of document handling and distribution to multiple parties
17	Project managers spend more time on managerial works

Private projects uses more ICT components than the governmental projects, the following table shows the percentage of ICT components used according the repliers answers.

Table no.2 percentage of ICT used

No.	component type	private Sector replies	% of priv.	Government Sector replies	% of gov.
1	laptop	16	100%	12	75%
2	GPS	6	37%	2	12%
3	GIS	4	25%	1	6%
4	H.D	2	12%	1	6%
5	PDA	4	25%	2	12%
6	Monitoring cam	4	25%	2	12%
7	RFID	1	6%	1	6%
8	WiFi	16	100%	15	90%
9	MS Office	16	100%	16	100%
10	primavera	4	25%	3	18%
11	web based software	2	12%	0	0%

3. RESEARCH METHODOLOGY

A questionnaire survey was conducted to identify current level of usage of ICT and the factors hindering the level of usage in their organizations. The survey utilized a structured questionnaire approach. Based on the fact that questionnaires are the simplest method to collect data from a huge number of respondents, a well-designed questionnaire that is used effectively can gather information on both the overall performance of the test system as well as information on specific components of the system. Besides, if questionnaires include demographic questions on the participants, they can be used to correlate performance and satisfaction with the test system among different groups of users. Survey questionnaires are categorized as quantitative research and this was preferred because, quantitative approaches are deemed more specific and result oriented; and involves the collection of numerical data in order to explain, predict, control phenomena of interest.

4. DATA ANALYSIS

4.1 Details of Response Rate

NO.SENT	NO. RETURNED	RESPONSE RATE (%)
50	40	80%

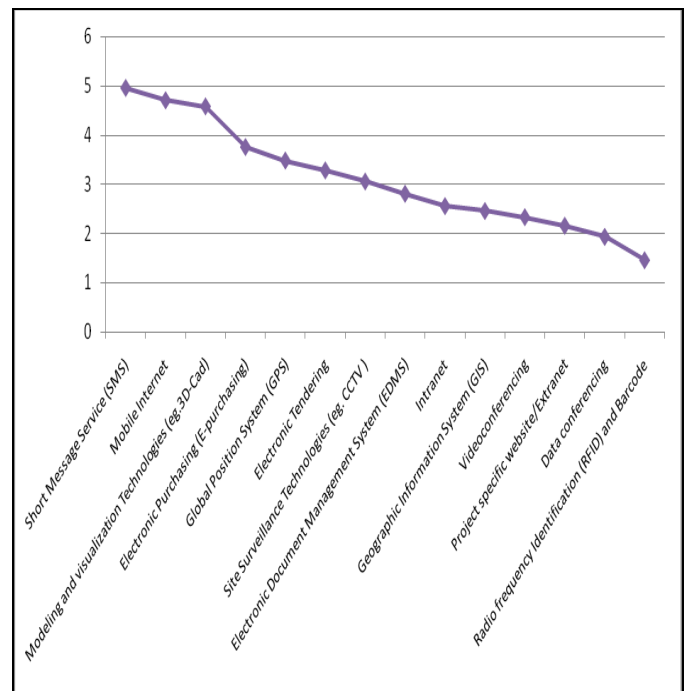
4.2 Level of usage of advanced ICT tools and applications

Table 4.2 below provides a range of ICT tools and application and the mean index score of the level usage. Mean ratings on the level of usage were calculated based on a scale of 1-5 (from "Never" to "always").

Table no 4.2 Level of usage of advanced ICT tools and applications

ICT tools/Applications	Mean	Std.deviation	Ranking
Short Message Service (SMS)	4.95	0.220721428	1
Mobile Internet	4.7	0.91146543	2
Modeling and visualization Technologies (eg.3D-Cad)	4.575	0.902631481	3
Electronic Purchasing (E-purchasing)	3.75	1.720912102	4
Global Position System (GPS)	3.475	1.724447143	5
Electronic Tendering	3.275	1.739252713	6
Site Surveillance Technologies (eg. CCTV)	3.05	1.678674691	7
Electronic Document Management System (EDMS)	2.8	1.842517787	8
Intranet	2.55	1.796720659	9
Geographic	2.45	1.63220788	10

Information System (GIS)			
Videoconferencing	2.325	1.730384573	11
Project specific website/Extranet	2.15	1.369072304	12
Data conferencing	1.925	1.047279749	13
Radio frequency Identification (RFID) and Barcode	1.45	1.175606772	14
Average Mean	3.101786		



By considering usage the range of emerging ICT technologies; the study revealed that current level of usage by the firms was largely below average (Average mean score of 3.101). According to the data, the most prominent ICT application in used was short message Service (mean=4.95),mobile internet (mean=4.7), Modeling and visualization Technologies (mean=4.575),Electronic Purchasing (E-purchasing) (mean=3.75),Global Position System (GPS) (mean=3.475),Electronic Tendering (mean=3.27). Apart from these technologies which were significantly above average, data analysis revealed that the firms usage of other ICT tools and applications are generally

deficient. For instance, usage of applications such as Site Surveillance Technologies (e.g. CCTV) (mean=3.05), Electronic Document management systems (EDMS) (mean=2.28), Intranet (mean=2.55), Geographic Information System (GIS) (mean= 2.45) were found to be very inadequate and below test level of 3.0. Besides, other tools and applications such as Videoconferencing (mean =2.325), Project specific website/Extranet (mean=2.15), Data conferencing (mean=1.925) and Radio frequency Identification (RFID) / Barcodes (mean=1.45) were basically not used.

4.3 Analysis of factors hindering use of ICT by the firms

for analysing the factors hindering the use of ICT the mean score method was used to obtain the most important reasons which affecting the use of ICT in the small and medium enterprises.

Table no.4.3 Analysis of factors hindering use of ICT by the firms

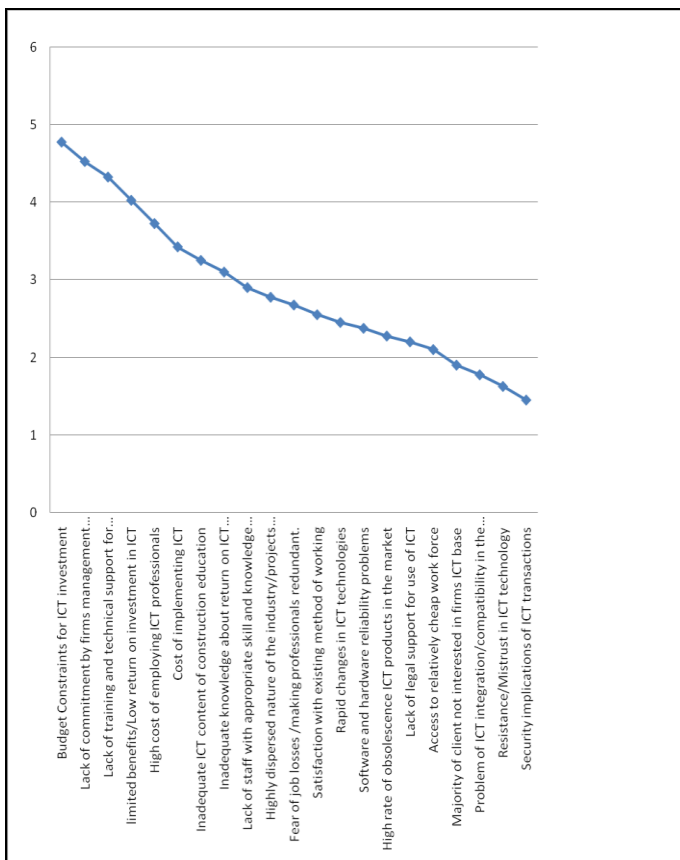
factors	Mean	Std.deviation	Ranking
Budget Constraints for ICT investment	4.775	0.800240349	1
Lack of commitment by firms management towards ICT	4.525	0.715667162	2
Lack of training and technical support for professionals in ICT	4.325	1.141018438	3
limited benefits/Low return on investment in ICT	4.025	1.476091513	4
High cost of employing ICT professionals	3.725	1.739252713	5
Cost of implementing ICT	3.425	1.599479082	6
Inadequate ICT content of construction education	3.25	1.850155919	7

Inadequate knowledge about return on ICT investment	3.1	1.661016062	8
Lack of staff with appropriate skill and knowledge in ICT	2.9	1.706698718	9
Highly dispersed nature of the industry/projects & participants	2.775	1.804375025	10
Fear of job losses /making professionals redundant.	2.675	1.384668802	11
Satisfaction with existing method of working	2.55	1.663329993	12
Rapid changes in ICT technologies	2.45	1.466724941	13
Software and hardware reliability problems	2.375	1.56381355	14
High rate of obsolescence ICT products in the market	2.275	1.484751555	15
Lack of legal support for use of ICT	2.2	1.017790468	16
Access to relatively cheap work force	2.1	1.464100319	17
Majority of client not interested in firms ICT base	1.9	1.236205941	18
Problem of ICT integration/compatibility in the organization	1.775	1.073873888	19
Resistance/Mistrust	1.625	0.97894501	20

in ICT technology			
Security implications of ICT transactions	1.45	0.875595036	21
Average mean	2.866 67		

Notwithstanding the importance of these factors however, Table 4.1.12 revealed that the most significant ones among them as reasons hindering the use of ICT by the small and medium enterprises are:

1. Budget constraints for ICT investments.
2. Lack of commitment by firm's management towards ICT.
3. Lack of training and technical support for professionals in ICT.
4. Limited benefits/Low return on investment in ICT.
5. High cost of employing ICT professionals.
6. Cost of implementing ICT.
7. Inadequate ICT content of construction education.
8. Inadequate knowledge about return on ICT investment
9. Lack of staff with appropriate skill and knowledge in ICT.



5. CONCLUSION

Digitization of business activities associated with resource planning and scheduling, Bookkeeping and accounting, payroll, communication and distribution of documents (e-mail), Technical calculations, Costing and Budgeting; Resource management (labour, Plant and Materials), Project Cost Control by the firms were very encouraging. Though majority of firms were deficient in the use of most advanced ICT tools and applications, the trend is that mobile internet applications and Short Message Services (SMS) through the use of mobile phones were significantly gaining adequate level of usage. As a whole, there appears to be a high level of optimism among the firms that more advanced ICT applications such as Electronic Purchasing, Project Specific Websites, Electronic Tendering, Videoconferencing and intranets applications could gain some patronage in the near future if the necessary awareness is created. Finally, it is notable to recognize from this survey that, the most significant factors affecting the use of ICT by small and medium enterprises are: Budget constraints for ICT investments, Lack of commitment by firm's management towards ICT, Lack of training and technical support for professionals in ICT, Limited benefits/Low return on investment in ICT, High cost of employing ICT professionals, Cost of implementing ICT, Inadequate ICT content of construction education, Inadequate knowledge about return

on ICT investment, Lack of staff with appropriate skill and knowledge in ICT.

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