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COMPUTER APPLICATIONS IN ARCHITECTURE: A PILOT SURVEY OF THE USAGE IN EGYPT

ABSTRACT

This paper is the second among a series that explores computer and information technology (IT) applications in architecture. The goal of this paper is to investigate the usage in Egypt of the various computer and IT applications in architecture. The aim is to understand the points of strength in the Egyptian practices and the points of weakness and thus contribute in finding the solutions. To do so a pilot survey was performed on a number of Egyptian practices. The questionnaire objectives can be summarized as follows:

- Identify the purposes for which the industry now uses IT facilities, and the extent of such use.
- Identify the type of computer and IT facilities used within the surveyed organizations.
- Identify the barriers that prevent the industry from better using existing IT facilities.
- Identify the perceived benefits of using IT within the surveyed organizations work flow, and exploring the work processes affected due to such use.

In order to better understand the survey results, they were compared to a similar survey that was performed in Canada.

The study closes with the conclusions and directions for

further research. Among the findings of this study were that the usage of computers and information technology in the Egyptian architectural practices seemed to be biased towards: 1) getting good-looking drawings and documents and 2) towards controlling costs. The usage does not seem to be oriented towards improving the quality of buildings. Some directions for the solution of this problem are suggested.

KEYWORDS: architecture, computers, information technology, applications, survey, questionnaire, usage, practice, Egypt

INTRODUCTION

Problem, Goal and objectives, the concept of pilot survey

Information technology represents a paradigm shift with respect to the transfer and management of information. This shift has come about recently and has occurred very quickly. In order to see how IT has affected the organizations working in the architectural and construction sector, this part first reviews the findings of a survey that was held in Canada in 1999 and whose findings were published in the year 2000 by Rivard[16]. The survey was concerned about the current and planned use of information technology (IT) and its impact on the architecture, engineering, and construction (AEC) industry in Canada.

According to the Canadian survey results presented by Rivard[16], it was found that many business processes are now almost completely computerized and the tendency is toward a greater computerization of the remaining processes. Although the Internet has been adopted by most firms surveyed, design information is still exchanged in its traditional form. These firms have increased and will increase further their investment in IT, which has raised productivity in most business processes and has resulted in an increase in the quality of documents and in the speed of work, better financial controls and communications, and simpler access to common data. The firms of most respondents have adopted the Internet and are now using e-mails and the World-Wide Web. The remaining firms will predictably adopt this new technology in the coming years if not months. All the surveyed firms

even have a presence on the Web. Although IT has been adopted by most of the surveyed firms, because it provides quick and efficient means of exchanging information digitally, the majority of the surveyed companies still exchange design information by means of paper drawings and specifications as they used to do prior to the advent of computers.

On the other hand the complexity of work, the administrative needs and the costs of doing business have all increased. The continual demand for upgrading and the greater know-how required are considered important obstacles according to Rivard[16]. The two most important areas of future research are the implementation of computer-integrated design and construction as well as the development of new tools to support concurrent design and to assist designers in the conceptual stages.

The Pilot Survey

This study examines a number of Egyptian and international organizations looking at the differences in resources and IT tools available within these practices. It focuses on the findings of a questionnaire on the practices' general profile, their computer and IT profiles, their particular applications of technology and the way the practice works. Finally the effect of computer and IT tools on the profitability and cost reduction of their practices is introduced. The results only provide an insight into the particular current patterns in IT applications, and planned use of computer-based and telecommunication technologies within the architectural and construction practices. Thus the questionnaire objectives can be summarized as follows:

- Identify the purposes for which the industry now uses IT facilities, and the extent of such use.
- Identify the type of IT facilities used within the surveyed organizations.

- Identify the barriers that prevent the industry from better using existing IT facilities.
- Identify the perceived benefits of using IT within the surveyed organizations work flow, and exploring the work processes affected due to such use.

The questionnaire used in this study is a slightly modified version of a questionnaire conducted in Canada to measure the computers and IT usage in the building and construction industry. The setup of the questionnaire includes categories covering most of the details relevant to IT application usage within the architectural and construction practices. The questionnaire explores the following items within the surveyed organizations:

(a) IT applications for office management like databases, specification writing, e.g. Microsoft Office for text manipulation, letter-writing, report-writing, standard forms, databases and specifications. Other software used for accounting, time sheets spreadsheet, project management, and graphics manipulation, were also explored.

(b) IT applications for drawing, modeling, and visualization for all aspects of work, e.g. all working drawings, 3D modeling, animations, presentation plotting. The main emphasis is to show that CAD is more than AutoCAD but relates to the description of the practice's complex process as an idea is developed from concepts to sketches to 2D to 3D production information and/or rendering and video for client presentation.

(c) IT applications for Networks and Internet-Collaboration, i.e. hardware types, type of network, and links with other offices or consultants as members of the project/design team. The nature of integration with the client and other professionals was also discussed.

(d) IT training within the practice, i.e. the nature of training, help desk and trouble-shooting provisions, e.g. whether this is through in-house using experienced users, vendor support or consultancy.

The Information presented about the international case studies are based on interviews and questionnaires made by Phiri[15] within the presented companies, in addition to updated information that was extracted from the companies websites.
Consideration of the case study organizations is not done on the basis of prioritization, but in alphabetical order to reflect different design practices and strategies. The study methods include the following:

- Interviews with principals (and staff where relevant) about the firm as a whole.
- Practice profile and marketing information made available by the organization or from the Internet location.
- Selected projects identified with the co-operation of the case study organization.

The interviews were based on a framework of questions that were designed to understand both technological and non-technological issues. However, this was not a conventional survey with an intention to analyze quantifiable data. The intention was to get a qualitative view based on the experience of the interviewees. Because of this, interviews usually took the form of discussions and frequently moved into areas that the framework had never anticipated. The result was that much more information became available and it was possible to modify and improve the framework as more interviews were conducted. Because of the approach taken, there are known limitations to the survey:

1. It is not possible to analyze the results of the survey with the objective of identifying quantifiable data. Any quantified benefits that are mentioned in the results are opinions of particular persons interviewed.
2. The number of organizations interviewed is not sufficiently large for results to be treated as having statistical significance.

No attempt is made to suggest that the local firms represent a statistically relevant sample thus the survey results can not be regarded as representative of the whole practices working in that field in Egypt. The firms selected for that questionnaire were not randomly chosen, they were selected on the basis of knowledge of the firms, the respect

that they command within the architectural and construction professions and the likelihood that their histories would shed some light on how IT changes have taken place and have affected their processes.

RESULTS OF THE PILOT SURVEY

The survey results showed that there are commonly used applications in both the Egyptian and international organizations. Table 1 shows that IT applications concerned with word processing, spreadsheets, graphics manipulation, image processing, computer aided drafting, and project management are often used within the surveyed Egyptian and international firms. IT applications that are not commonly used within Egyptian firms are those related to the building performance evaluation, computer aided lighting and acoustics design, geographic information systems, database management systems, electronic document management systems automated specifications writing, in addition to project extranets solutions which are occasionally used by Egyptian companies.

The impact of computer applications implementation in Architecture appeared to be profound in terms of better information management and exchange, effective communication and project collaboration, time savings, reduced waste and overall productivity.

Table 1: A comparison between the IT applications of interest to the Egyptian firms and the international ones (modified from Abd-Allah[1])

Application Type	Egyptian Offices					International Offices				
	Availability					Availability				
	None	Seldom	Half	Often	Always	None	Seldom	Half	Often	Always
Office and Job Management										
Word Processing					√					√
Spreadsheets					√					√
Graphics Manipulation				√						√
Project and Construction Management				√					√	
Financial Accounting Systems				√						√
Appointment Schedulers		√							√	
Database Management Systems		√						√		
Computer Aided Facilities Management	√						√			
Automated Specification Writing	√								√	
Electronic-Document Management Systems	√								√	
Drawing, Modeling and Visualization										
Computer Drafting					√					√
Computer Modeling			√							√
Virtual Reality		√							√	
Design Analysis and Evaluation										
Solar Radiation and Shading Simulation		√								√
Lighting Simulation Analysis		√							√	
Acoustic Simulation Analysis		√							√	
Geographic Information Systems		√							√	
Networks and Internet-Collaboration										
Network availability					√					√
Permanent Internet Access		√							√	
Intranet		√							√	
Project Extranets (Project Collaboration Websites)		√							√	
Extranet	√							√		

The survey also shows how information technology has changed the architectural practice. Results in Table 2, show that the impact had been both advantageous and disadvantageous. Among the advantages are the decrease in the number of mistakes in documentation, the number of construction errors has not changed or has lowered, and the quality of documents and the speed of work have both increased. Among the disadvantages are the increases in: the complexity of work, the administrative needs, and the costs of doing business. The benefits of information technology come at a cost.

Table 2: Changes caused by the introduction of information technology in the architectural and construction processes (Abd-Allah[1])

Affected Processes	**Egyptian Offices (%)**			
	Information Technology Effect			
	Reduced	No difference	Increased	Do not know
Document quality (more is better)		25	75	
Speed of work (more is better)			100	
Mistakes in documents	75	25		
Construction errors	50	25		25
Degree of difficulty		50	50	
Complexity of work		25	75	
Administrative needs		25	75	
Costs of doing Business		25	75	

The main benefits achieved by the adoption of IT within the surveyed Egyptian firms are shown in Table 3. The main advantages perceived

due to the use of IT are, better quality work, work done more quickly, information and experience sharing, better financial control, team distribution, better communications and simpler and faster access to common data according to the respondents. Less use of paper work and the possibility to reduce staff were not selected by any of the respondents as being potential benefits.

Table 3: Benefits of information technology as perceived by the surveyed Egyptian firms (Abd-Allah[1])

Benefits of Information Technology	**Egyptian Offices (%)**				
	0	25	50	75	100
Better quality of work					√
Information and experiences Sharing					√
Faster and simpler access to information				√	
Great flexibility to satisfy customers				√	
Better financial control				√	
Work done more quickly				√	
Better communications between project members			√		
Team distribution			√		
Possibility of reducing staff	√				
Less use of paper work	√				

Obstacles to greater use of IT within the surveyed Egyptian firms are summarizes in Table 4. These can be grouped in four categories:

- First degree obstacles; these are the too high investments costs and, the risk that IT investment leads to inefficiency.
- Second degree obstacles; these are the continual demand for upgrading hardware and software, the difficulty to estimate the

benefits of IT investments, greater know-how required from the staff and lack of standards and coordination problems.

- Third degree obstacles; these include the lack of commitment from management, the belief that old ways work well, the fear of reduced security especially when dealing with internet applications and finally, because decision-makers have no time for IT efforts.

Table 4: Obstacles to a greater use of information technology as perceived by the surveyed Egyptian firms (Abd-Allah[1])

Obstacles to greater use of Information Technology	**Egyptian Offices (%)**				
	0	25	50	75	100
Investment costs too high					√
Risk that IT leads to inefficiency					√
Continual demand for upgrading				√	
Greater know-how required from staff				√	
Difficulty in assessing investments				√	
Lack of standards and coordination problems				√	
Lack of commitment from management			√		
The old ways work well			√		
Decision-makers have no time for IT efforts			√		
Reduced security		√			

One of the major problems concerning IT implementation within the Egyptian firms, is that these firms tend to be risk avert and prefers to adopt a technology that has been proven. This reflects the certainty that

technological improvement in this field is usually driven by necessity rather than by the need to be at the cutting edge and this makes it little slower in adopting IT than other fields.

The survey also identified some of the reasons for adopting IT within the surveyed organizations (with regard to the organization priorities and policies).The drivers for investing in computer applications and IT within these organizations can be summarized as follows:

- Project requirements, e.g. complexity; especially when projects are characterized by the absence of traditional building blocks of beams and columns, examination of options, time and resources constraints.
- Increasing workload generally.
- Increasing affordability of IT with the continuous development of new technologies.
- Keep abreast of market developments, in addition to keeping up with the latest releases of products.
- Client requirements and expectations, e.g. a firm of a certain size is expected to have advanced CAD capabilities, visualization and animation tools, project management and scheduling abilities and opportunities to explore alternative design solutions.
- Pressures to maintain a competitive business advantage and the need to find a route to 'world class performance' in order to maintain active superior levels of customer service.
- The need for improved time flexibility, improved management, control and reporting especially with the increase of distributed teams environments within the AEC offices.
- Office requirements and Staff expectations.

CONCLUSION

1- **B**y analyzing the survey that was carried out to sense the usage of computing and information technology in Egypt, we can see that the usage of computers and information technology in

Egyptian architectural practices seems to be biased towards: 1) getting good-looking drawings and documents and 2) towards controlling costs. The usage does not seem to be oriented towards improving the quality of buildings. This is evident in that the products that are used by 50% or more of the participants in the survey are word processors, graphics, computer aided drafting and 3D modeling. The only exceptions are project management (as it ultimately saves money) and financial accounting systems (as they control money)

2- **This bias towards the looks over the quality** is not good and should change. The same bias is slightly evident in the international practices (however, the usage rate is much higher there.
3- **A survey about the changes that information technology has done** to the architectural practice in Egypt shows that the impact has advantaged and disadvantages. However, since there is no firm that has reverted to manual practice, the impact should be assumed generally positive.
4- By analyzing the Egyptian **survey of the obstacles to greater use** of information technology in architectural firms, we can see that the roots of most of the obstacles can be summarized in 1) the cost, 2) the culture and 3) the lack of knowledge.
5- **One possible solution for the high costs problem**, in Egypt, is by the adoption of the application service provider (ASP) model. The ASP model reduces startup and running expenses in most practices.
6- **The cultural problem is the most difficult to solve**, however, lectures promoting best practices and success stories, books, magazine articles and research papers, should all reduce the problem.
7- **The "lack of knowledge" problem**, in Egypt, should be solved in the same manner as the cultural problem and also by promoting information technology and computer training specialized for architects. The role of education is also greatly emphasized.

8- **The lack of adoption of electronic means for sending documents** and drawings, in Egypt, is one of the problems that the survey showed. Survey participants send their drawings and documents in a printed format to other parties. This is mainly because of legal reasons. However, this problem should be solved gradually with the take off of the e-government project in Egypt. With the completion of the legal framework and as more and more firms will have digital signatures, networks should become the main mean of sending construction documents.

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