

The Evolution in Design Process with Software Packages

A Case Study of Hyderabad and Karachi

¹Irum Arisar, ²Dr. Bhai Khan Shar, ³Sabeen Shah

^{1,3}Department of Architecture, Mehran U.E.T. Jamshoro, Sindh, 76062, Pakistan

²Centre of Excellence in Art and Design, Mehran U.E.T. Jamshoro, Sindh, 76062, Pakistan

Abstract - Architectural tools play an important part in the solving design issues. The best way to represent a designer's imagination in a concrete reality is by using drawing techniques. With changes occurring in the field of technology and design the use of drawing tools has also evolved and improved. Although digital tools replaced conventional drawing tools that were used in the past, the influx of computer technology in architectural design has had a profound influence on how buildings are planned and constructed. The widespread use of digital technology (IT) transformations at this stage introduced technologies that encourage the development in architectural designs and manufacturing techniques for reasons other than necessity, and their impact on architecture is still widely undefined. Many new software applications for digital models with Building and Modeling Knowledge have launched in recent years been used for model developing and 2D drawings as well. This study aims to analyses the characteristics and nature of design process and how it is evolved from beginning through organic approach till now with the advent of software packages, by doing so it will highlight the comparison of conventional and modern tools and the impact of software tools on architects and design, the advantages of utilizing software tools in the field of architecture.

Keywords: Design process, Evolution, Architectural design tools, Software packages, Vernacular, Digital tools, Architect, Computer technology, Architectural firms.

I. INTRODUCTION

Man began to make drawings and models to investigate geometric patterns over period. It was here that architectural innovation took the first steps. To make sketches and models, various tools were used and changed over time. At this point, the simulation and construction processes were separated from the ideation and development processes. Without having to create it, the architect conceived and conceptualized his idea, making complex digital environment manipulations. Architectural design is the practice of designing spaces for

humans to live in, spaces that form their lifestyles. The design process is among experimentation and discovery, convergence and practice. It entails something more than just playing with volumes and geometry. Architectural tools and strategies have significantly evolved over time there was architecture before architects, but no design style as we know it. It was a hands-on exercise in which ideation, conception, and production were all put to the test.

With the influx of the digital era, computers were initially used to assist with the work of the design process, to enable architect complete design the work process more efficiently. With the introduction of algorithms and their use to produce design by computer, a fundamental change occurred. It was at this stage that an effort made to externalize the design process, and the design methodology's framework totally altered. This method of conceiving and laying out the goal (developing the algorithm) is separate from the process of conceptualizing the design (which is done by the computer) and the simulation and construction process. The progression of design methods and tools has a major influence on the form of architecture that is created. As a result, understanding design practice is critical to comprehending the forces that drive our architecture. In addition, there has been a significant shift in how architects across the world approach architecture problems. The importance of the architect began to change as the computer began to play an important role in the design process, which was traditionally carried out exclusively by the architect. Some people were critical of technology interference, although others had strong hopes for it. This paper identifies change in design process due to the digital technology and providing stance for its importance with the rational approach and technical reasoning

1.1 Traditional Drawing Tools

The drawings are classified into three parts: design diagrams, rough plan drawings, and detailed drawings. Tools involve, pencil, eraser, paper, ruler, T scale, set square, different tracing sheets, simple and geometric templates, glass, sketch sheet, snake ruler, roll copy paper, presentation sheet,

curved ruler, and scrapper are among the drawing instruments. All of these techniques take a great deal of focus and experience to use effectively (Mitton, 2003) During the Renaissance period, the job of the architects was split up into different parts between 1400 and 1500 AD. Architects started to produce scale models to render architectural plans outside of the building field during the late Renaissance era. The following are examples of 'Conventional Expression Techniques' created using 2d drawing methods (Yldrm et al. (2010):

- 2D drawings on paper
- 3D drawings: Views
- 3D models: models

1.2 Traditional Design Method

Paintings and sketches were an important part of the architectural method for decades after the Renaissance. The architects also designed their own sketches and draughts, parts and elevations to interact with the designers on paper and explored them as crafted models. Designs and templates were the major design tools until the modern revolution broke out for the longest time.

i. Beginning

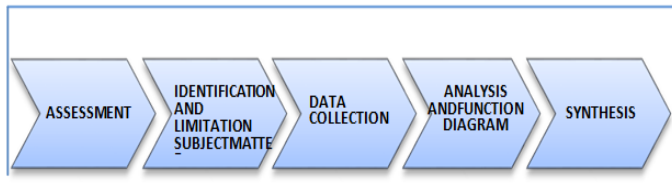


Figure 1: Nature of Design Process in the History

ii. Middle

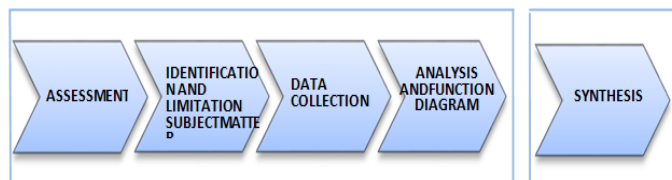


Figure 2: Nature of Design Process in the Middle Era

iii. Now



Figure 3: Nature of Design Process Now

1.3 Design and Design Process

Architecture design is a method of constructing space for objects in order to build areas that serve people not just as a functional but also as a type of form. The typical design process steps include 5 phases:

- Pre-design phase
- Schematic design
- Design Development phase
- Construction drawings
- Construction Administration

1.3.1 Key Elements of Design Process

The key factors of the design phase are function, location, and form in combination. They are the most important contributing factors that direct the design process in any architectural challenge. On the premises of the architect's design world, the designing process occurs. Project activities are addressed by both designers from their design environments, which are following two:

- In-Depth Understanding (what he or she knows)
- Processing skills (what he or she does?)

1.4 Changes in the Architectural Design Process Caused by the Introduction of Computers

For decades almost all designs were done with pencils on paper until introduction of CAD, small modifications required erasing, deleting, and redrawing, while big changes necessitated whole new drawings. These procedures have an effect on the architect's pace during the design process. The computer, by speeding up drawing time, often increases the time set aside for design and makes it easier to make adjustments to the drawing. Dr. Partrick Hanratty, who invented PRONTO, the 1st professional numerically controlled credited with the development of CAD (Computer - aided Design) drafting. As a result, in 1960, Ivan Sutherland developed SKETCHPAD, world's first CAD program, demonstrating the fundamental concepts and feasibility of computerized scientific drawing. Programming language and 1st professional CAM software platform in 1957, is (Expression Strategies' created with CAD drawing software (Yldrm et al. 2010).

- Drawings in 2D form includes plan, elevation, section
- 3D forms or models views
- Animation and graphics

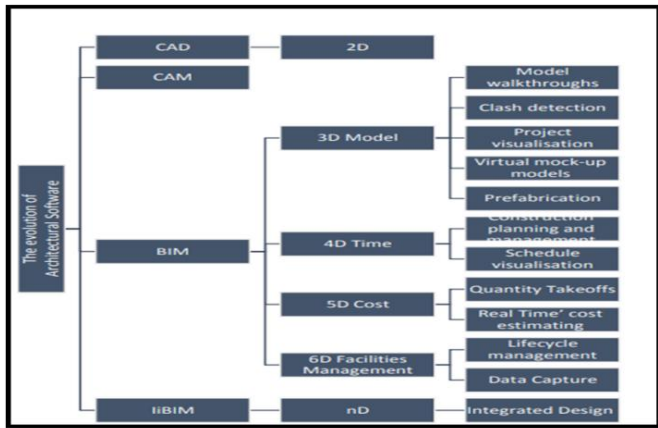


Figure 4: Evolution of architectural software (Aliabadi, M., Mohammad, S. and Mirsharafi, R., 2013)

(www.autodesk.com), ArchiCAD (www.graphisoft.com), and Micro station Triforma are the most common software programs in this group (www.bentley.com). Bentley is now working on Generative Elements, a parametric program for architects that could describe complex constraints after constructing object's geometry, its structure and laws that determine the constraints given as a second step (Greetham, 2002; Aish, 2000).

1.4.3 Building information model (BIM)

Theoretical advances in BIM indicate that it helps with project management and environmental design architecture in addition to surface models of a structure's performance. BIM and environmental design are transforming how architects dream of their work. The BIM modelling method now has biggest effect on constructions therefore can be effectively extended to sustainable architecture, according to BIM science digital tools and fabrication's architectural opportunities, including a classification of all the various technology and methods that are already firmly impressing modern architecture and process.

1.4.1 3D Modeling Through Cad

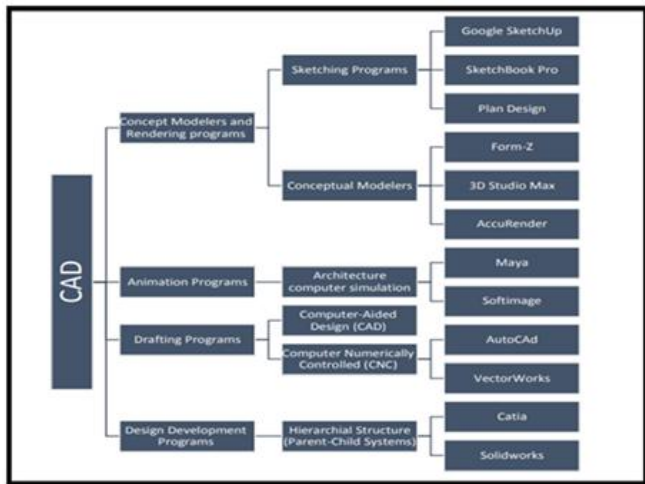


Figure 5: 3d Modelling Emergence Through Cad (aliabadi, m., mohammad, s. And mirsharafi, r., 2013)

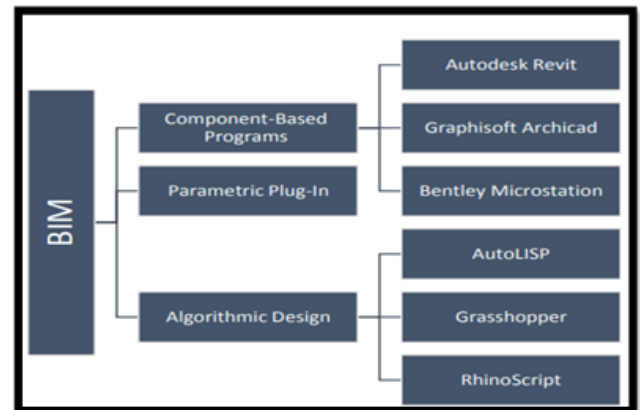


Figure 6: BIM Evolution hart (Aliabadi, M., Mohammad, S. and Mirsharafi, R., 2013)

Modeling software used in architecture fall under second kind (design, modeling, representation and the production of models and building elements). It could be a small version of animation programmed in some cases. 3D VIZ, restricted edition of 3ds Max (www.discreet.com), Sketch Up (http://www.sketchup.com), and Rhino (http://www.rhino3d.com/) are examples of commercial applications in this general.

1.4.2 Parametric Applications

This programme took a different tack, recommending a solution that addressed both 3-D modelling and 2-D documentation requirements. The plans and parts of this programme are derived from the same 3-D model. This style of architecture is also known as "one-model design" or "one-model construction." Documentation methods such as measurement and document are used in the software. Architectural Desktop (ADT) (www.autodesk.com), Revit

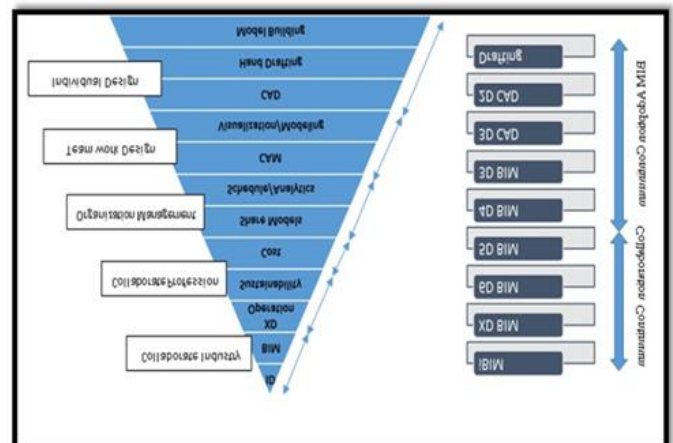


Figure 7: BIM Maturity Graph (Aliabadi, M., Mohammad, S. and Mirsharafi, R., 2013)

II. RESEARCH METHOD

The consolidated research technique and reenactment on the off chance that reviews are utilized as a part of the research. This Paper is an endeavor to survey the transformation in the design process by focusing on how design methods have changed from past until now since architects have been using software packages.

Quantities of researches related to the current study were assessed before going any step ahead; all the papers were taken under consideration by taking related data and statistics in order to solidify the study along with highlighting the aspects of impact of architectural software packages on architects as well as on success and growth of firms. In person and telephonic Semi structured interviews conducted from Architects, Civil engineers, draftsmen, visual designers of Hyderabad and Karachi. Questionnaires were then prepared by considering all those factors and features. Questionnaires were filled up online mostly by Architects, Civil engineers, Students and other professional designers.

III. DATACOLLECTION

The survey information with regards to finding out the transition in design through software tools is collected through of preliminary survey and observation, semi- structured interview and questionnaire survey from architects, engineers, builders of Hyderabad and Karachi.

The necessary data is collected through quantitative data, technique to examine massive transformation in design process and comparison of use of both tools, the qualitative however is conducted to explore the awareness of latest software tools by comparing with traditional tools, and advantages and disadvantages of both methods in the field of architecture

IV. METHOD OF DATA ANALYSIS

Various methods can be employed for qualitative and quantitative analysis, for this research, SPSS version 22.0 was used to survey the information to obtain the objectives of the research. To attain objective of this research, SPSS version 22.0 was used to observe the respective transformation due of evolutionary tools in the field of architectural design.

The surveys orchestrated in the arrangement and the information was placed in the SPSS programming for data investigation. It was classified presenting to the examination questions and the exact consequences of the exploration were made appropriately.

V. RESULTS AND DISCUSSION

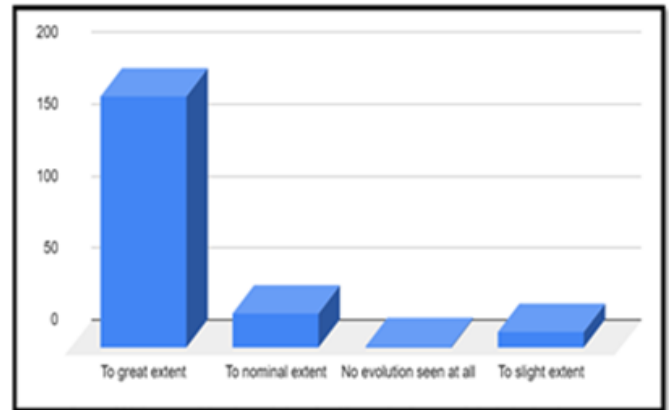


Figure 8: Demographic result of degree of Evolution of Software Tools

Through results from questionnaire and surveys it is found that the evolution is seen to a great extent, many of the firms are availing these digital platforms for the productivity and success, the disparity between old methods and new methods is also up to the a mark in terms of impact on structure, its elements, vernacular architecture etc.

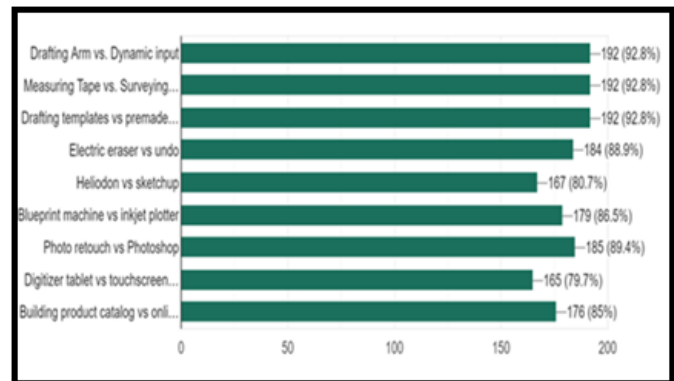


Figure 9: Replacement of Manual Tools to Digital Tools

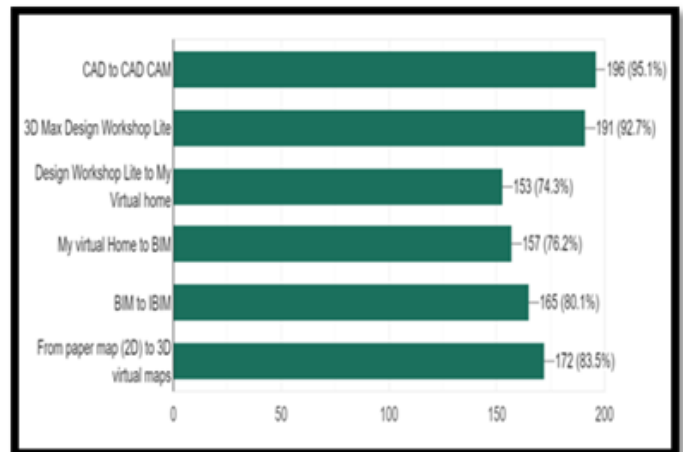


Figure 10: Revolution in Software Packages

The remarkable transformation is seen in the form of AR AND VR software, while modern BIM applications like ARCHICAD and Revit achieved advancement to a high degree of complexity, their emphasis on a conventional document-based design framework prevents the exploratory approach to design" Further, findings show that workload is saved 30%-40-% now as compared to conventional tools, calculations and material value determining became easy and handy, communication level is improved, and responsibility is increased since software provides accurate and precise results.

Digital production and integrated design enabled to reinterpret traditional crafts and building technology. The new concept of digital morphogenesis has the same existing approach of vernacular architecture, a sequence of developments and adjustments through the ages to get the optimal outcome under local conditions (structural, cultural, and environmental). It is in the manner where the material is treated and handled using traditional crafts that "transfer the material into material system technologies. Detail is increased however more in a contemporary way yet architects are facilitated by it regardless of conventional methods of detail and aesthetic like carved wooden windows, doors, the column detail and design approach is almost vanished, many software are introduced as substitute like CNC machine in order to imitate these aesthetic motifs, but this entire process has affected organic sense of creativity and knowledge of architect as seen in table 1. From surveys of firms it was revealed that the projects have become easy to assign since the software packages allow design process to be executed more efficiently and smartly. Be it initiating, documentation, and communication with the clients, implementation and so on, hence success and growth rate of organizations also increased. It has also found that a few firms still follow the old methods reason is less resources and also to sustain the traditional methods. In a nutshell it can be said that software played a huge role in transforming the design process completely with more advantages than disadvantage but the old methods should not be omitted.

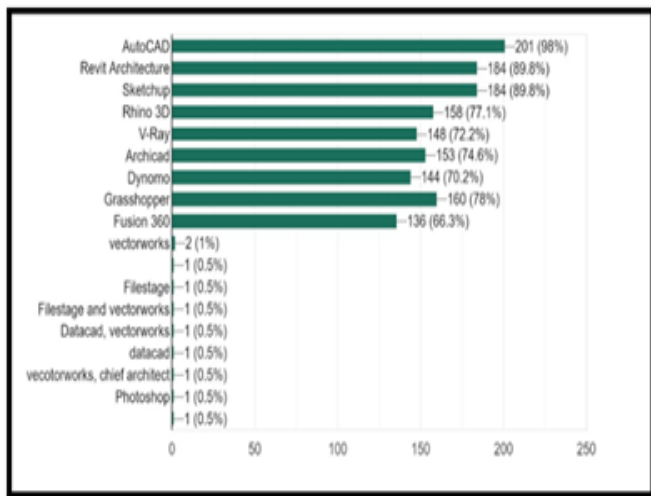


Figure 11: Software Packages Used in Architectural Design

Table 1: Data collection from questionnaire survey

Questions	Agree			Neutral			Disagree			Total	
	Score	%age	Rank	Score	%age	Rank	Score	%age	Rank	Score	%age
There is need to revitalize the old methods of designing.	1.04	48.1	1 st	0.35	16.2	3 rd	0.77	35.6	2 nd	2.16	100
Software packages increased the detailing of architectural drawings	1.86	86.1	1 st	0.28	13	2 nd	0.02	0.9	3 rd	2.16	100
Software has helped in designing views efficiently rather than designing different views in manual drafting each time.	2.01	93.1	1 st	0.15	6.9	2 nd	0	0	3 rd	2.16	100
Transformation of data creation from drafting tables to high-end computers running augmented reality software	1.82	84.3	1 st	0.29	13.4	2 nd	0.05	2.3	3 rd	2.16	100
Transformation of data visualization from design boards to virtual reality rooms	1.85	85.6	1 st	0.28	13	2 nd	0.03	1.4	3 rd	2.16	100
Data storage from boxes full of paper to servers full of digital files.	1.84	85.2	1 st	0.28	13	2 nd	0.04	1.9	3 rd	2.16	100
Impact of digital architecture on vernacular architecture is significant?	1.96	90.7	1 st	0.16	7.4	2 nd	0.04	1.9	3 rd	2.16	100
The dependency on software affected an architect's substantive knowledge	1.88	87	1 st	0.22	10.2	2 nd	0.06	2.8	3 rd	2.16	100
The dependency on software affected the sense of creativity of an architect ?	1.86	86.1	1 st	0.2	9.3	2 nd	0.1	4.6	3 rd	2.16	100
Software challenged the level of knowledgeability of highly educated, experienced and skilled architect v/s less educated, less experienced and less skilled architect	1.84	85.2	1 st	0.26	12	2 nd	0.06	2.8	3 rd	2.16	100
There are more Advantages than the disadvantages of software in the field of architecture	1.92	88.9	1 st	0.17	7.9	2 nd	0.07	3.2	3 rd	2.16	100
There are more advantages of designing on software tools than using manual tools.	1.9	88	1 st	0.19	8.8	2 nd	0.07	3.2	3 rd	2.16	100
There is a difference b/w old/traditional architecture and contemporary architecture since the digital approach is efficiently taking over.	1.92	88.9	1 st	0.17	7.9	2 nd	0.07	3.2	3 rd	2.16	100
The utilization of software completely shifted design parameter from traditional to modern	1.93	89.4	1 st	0.22	10.2	2 nd	0.01	0.5	3 rd	2.16	100
Do you think that there is a great impact of software tools on the productivity of architects?	1.97	91.2	1 st	0.17	7.9	2 nd	0.02	0.9	3 rd	2.16	100
The approach towards software tools has enhanced the opportunities of growth and success for firms.	1.96	90.7	1 st	0.09	4.2	3 rd	0.11	5.1	2 nd	2.16	100

VI. CONCLUSION AND FUTURE RECOMMENDATIONS

From phases pre-design to construction phase design process has completely evolved in private firms and to some extent it has also evolved in government firms since they are still availing manual approach. The use of computer applications at various design stages offers more advantages than disadvantages and the best form of all approaches at each design level Software programs in the designing process play a crucial role in future as modern technology emergence of a new architectural structure. From survey it has found that the vernacular architecture is greatly affected by digital elements. Besides this, software helped as the forms of the buildings, as building systems, construction technologies, cost and structural analysis getting more complex, the involvement of design and manufacturing processes becomes more necessary. Results and findings it is proved that software packages have definitely facilitated architects on a large scale, there is improved Collaboration, which is intrinsic in any architectural profession could now happen at a quicker rate than ever before due to emerging connectivity technology fueled by its growth. Having looked at the evolution of design tools and methodologies over the centuries and the nature of each, one starts to realize that there's still a domain of challenges to overcome. The geometric freedom and the range of formal exploration that digital design methodologies offer tend to make the designer too occupied with the play of geometries and the forms. Challenge lies in coming up with a design model that aims at efficient forms that can be built in a sustainable fashion. The further research can be done by investigation on digitalization in design practices on how vernacularism is being incorporating in the software packages in order to retain the cultural and historical architecture. The approach toward digital software should be made easy in order to let designers reach out to those methods hassle free and efficiently. From surveys and interviews it is realized that old methods should be revitalized and even manual drafting classes should be provided at every medium along with the training of digital tools. Benefits of combining the two processes, preventing drawbacks and using manual tools and digital drawings at the appropriate stage of the design process, this paper is recommended for combination and interchanging them and establishing a balance and the integration between them to show the best result.

The firms with limited resources and outdated software should be provided with latest versions economically and also free online or in person training and education for designer should also be considered.

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AUTHORS BIOGRAPHY

First Author – **Irum Arisar**, Architect and professor, Department of Architecture, Mehran U.E.T. Jamshoro, Sindh, 76062, Pakistan. E-mail: irumarisar@gmail.com

Second Author – **Dr. Bhai Khan Shar**, Director and Professor, Centre of Excellence in Art and Design, Mehran U.E.T. Jamshoro, Sindh, 76062, Pakistan, E-mail: director@cead.edu.pk

Third Author – **Sabeen shah**, Architect and professor, Department of Architecture, Mehran U.E.T. Jamshoro, Sindh, 76062, Pakistan, E-mail: Sabeenshah46@gmail.com

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