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SUSTAINABLE EDUCATION - A PREREQUISITE FOR MEANINGFUL DESIGN PRACTICE IN PAKISTAN

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Abstract

Green architecture is a necessity across the world. In Pakistan, green architecture, despite its potential, is still in its early stages. Architects and researchers have not yet shown a strong sense of urgency in addressing the challenges posed by climate change. As a result, the discussion on green architecture has been limited. This paper explores the level of understanding of green architecture amongst architects in Pakistan and to identify barriers that inhibit its application. It is based on a study conducted in the form of surveys and semi structured interviews of both the architects and the academicians. Many barriers were identified including cost, lack of government support, absence of bye laws, lack of availability of materials and technology. However, it was established that lack of education and understanding about the concept of green architecture in architects and academicians is the main problem. If we teach architecture in a way that empowers and makes future architects aware of their environmental responsibilities, the problem of environmental degradation can be overcome. Architectural education is the vital link that is needed to incorporate green consciousness into professionals. This could be done by embedding the green design in the architectural curriculum and by educating the professional through professional education.

INTRODUCTION

Energy Crisis in Pakistan

Pakistan's devastating 2010 floods are a direct result of global warming, with 90% of the country's glaciers projected to melt in the next few decades (Gronewold 2010). This melting will severely deplete water resources, potentially eliminating them within the lifetime of the current generation.

Pakistan heavily relies on hydroelectric power, with its dams generating nearly 30% of its electricity. However, due to the growing risk of water shortages, the country faces a severe energy crisis that threatens both its economy and stability. Pakistan's current energy production capacity is 19,500 megawatts (MW), while the demand deficit stands at 4,500 MW. This gap is projected to widen to 6,000 MW or more in the next five years (PEPCO 2013). In Pakistan, despite severe housing shortages (6 million units), inadequate access to clean water and sanitation (affecting over half the population), buildings are consuming a substantial portion (nearly 40%) of the country's energy supply (ENERCON 2014). It is estimated that by the year 2030 60% of Pakistan's population shall be living in urban centers (Haider 2006).

Pakistani professionals must actively participate in international discussions on minimizing chlorofluorocarbon (CFC) emissions and promoting energy efficiency in their daily lives. In this scenario,

architecture becomes one of the most valuable professions. Most architects and academics in the country are still focused on creating aesthetically pleasing designs and engaging in abstract discussions, ignoring the urgent need to prioritize energy efficiency and environmental responsibility in construction. To ensure the future success of architecture, professionals must actively incorporate sustainable principles into their designs, fostering a future that emphasizes environmental responsibility.

Research Question

Despite facing severe impacts from climate change and energy scarcity, the profession in Pakistan exhibits a notable lack of enthusiasm for implementing proactive actions to address these pressing issues. This raises the question that, *"Why is green Architecture is not being practiced in Pakistan?"*

Methodology

To investigate the limited adoption of green architecture in Pakistan, an extensive study of Pakistani architecture was undertaken. This study used both correlational and explanatory research methods. In the correlational phase, it found a relationship between the absence of green architectural practices and deficiencies in architects' knowledge, awareness, and education. Architects provided essential information through both a written questionnaire survey and in-depth interviews conducted by researchers. This information was confirmed and expanded upon by reviewing external sources and literature. The sample group of architects was randomly selected, meaning each architect had an equal opportunity to be included. Due to a poor response rate, an alternative sampling method called purposive sampling was utilized. This method involves intentionally selecting a group that is expected to effectively represent the entire population. This approach involves identifying a specific goal and selecting a sample that aligns with that purpose. The resulting sample is typically smaller than in random sampling methods. Despite sending out 600 questionnaires to architects in Lahore and Islamabad, only 54 responses were received, reflecting a low response rate. To compensate, 80 architects were selected from the IAP membership list and interviewed using a structured format. Required information was provided by 134 architects. Interviews were conducted with architects of diverse ages and career backgrounds to ensure a broad perspective. Out of the respondents, 92 (around 70%) held decision-making roles within their companies. Meanwhile, 42 respondents (approximately 30%) had limited or no influence in the decision-making process.

Theoretical Framework of Research

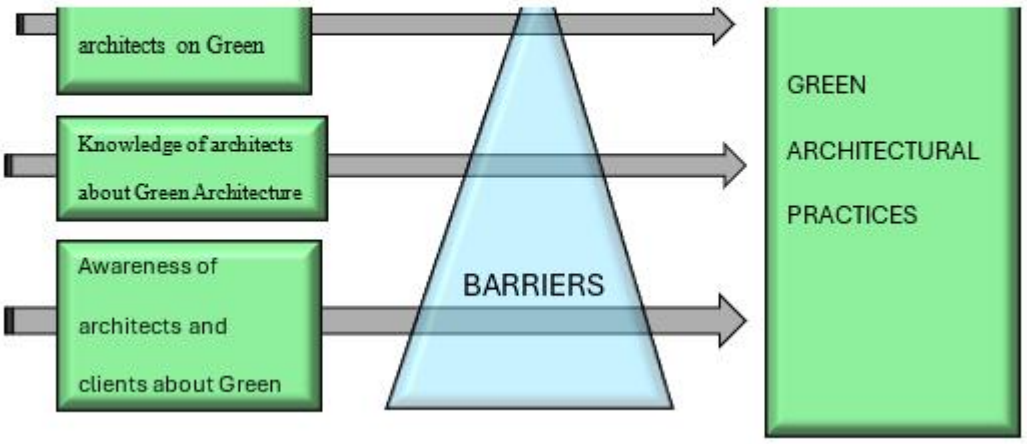
This research study employs a theoretical framework that includes one variable that is affected (dependent variable) and three variables that influence it (independent variables). Additionally, a variable is included that affects the relationship between the dependent and independent variables (moderating variable).

Variables

Green/Sustainable Architectural Practice (GAP) is set as a dependent variable in this research. This research aims to demonstrate that Green Architectural Practice in Pakistan is significantly influenced by three factors: 1. Architects' Knowledge (KN) of green building principles 2. Architects' Awareness (AW) of the benefits and importance of green design 3. Architects' Education (ED) in sustainable building practices. The relationship between the dependent variable (Green Architectural Practices) and the independent variables (Knowledge, Awareness, and Education) is influenced by a third variable called "barriers" (B). This moderating variable affects how strongly the independent variables are related to the dependent variable.

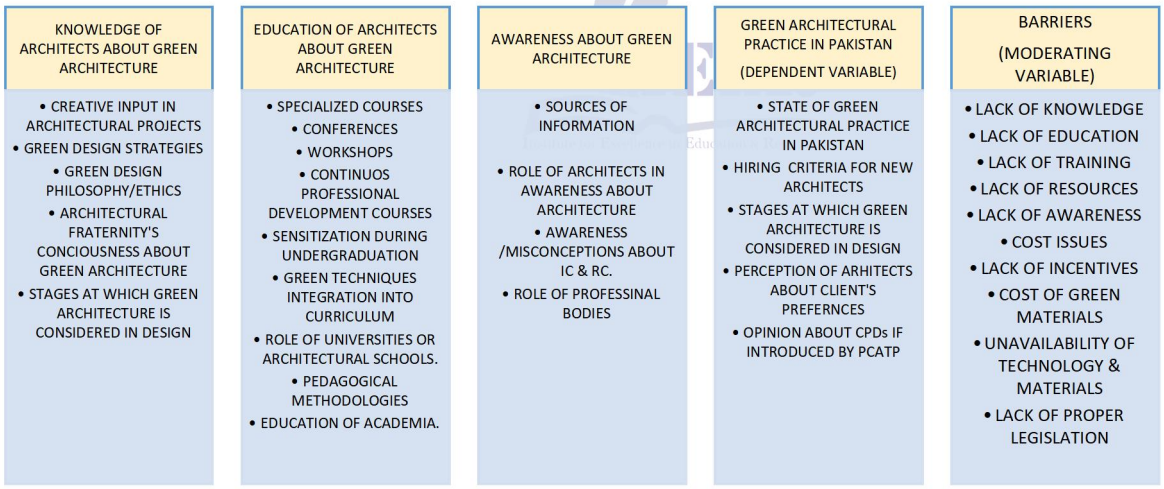
Research Model of Study

Figure 1.
Research Model of Study



Dimensions of Independent, Moderating and Dependent Variables

Figure 2 *Description of Variables in the Research*



Operational Research Question (Hypotheses)

The study began by explicitly specifying the assumptions or suppositions that guided the investigation.

Ha1: Better knowledge of green architecture among architects can enhance green architectural practices.

Ho1: Even with improved knowledge of green architecture, green architectural practices cannot be improved.

Ha2: Enhanced education on green architecture for architects can improve green architectural practices.

Ho2: Education on green architecture, regardless of quality, will have no impact on green architectural practices.

Ha3: Raising awareness of green architecture among architects and clients can improve green architectural practices.

Ho3: Improving awareness of green architecture will not result in any improvement in green architectural practices.

Instrumentation Design

To ensure clarity, the questionnaires were organized into sections that specifically targeted different subtopics. In the architect questionnaire, four distinct sections were created. The initial part of the study aimed to evaluate the current status of architects in the field of sustainable architecture. The study involved four sections: * Architects' assessment of their knowledge and education in green architecture. * Architects' views on their clients' understanding of green architecture. * Identification of obstacles to practicing green architecture in Pakistan. This study employed a Likert scale for data collection. Respondents were presented with a 5-point scale ranging from 1 (Strongly Agree) to 5 (Strongly Disagree), where 3 represented neutralities. The magnitude of the mean value reflects the level of consensus: a higher mean indicates greater disagreement, while a lower mean indicates greater agreement.

Reliability of the Instrument

The questionnaire's measurements were tested for consistency. Cronbach's Alpha, a statistical measure, was used to assess how consistent the responses were within the questionnaire. This helped ensure that the questionnaire provided reliable data. The value of Alpha should be within 0.05 to 1 to term it a consistent scale. The value of coefficient for Cronbach's alpha came out to be **0.806**. for the architect's questionnaire. This value suggests a reliable scale of data.

Data Processing and Analysis

To process the data, IBM Statistics SPSS (version 21) was used. The first step was to add all the variables to the variable view. Next, the appropriate measurement scales (e.g., nominal, ordinal, interval) were assigned to each variable. Finally, values were assigned to each scale to represent the different data points. Once the structure of the questionnaire was finalized, data was collected using the data entry section of the software (see Appendix). To ensure the accuracy of the collected data, the Cronbach's Alpha test was applied to the questionnaire to determine the reliability of the scale used in the study. The analysis of the data was guided by the two research design strategies that were implemented at the outset of the study. For correlational study a **bivariate correlation** was conducted to check the direction and magnitude of the relation between Architectural Practice and knowledge, education, and awareness about green architecture. The research model was checked for goodness of fit by running **Linear regression**. Specific items were examined in detail by studying the average scores, how often each response was given, and the most frequently occurring response.

This study highlights the lack of knowledge, understanding, and education as key obstacles limiting the adoption of green architecture. However, it does not attempt to identify or explore all potential barriers and their impact on green architecture practices. Through bivariate correlation tests, researchers determine the strength and direction of the relationship between a pair of variables. These tests reveal the extent to which the independent variable influences the dependent variable.

Green architecture practices exhibit a highly significant relationship with knowledge (Pearson correlation = .915, p = .000). Education also holds a strong correlation (Pearson correlation = .811, p = .000), while awareness has a moderate correlation (Pearson correlation = .771, p = .000).

The predictions (Ha1, Ha2, Ha3) have been confirmed to be accurate. Using Linear Regression Analysis, we validated the research model's accuracy. The Multiple Regression Model gauges the model's quality. A perfect model would have an adjusted R square value of one, indicating that the independent factors completely determine the dependent variable. In our study, the adjusted R square value was 0.864, suggesting a highly accurate model that nearly perfectly predicts the dependent variable.

Table 1 *Correlation Table*

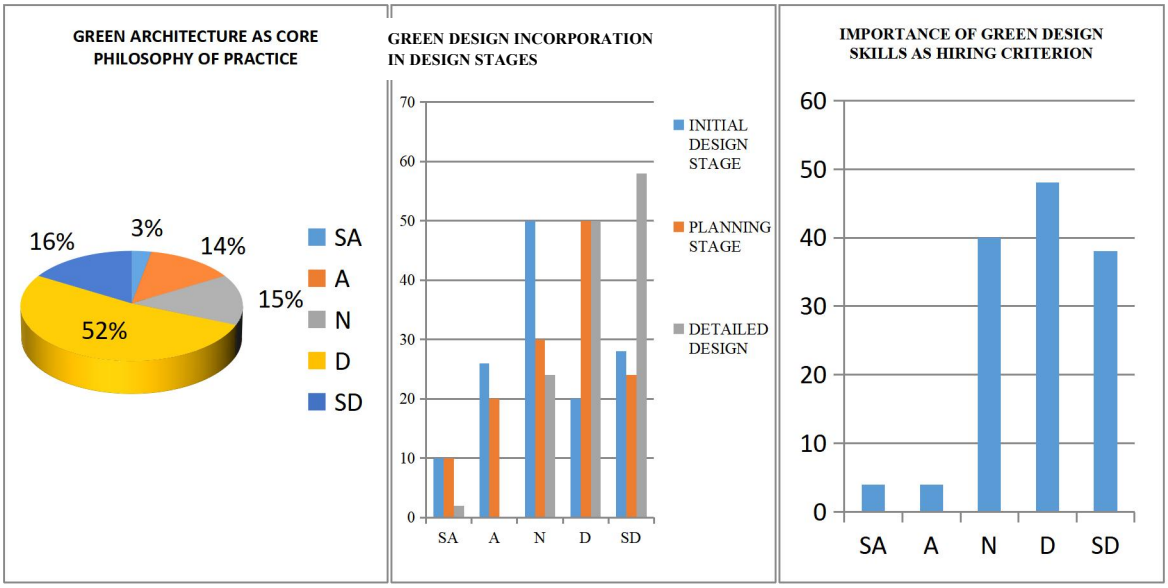
Correlations					
		Practice	Knowledge	Education	Awareness
Practice	Pearson Correlation	1	.915**	.811**	.771**
	Sig. (2-tailed)		.000	.000	.000
	N	134	134	134	134
Knowledge	Pearson Correlation	.915**	1	.793**	.712**
	Sig. (2-tailed)	.000		.000	.000
	N	134	134	134	134
Education	Pearson Correlation	.811**	.793**	1	.908**
	Sig. (2-tailed)	.000	.000		.000
	N	134	134	134	134
Awareness	Pearson Correlation	.771**	.712**	.908**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	134	134	134	134
**. Correlation is significant at the 0.01 level (2-tailed).					

Significance of Green Architectural Practice in Pakistan

An examination of data on green architecture in Pakistan reveals that the idea of sustainable building methods has not yet become widely accepted in practice. The vast majority (almost 70%) of those surveyed expressed skepticism towards the idea that sustainable architecture is a fundamental aspect of their work or contributes to their design creativity. The concept of integrating eco-friendly principles into building designs faced significant opposition. On a scale of 1 to 5, the mean score of 3.46 strongly indicates a tendency to reject this approach. Despite some projects showing a lower response mean (2.25), the positive response to green or sustainable architecture indicates that architects appreciate its importance. The architects understand the importance of green architecture, as evidenced by the low mean score of 4 in response to the question dismissing it as irrelevant or unimportant.

During the design process, architects typically rate their consideration of green design strategies as follows: * Initial Design Stage: 3.2 (Most frequent rating: 3) * Planning Stage: 3.4 (Most frequent rating: 4) * Detailed Design Stage: 4 (Most frequent rating: 5) These scores suggest that most architects do not prioritize green design throughout the design process, as the majority of them give low to moderate ratings for its incorporation at all stages. During the recruitment process for new architects, approximately 90% of respondents did not prioritize skills in sustainable design methods. This finding aligns with prior observations indicating that Pakistani architects typically do not incorporate environmentally friendly practices into their designs. Despite recognizing the importance of green design principles, companies face challenges that prevent them from implementing them.

Figure 4 *Data Related to Architects Attitudinal Responses towards Green Design Philosophy as a Mainstay of their Architectural Practice*



Knowledge of Architects about Green Architecture

To evaluate architects' knowledge of green architecture, researchers identified key sustainable design strategies and areas. Architects were asked to rate their familiarity with these strategies using a Likert scale, indicating their level of understanding from strongly disagree to strongly agree. On a scale where higher scores indicate agreement, the average ratings for different sustainability aspects were as follows: * Efficient water use: 2.5 * Passive environmental design strategies: 2.7 * Longer structure lifespan: 2.8 * Form and visual aesthetics: 1.9 * User comfort: 1.1. There was a strong consensus that form and user comfort are key aspects of design, regardless of whether it is environmentally friendly or not. These principles are not unique to green design but are essential for any well-crafted design. The greatest opposition was expressed towards aspects of green design related to carbon neutrality (mean scores of 4), lifecycle cost, waste management, and social and ecological impact.

The research reveals a significant gap in understanding and implementing environmentally friendly design practices in Pakistan. Concepts such as achieving zero emissions for buildings, integrating architecture with the surrounding ecosystem, and harnessing architecture to promote social well-being remain largely unexplored and unutilized in the Pakistani context. Currently, solar panels and insulation are the only energy-saving measures being explored, but they are implemented haphazardly. This limited approach stems from a lack of education about eco-friendly design principles tailored to our climate, economic situation, and societal norms.

Table 1 *Mean Score of Main Areas (Strategies) of sustainable Design Incorporated by Architects in their Designs*

CODE	DESCRIPTION	MEAN SCORES
PED	Passive Environmental Design Techniques like orientation, fenestration, plantation etc,	2.7
LLCOST	lower Life cycle costs	3.6
EWTR	Efficient Use of Water	2.5
3RWST	reduce, reuse, recycle waste	4.0

LSPSTR	lifespan of Structure	2.8
EED	energy efficient design/technology	3.7
CND	carbon neutral design	4.4
REMAT	use of renewable materials	3.7
FORM	visual aesthetics/form	1.9
COMF	comfort and wellbeing of users	1.19
ECO	Ecological Management of Resources	4.3
SOCIAL	Social Sustainability	3.7

The higher the value of mean the stronger is the disagreement.

Green Architectural Education of Architects

Of the population surveyed, 24% had participated in a Green Architecture training program, while the remaining 76% had not received any formal training in this field. All architects surveyed who held master's degrees had participated in a course on green architecture. A table was created showing the relationship between the respondents' qualifications and their participation in the green architecture course. Among the survey participants, those with master's degrees in architecture consistently had coursework in green architecture. In contrast, only 10 of the 102 respondents with undergraduate degrees in architecture had enrolled in green architecture courses. As the number of years of experience in the field grew, so did the integration of green architecture coursework into educational programs. Most of the respondents have between 1 and 5 years of experience. It's noteworthy that two respondents with over 30 years of experience reported obtaining green design qualifications. Both individuals received their training outside of Pakistan and had extensive experience in the United States before returning home.

In a survey, a majority of participants (over 50%) participated in a seminar or workshop on eco-friendly architecture. However, a significant portion (49.3%) expressed neutrality regarding the value gained from these events in Pakistan specifically. While many in the architectural profession advocate for incorporating green design into university curricula, a substantial proportion (indicated by a mean score of 4) strongly oppose making it a requirement for registration by the Professional Credential Accreditation Tracking Program (PCATP). More than 70 percent of architects believed that continuous professional development courses about green architecture should be conducted by the PCATP. The architects questioned the effectiveness of both government agencies and private companies in providing sufficient education and outreach on sustainable building practices with mean scores of 4 for the regulatory bodies and 4.4 for the private enterprises. Despite differing opinions among architects, there was a consensus that universities play a vital role in providing the architectural profession with the highest caliber of education. It's noteworthy that the average score of 2.7 indicates a slightly neutral stance rather than a strong belief in the effectiveness of universities in educating students about environmental issues.

The findings indicate that architects generally lack sufficient knowledge and understanding of environmentally friendly building practices. The primary challenges in promoting green architecture education stem from: * Limited availability of

qualified instructors offering courses dedicated to green architecture. * Insufficient collaboration and communication between architects and academic institutions. * Absence of high-quality seminars and workshops on green architecture practices. The absence of ongoing training programs on sustainable architecture offered by professional licensing organizations contributes to the low enthusiasm for adopting green building practices.

Figure 5 *Data Depicting the State of sustainable Architecture Education of the Architects in Pakistan*

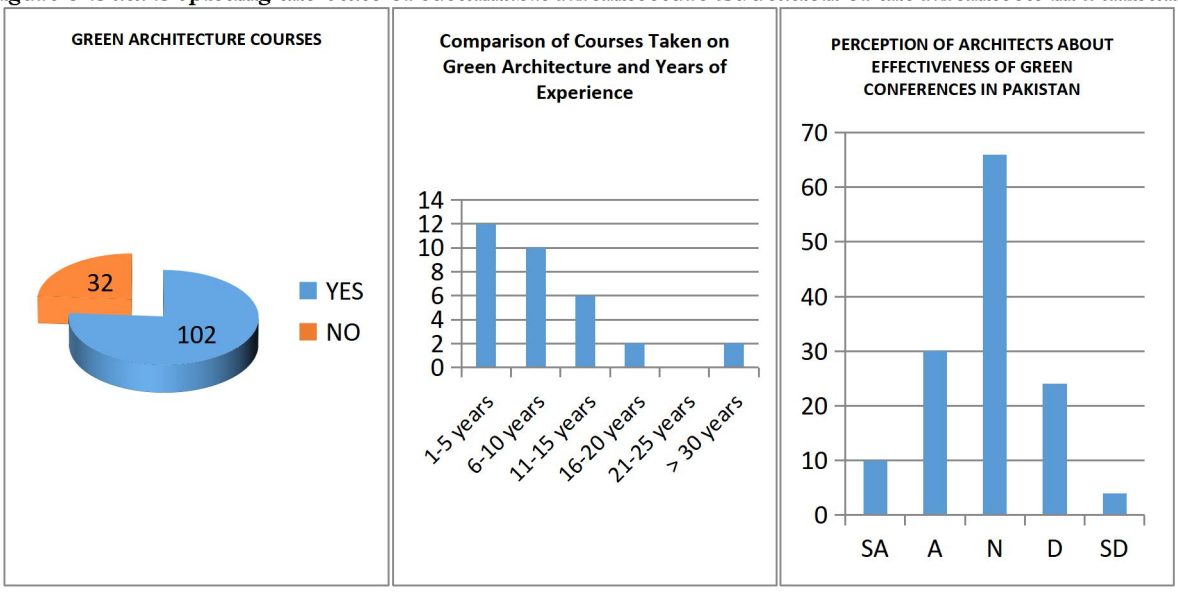
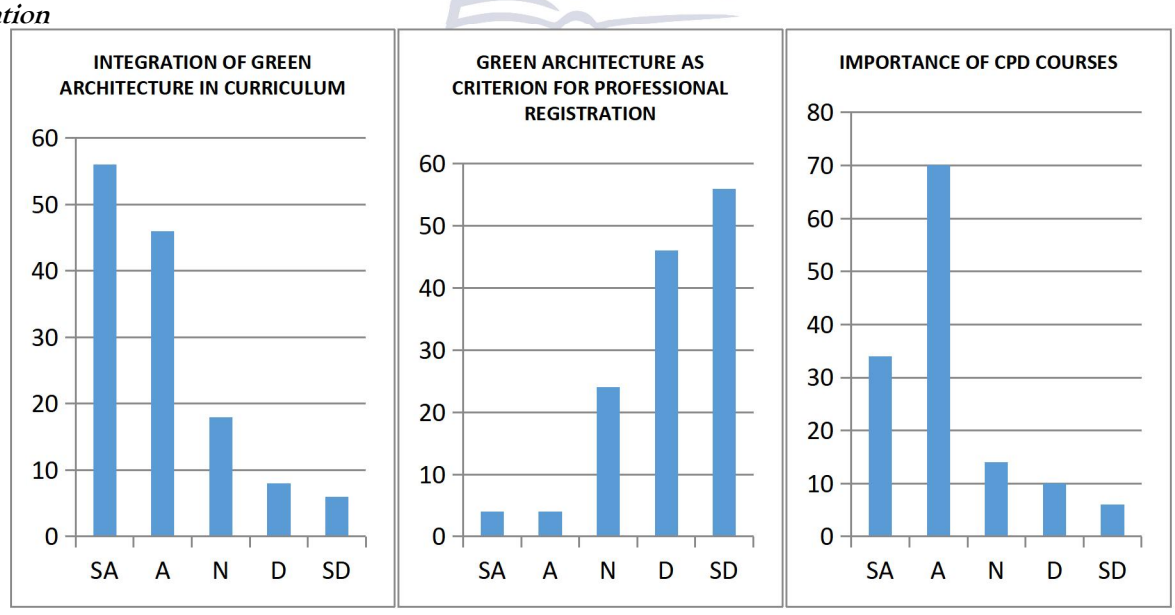


Figure 6 *Perception of Architects regarding Continuous Professional Development through Sustainable Design Education*



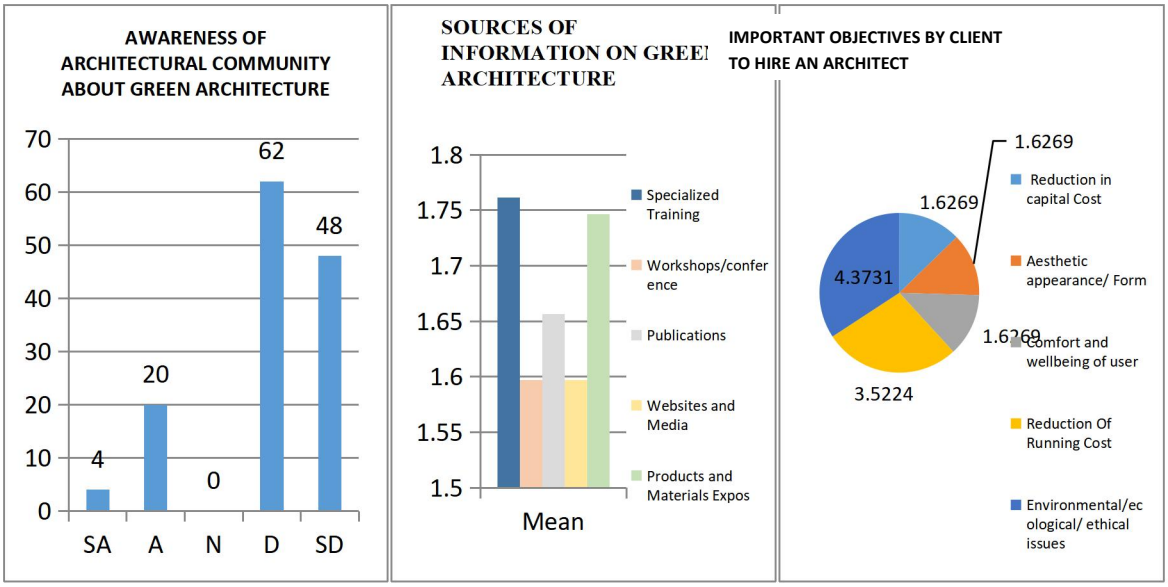
Awareness of Praxis about Green Architecture

Most architects feel that their colleagues don't fully understand or value sustainable building practices (average rating: 4.7). Additionally, clients' knowledge of green architecture is generally low (average rating: 2.5). Contrary to client expectations, architects prioritize ecological and social considerations in their work, with reducing running costs and enhancing

user experience being less important. Architects value specialized training and media sources for acquiring knowledge about sustainable design. This information can also benefit clients in understanding the broader value of architects' services beyond aesthetics and initial cost savings. Most architects believe that clients hire them primarily for aesthetic design and visual appeal and Cost savings in the initial construction phase and enhancing user comfort and experience.

People are not fully aware of the benefits of sustainable architecture as a way to live more efficiently. Architects believe that since the public and the design community are unaware, clients aren't requesting eco-friendly design. Architects often avoid discussing practical considerations with clients, such as cost-effective materials and energy efficiency. This reluctance stems from their internalized belief as artistic creators, an image instilled by their education. They are hesitant to compromise their perceived status as creative geniuses by engaging with these "uninspiring" aspects of building design. Clients often prioritize aesthetics over functionality, overlooking other design options that could enhance their living experience.

Figure 7 ***Data depicting the Perception of Architects regarding both architectural community's and client's awareness about Sustainable Architecture***



Barriers in Practice of Green Architecture in Pakistan

Table 3 ***Identification of Main Barriers in Practicing Sustainable Architecture in Pakistan by Respondents.***

CODE DESCRIPTION	MODE*	MEAN**
Bpdg1: Lack of education in latest techniques and materials used in Green Architecture	1	1.8657
Bpdg2: lack of knowledge about the Green/Sustainable Design strategies	3	2.1194
Bpdg3: lack of integration of green/sustainable subjects into the design studio courses	1	2.2388
Bpdg4: lack of grounding in topics like Ethics or interdisciplinary studies	2	2.7612
Breg1: lack of appropriate energy efficient building codes and bye laws is detrimental in proper practice of Green architecture.	3	2.4627

Breg2: Lack of proper implementation of bye laws and codes is detrimental in practice of green architecture in Pakistan	2	2.5075
Bpbod1: lack of specialized training of the architects	2	1.9851
Bpbod2: Lack of initiative by the PCATP in incorporating a minimum criterion of knowledge about Sustainable architecture while registering an architect.	3	2.9104
Baraw1: Lack of awareness about available materials and techniques about Green Architecture	1	1.8955
Bclaw1: lack of demand	2	2.1940
Bclaw2: lack awareness on the client's end about the difference between initial and running cost of a Green building	2	2.1791
Bawgov1: lack of awareness and knowledge in the Government sector	1	2.7015
Bgovaw2: Lack of incentives by the Government like tax rebates and bonuses to encourage the use of Green design Strategies.	1	2.5224
Bgovaw3: Lack of proper strategy to promote Green Architecture both in public and Private sectors	2	2.4627
Bmat1: lack of availability of appropriate green materials	3	2.6269
bcost1: High cost of Green Materials	1	2.6567
Bconst1: lack of availability of trained workers to execute the Green Design	1	2.4925

*1=Strongly Agree, 2=Agree, 3 = Neutral, 4=Disagree, 5=Strongly Disagree
** Higher value of mean depicts stronger disagreement

The main obstacles preventing the widespread adoption of green architecture in Pakistan stem from a lack of understanding, information, and training. Most of the reported obstacles received average ratings between 1.8 and 2.9, which signify opinions ranging from agreement to neutrality. The results reveal a clear pattern: knowledge, awareness, and education-related obstacles tended to receive ratings closer to 1, indicating a strong consensus that these factors are significant barriers.

Green Architecture in Pakistan

In Pakistan, less than 1% of buildings are designed and constructed by architects. This lack of involvement by architects has resulted in limited economic opportunities for professionals in this field. Most graduating architects are primarily concentrated in the three metropolitan centers of Karachi, Islamabad, and Lahore. Only a small fraction of architectural graduates' work in cities outside the main urban centers. After gaining some experience, many either pursue more lucrative opportunities or leave the profession altogether. Brain drain is a significant issue in Pakistani architecture. Architectural graduates often migrate to Gulf countries or Western nations to secure employment or pursue "Foreign Degrees" to improve their career prospects in Pakistan. The ratio of architects to the population in Pakistan has consistently been low. Over the past 22 years, just 1600 architects have joined the official registry of the Pakistan Council of Architects and Town Planners (PCATP).

Traditionally, architects have catered primarily to wealthy individuals and organizations with substantial financial means for constructing grand architectural projects. This has led to the emergence of the "celebrity architect," a concept where architects gain fame and recognition for their exceptional designs and high-profile projects. Pakistan's elite market is dominated by a small number of well-established companies, leaving little room for newer, smaller businesses to grow and succeed. As a middle tier architect, it is unwise to reject projects solely based on personal values and beliefs. This is especially true for architects working in the public sector, where they have additional responsibilities to consider. Government buildings are often visually

unappealing and poorly designed, reflecting the state architect's disregard for aesthetics and the needs of the people who use these structures. Kausar Bashir's paper on the architectural profession in Pakistan accurately encapsulates the current issues and challenges facing the field.

Instead of confronting the causes of our problems over the last thirty-eight years, architects have been paying attention to the needs and requirements of a very small segment of the population at the cost of most of the people. This alienation from the masses has been further accentuated by our desire to try to play the role of the architect in the West, which is totally out of context in Pakistan. (KB 1998)

Architects often embrace the image of the lone creative genius who designs aesthetically pleasing structures. However, they have ignored pressing urban challenges such as: * Rapid and uncontrolled urbanization, leading to overcrowding and infrastructure failures. * Proliferating slums that exacerbate poverty and inequality. * Ethnic tensions and social unrest caused by population shifts in cities. Architects tend to downplay these issues, blaming them on poor governance, rather than acknowledging their own roles in addressing these challenges.

The survey conducted among architects and subsequent analysis of the data showed that: * Green architectural practices are effectively nonexistent within the architectural community. * The concept of Green Architecture has minimal influence as an innovative or guiding principle in the architectural design process of architects. It appears that architects are somewhat isolated, from the concept that buildings and by extension architects have an impact on harm. This lack of concern may stem from the fact that the architectural field relies heavily on a clientele base. This makes green architecture practice to be a restricted field, and it also limits the architect's creative abilities when it comes to exploring innovative ideas. While architects believe that clients value form over substance in design decisions, clients are largely unaware of the benefits and importance of environmentally sustainable architecture. Architects' insufficient belief in Green Architecture principles hinders their efforts to inform clients about it. While financial concerns may play a role, their reluctance stems from deeper reasons beyond monetary gains. In Pakistan, there is a notable shortage of practical understanding and training on the implementation of sustainable design strategies. This absence has resulted in a lack of applicable examples or successful practices that architects can draw upon for guidance. The responsibilities of professional organizations in architecture, such as PCATP (registration and accreditation) and IAP (promotion), are under scrutiny here. After completing their formal architectural education, the majority of architects lack accessible pathways to continue developing their knowledge and skills in the field. Pakistan Council of Architects and Town Planners (PCATP) does not incentivize continuing professional development (CPD) because it does not include it as a requirement for architects to renew their registration. Without formal assessments to encourage architects, they have little incentive to stay informed about cutting-edge theoretical and practical advancements. In Pakistan, promoting sustainable architectural practices requires teaching sustainable design so that principles of environmental stewardship and sustainability become deeply ingrained in architects' mindset and creative process.

REFERENCES

Brundtland Commission. (1987). Report of the World Commission on Environment and Development: Our common future. United Nations. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

Day, C., & Roaf, S. (2007). *Ecohouse: A Design Guide*. Routledge.

Haider, M. (2009). Urbanization challenges in Pakistan: Developing Vision 2030. Journal of Infrastructure Development, 1(1), 17–38. https://journals.sagepub.com/doi/10.1177/097542530900100107

Indian Green Building Council. (2012). IGBC Green Homes Rating System Version 2.0: Abridged reference guide. https://igbc.in/frontend-assets/html_pdfs/abridged/IGBC%20Green%20Homes%20-%20Abridged%20Reference%20Guide%20%28Version%202.0%29.pdf

Mazria, E. (2003). It's the architecture, stupid. Solar Today, May/June. https://www.mazria.com/ItsTheArchitectureStupid.pdf

Ministry of Housing and Works, Pakistan. (2001). National housing policy 2001. Government of Pakistan. https://mohw.gov.pk/SiteImage/Misc/files/National%20housing%20policy%202001.pdf

NASA. (n.d.). Climate change: How do we know? National Aeronautics and Space Administration. https://science.nasa.gov/climate-change/evidence/

National Energy Efficiency & Conservation Authority (NEECA). (n.d.). Energy conservation initiatives in Pakistan. Government of Pakistan. https://www.neeca.gov.pk/

Natural Resources Defense Council. (n.d.). Green buildings and sustainability. https://www.nrdc.org/issues/buildings

Pakistan Electric Power Company (PEPCO). (n.d.). Power forecast. http://www.pepco.gov.pk/

Scientific American. (2022). Why are Pakistan's floods so extreme this year? https://www.scientificamerican.com/article/why-are-pakistan-rsquo-s-floods-so-extreme-this-year/

U.S. Department of Energy. (n.d.). Energy efficiency in commercial buildings. https://www.energy.gov/commercial-buildings

U.S. Green Building Council. (2009). LEED reference guide for green building design and construction. https://www.usgbc.org/resources/leed-reference-guide-green-building-design-and-construction-global-acps

United Nations. (1992). Agenda 21: The comprehensive plan of action from the United Nations Conference on Environment and Development. https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

Wines, J., & Jodidio, P. (2000). *Green architecture*. Taschen America Llc.

Yudelson, J. (2008). Green building A to Z Understanding the language of Green Building. New Society Publishers.