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JOURNAL OF RESEARCH IN ARCHITECTURE AND PLANNING

Introduction

Focusing on research works relevant to the fields of architecture and planning, the Journal of Research in Architecture and Planning (JRAP) explores issues of relevance to both scholars and practitioners in the field of architecture, urban design, urban planning, built form heritage and conservation. JRAP was initiated in 2000 as a peer reviewed journal, initially published annually, however, since 2011 its frequency has increased to biannual. In addition to the papers received through our regular submission process, the two volumes also include papers selected from those presented at the annual Conference of Urban and Regional Planning, hosted by the Department of Architecture and Planning at NEDUET. Contributions to the journal on general topics are accepted any time of the year, and incorporated in upcoming issues after going through a peer review process. A post conference review is also undertaken for the selection of conference papers, before their publication. JRAP holds the privilege of being the first peer reviewed journal in the discipline of architecture and planning, published from Pakistan. Contributions are received from across the globe and on average half the papers included in JRAP are from international scholars.

As of 2018, the category entitled 'Young Scholar's Contribution' has been included in the Journal. In this category, papers from young faculty and early career scholars are accepted and editorial assistance and peer review feedback is provided to improve the research papers. One such paper is published under the head 'Young Scholar's Contribution' within each issue of JRAP.

Aims and Scope

The primary objective of JRAP is to provide an international forum for the dissemination of research knowledge, new developments and critique in architecture, urban design, urban planning and related disciplines for the enrichment and growth of the profession within the context. The journal focuses on papers with a broad range of topics within the related discipline, as well as other overlapping disciplines. JRAP publishes a wide range of research papers which deal with indepth theoretical reviews, design, research and development studies; investigations of experimental and theoretical nature. Articles are contributed by faculty members, research scholars, professionals and other experts. The Editors welcome papers from interested academics and practicing architects. Papers published so far have been on topics as varied as Housing, Urban Design, Urban Planning, Built Environment, Educational Buildings, Domestic Architecture, Conservation and Preservation of Built Form. All back issues are openly accessible and available online on the Journal's official webpage:
http://jrap.neduet.edu.pk/online_journal.html.

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Note: All the photographs included in this issue have been taken by the authors unless otherwise mentioned.

EDITORS' NOTE

The following volume of the Journal of Research in Architecture and Planning is the 34th volume and second issue of 2024. It contains five papers contributed by international and local scholars. The papers cover major themes of environmental and social sustainability. With varying focuses and perspectives, and using different research methods, the papers outline various problems and strategic solutions, making the volume an interesting read in all. One paper in the volume assesses the challenges to conservation support to river forts in the context of Bangladesh. Paper from Sri Lanka presents a convincing argument for incorporating research processes in detail with design studios in architectural education. One paper assesses the success value of the design strategy of roof stacking in various buildings for achieving a measure of sustainability. A local paper from Karachi outlines the accessibility of urban parks as a measure for improving quality of life. The last paper in the volume quantifies the impact of COVID lockdown in 2019 on environmental factors, taking up Lahore metropolitan area as case area. The issue also consists of two book reviews.

The first paper shares research strategy that aligns with the hypothesis that research processes of documentation and analysis may be aligned with design studio teaching to create better and contextually relevant design education for the undergraduate curriculum.

The second paper based on Bangladesh context presents the significance of Mughal river forts in historical reference, along with the current challenges faced for the prospect of enforcing legislation on preservation. The research is three pronged; besides highlighting the historic significance of two case areas of Mughal river forts, he outlines the issues within the local legislation alongside that require update and further carries out a public opinion survey at the sites revealing lack of public awareness and as a hurdle in the process of local heritage preservation.

The third paper takes up several case examples of buildings in different parts of the world, exploring the different building types and construction materials with which roof stacking has been successfully carried out on old and later built buildings. The paper details out the issues and opportunities of this sustainable design strategy that may be attempted on existing buildings, conserving resources, becoming a fashionable trend addressing current needs and demands.

The fourth paper presents a convincing research case for evaluating accessibility and proximity to parks from residential areas. Taking up a District of Karachi, the study uses GIS as a tool to connect various standards outlined internationallyof availability of parks with the local context to highlight their need for improved quality of life.

The fifth paper equates through remote sensing data figures the improved impact of COVID 19 lockdown on air quality and urban heat islands in the metropolitan city of Lahore.

The volume includes two book reviews; first one is of Jamie Lerner's *Urban Acupuncture: Celebrating Pinpricks of Change that Enrich City Life,* reviewed by Rabbia Tanveer, and the second is of the recent publication of Architect Mukhtar Husain, *Foundations and Forms: Memoirs of a Pakistani Architect,* reviewed by Dr. Hira Qureshi.

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DEXTERITY IN RESEARCH AND WRITING: INTERPRETING DESIGN STUDIO AS A RESEARCH SPACE

*Harsha Munasinghe**

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ABSTRACT

Designers are often blamed for producing socially irresponsible products. Their inability to formulate a decision-making process that involves end-users was observed as *a* reason. Design studio teaching urges students to fine-tune a thinking process but students are not convinced if their thinking is duly weighed in grading or recognized by prospective employers. They incline to follow popular trends or their studio tutors rather than fine-tuning a rational thinking process that will generate a unique solution for the task in hand. They practice assembling solutions and excelling presentation techniques in the design studio. By devising twelve design studios where design was interpreted as research to inculcate design thinking, we exposed students to research methods that can integrate end-users in their design solutions. They showed signs of acquiring knowledge in investigation and analysis of in-depth data required for creating end-user empathetic design solutions. After learning academic writing, students started becoming less descriptive, less precedent-dependent, or less tutor-dependent. We found that they preferred qualitative research methods over quantitative methods in developing a design process.

Keywords: Design studio pedagogy, end user, knowledge construction, qualitative research methods.

INTRODUCTION

Research dexterity is critical in any academic setup to rationally frame knowledge construction required for a task in hand. In other words, ability to research makes an academic not only to be realistic, ethical, but also be equipped with tools to self-assess their decision-making process. As such, research dexterity guides them to avoid random decision making. Design pedagogy seldom demand students to develop a substantial investigation method to collect and rationally analyze in-depth data. Design students conduct precedent studies, observe, survey and interview potential users as well as conduct contextual analysis to collect tangible data such as climatic, traffic, etc. when a design assignment is introduced. They often limit these attempts to the preliminary stages of their assignment and hardly document intangible data such as cultural values, concepts, etc. More crucially, students are not guided to use collected data in their design decision-making. They often use collected data to defend a design solution that may have been shaped after a popular trend, style, ism, or a reputed designer. This has resulted in making socially irresponsible design products that fail to satisfy the needs of end-users in a particular context. The lack of orientation to improve strengthen students' rational thinking result in stereotyped solutions too.

Students produce new knowledge while engaging in their studio projects, but their reticence to develop the craft of writing makes this knowledge redundant. They leave a little proof about the appropriateness or reusability of these approaches. This rupture is mostly caused by the misconception that research and writing are not useful in creative industries such as design. This misconception may have emerged from the misunderstanding of what research is as well as what design is. If design is conceived as a creative solution to an existing problem, we can argue that

research is the way to investigate that problem in-depth (Munasinghe 2007). Design studio, being the most tested tool to teach design or to guide students to develop a design process, is the most fitting site to break this gridlock and improve students' research dexterity. If studio projects are reinterpreted as research tasks, design teachers can guide students towards rational decision making, and to make their products more empathetic to end-users (Dermikan and Hasirci 2009). Once their ability to investigate and examine data is strengthened, they may venture into finding more design-conducive methods to fine-tune a design process rather than trying to construct an argument to convince their tutors, examiners, clients or end-users. Research dexterity will help students understand the cyclic nature of design process better, collection and analysis of relevant data throughout the design process, and the significance of learning a design process over an end solution.

Designers argue that their products communicate with end-users, who are not interested in knowing the process of its conception or production and claim that their clients do not pay for research but for end-products (Munasinghe 2008). Students know that their prospective employers test their communication skills and not research abilities. They fail to recognize the significance of research dexterity as an essential skill to develop as a designer, and their design thinking hardly improves. Design studio should not focus on end-products but on teaching a thinking process to sustain its creativity and empathy to end-users (Munasinghe 2020; Crowther 2013). Another reason for students' random decision making is the lack of orientation to compile their decision-making process. Design students as well as practicing designers hardly document their investigation process, method of analysis, or the validity of discovered data. Developing the craft of writing could help them to self-assess their decision-making and design products. Therefore, research dexterity should be entailed by academic writing to explain how designers could integrate end-users and their expectations. Research dexterity and academic writing may make a designer better accomplished and their designs empathetic. Students may be explained that these skills are required to improve their design thinking.

This paper proposes that if research dexterity is inculcated, students will be in a better position to frame a rational design process. If they learn a research-based design thinking process, students can adopt it as per the circumstances. At the same time, if the laborious work in fine-tuning a product is documented along with the methods used to investigate and analyze, designers do not need to reinvent the wheel for each assignment but further their thinking process. Research dexterity supported with academic writing will assist students not only to scientifically collect and analyze data but also to inform what is being focused on, why it is focused, how it is investigated, the results and the scope and limitations of an investigation. This, making a designer a better human being (Pallasmaa 2019), would help them to integrate end-users in the decision-making process. The inttent is to propose that academic writing will make designers more responsible for their products.

This paper presents the results of integrating research in twelve design studios that exposed students to qualitative research methods and to the writing format IMRaD (Introduction, Method, Results, and Discussion). Urban design students were involved to design an urban space, architecture students to design a modest public building, interior design students to design a public interior space, and product design students to design furniture in an interior of a public building. They worked in teams, sometimes within their field and sometimes crossing boundaries. Observation and interviews of students and studio tutors were used to collect data. A few employers who usually train students during their practicums were also interviewed. Having provided clues to improve pedagogical practices in studio teaching and assessing, we asked studio critics to assess how their design thinking became more intelligent, focused, and intensive especially when they had to present their thinking in writing (Cikis and Ek 2010). Research ability was emphasized as a requirement to learn systematic investigation as well as critical and creative thinking. In studios, students were coached to systematically collect and analyze data, to rationally construct results, and to coherently present their decision with a self-assessment. They understood the need to check the validity of their methods and findings and how writing directed them to deconstruct the entire thinking process. Their engagement in studio was also documented learning to assess the consequences of research dexterity and academic writing.

This paper also aims at introducing research methods and writing to design students so that they can acquire research and writing dexterity.

RESEARCH DEXTERITY IN DESIGN STUDIO

Research entails an in-depth investigation to create new knowledge based on empirical evidence. It is a way of discovery, a way of developing analytical skills and inquiry-based skills, a way of developing thoughtfulness, and of making rational judgements (Adams et.al 2007). Research dexterity in design means ability to practice in-depth

investigation and rational decision-making. Designers should produce socially acceptable solutions rather than demanding the society to change its lifestyles to use what was produced. Hence, it is imperative for schools to teach strategies and methods of empirical research that examine the requirements of a society. Design schools included in study teach research methods to formulate study plans with defined problems, aims, and methods within inherent scopes and limitations, thus enabling students to evaluate various artefacts. Yet over 50% of their studios do not persuade students to apply such methods in their design studios. There, students' data collection is limited to the preliminary stages of the design process. Teaching to develop a competent research plan in design studio could guide students to fine-tune a rational design thinking process thus avoiding stereotype design products.

A research plan contains a means of planning, executing, monitoring a task, and comprehending results (Lukenchuk and Kolich 2013). A plan, creating the most relevant knowledge in a focused phenomenon, could help formulate a substantial design approach. In the experimental studios, students were first guided to compile data through literature surveys and precedent studies and then to make initial observations to assess the validity of research strategies in terms of their coherent nature, aptness to the task in hand, feasibility, and contextual and ethical limitations. The collected secondary data helped in determining the valid primary data to fine-tune a preliminary design concept by testing their initial observations. They were urged to continuously test their concepts and initial solutions with potential end-users thus emphasizing the importance of a cyclic design process. Their research focus changed depending on the task in hand. The studios exposed students to ethnographic analysis, grounded theory, and phenomenological analysis to assess social contexts through targeted lectures and facilitated them to apply those in several design exercises. They used observation and in-depth-interviews to collect data, complemented with surveys, questionnaires, experiments, and simulations. Initial discussions with students revealed that they prefer qualitative research methods.

Ethnographic analysis (EA) describes social groups, cultural systems, and sub-cultures (Whitehead 2005). Designers can use EA to assess the needs of end-users. *Holistic school* of ethnography stresses empathy to a focus group, if researchers avoid preconceptions that may limit their capacity to the extent of restricting the insight of that group. *Semiotic school* helps one to develop skills to read signs, symbols, and their signification. Students used this to get insights into the communication between a designed product and end-users. This inductive method does not start with a hypothesis but produces one as a study progress. It is important to be open-minded to understand social groups from the perspective of their members. Students were exposed to the *Critical school* to study beyond symbolic forms to explore the power structures of subordination that lie beneath them. Students used interviews and observations to collect data, and to document them in field notes to find how decisive intermingling with potential end-users is in fine-tuning their design products.

Grounded Theory (GT) is a bottom-up strategy that strives to develop theories by analysing empirical data (Glaser and Straus 1967). GT does not start with a hypothesis but generates an analytical model with data collected from a site, and as such fits a scenario that has no existing theory to analyze a phenomenon. GT insists that empirical data is the point of departure, and theoretical tools that may emerge through analysis could be grounded with collected data. Researchers must not ignore existing theories but should not allow their thinking to be entrapped in those. Students have been using similar strategies to conduct initial context studies but required guidance to focus on more intangible data of socio-cultural contexts and then to integrate them throughout the design process. GT could help students to be exploratory if they do not have established theories or approaches to frame decision-making. The scope of design projects and time constraints limited students' involvement to stop at reading a context.

Students were trained to collect data without preconceptions through studies of intricate relationships within phenomena. They, converting collected data to concept formulation, developed fresh insights into those relationships. The nature of GT to generate samples gradually during the process of a study was useful for students as they start their projects by collecting and analysing data on users, events, programs, contexts, etc., and then developing alternative concepts. In our studios, students developed their research abilities to view beyond representative objects to further illuminate or extend concepts and categories that had been constructed in previous studies. They selected objects and compared them to others already analysed, thereby further shaping a partial theory that they had refined. The sampling was informed by the analysis of empirical data, and sampling, data collection and analysis proceeded iteratively. GT dexterity helped them to understand end-users better.

Studio projects guided students to collect data, adding objects to provide new insights to user groups, and to examine them

in their own contexts to find the formation of groups and structures. In using GT, this continues until the sampling reached the point of *theoretical* saturation, when additional data did not extend but only confirmed what had been established. After collecting data, students categorized them through coding: for example, interviews of end-users about their experiences of a prototype were coded to categorize them. They shaped their products using known perceptions, attitudes, emotions, and other factors expressed in data. The portions of codes produced excerpts, and one or more codes were assigned to each excerpt. This *open coding* describes empirical data by slicing it up and labelling the pieces. Students then categorized codes and related them to others through *axial coding*. Finally, they selected the most central codes and suggested categories under which the codes could be grouped to produce *selective coding,* to focus on main ideas to identify relations between them. Based on the results from three levels of coding types, students noted the core concepts of inter-relationships in the domain they studied, especially the social implications of design. They modelled a theoretical framework to explain phenomena in the domain. Students were advised not to acquire knowledge on a domain before starting a study to avoid preconceptions that could prejudice their work thus impeding their work to identify valuable knowledge.

Phenomenological analysis (PA), as a strategy, focuses on the perceptions and experiences of people and their feelings. Students were familiar with the concept of phenomenology as a way of depicting an experience of a place (Heidegger 1967) and have been using the concept of *genius loci* that evolved with PA (Norberg-Schulz 1979). The key notion in PA is how one senses a space, pre-reflectively without objectifying, classifying, abstracting, and sensing. These may not essentially be tangible, and therefore PA has been criticized for the lack of scientific rigour and as descriptive rather than analytical. This quality can be considered as a strength in PA too.

Students used PA to reveal links between people and places, or how they continuously are involved in place-making. PA dexterity could help them to note that social structures are not given from above and neither are the people robots that follow such given scripts. Social structures continuously evolve as members collectively give meanings to their lived experiences. Students know that they could not exert a design from the above but to facilitate one that fits evolving social structures. They used unstructured interviews, in which respondents could tell their own story without being unduly influenced by the researcher, were used to collect primary form of data. The respondents brought up new topics that were important to them, but were not foreseen by students, who regularly checked if the respondents were understood correctly. In addition, students observed the behaviour of groups by participating in their context to expose more information. It was vital to observe their behaviour during interviews to understand possible attitude changes of behaviour and reasons for them. The improved dexterity in PA made them feel confident in their work.

Qualitative research methods in design studio

Students were exposed to research methods such as interviews, focus groups, observation, case studies, surveys, experiments, action research, and simulations to collect and analyze data.

In-Depth interviews*,* as a qualitative research technique, are effective in collecting complex and sensitive data in different contexts. In the studio, students practiced how to communicate with their interviewees while controlling an agenda. They enjoyed *feeling like sociologists* and gaining confidence in knowing what an end-user would expect. The strength of interviews to elicit emotions, attitudes, experiences, opinions, or privileged information depends on questions and how the questions are presented to respondents. Students learned *structured interviews*, framed with a fixed question to follow a predefined protocol to address predetermined responses; *semi-structured interviews*, based on questions to promote a flexible discussion; and *unstructured interview*, in which the interviewer is as inconspicuous as possible thus letting respondents talk freely. Students did not favour the third option as the absence of specific questions resulted in irrelevant information and they had a limited timeframe. *Structured interviews* have the advantage of being carried out faster as there is no requirement to interpret answers (Zadkowska, et.al. 2022) this did not reveal some data. Students preferred *semi-structured interviews* to investigate complex issues as respondents expressed their ideas and feelings with less restrictions. They practiced using them to conduct *in-depth interviews* in their studios and schools to gain experience. They became confident to identify a credible respondent and to conduct interviews for an extended period whenever they found such a respondent.

Students noted how the venue, interview schedule and how a respondent perceives an interviewer impacted the responses when sensitive issues were discussed. The students practiced mixing closed and open questions to prompt, probe, or check; prompting to nudge the respondent to speak up, probing to find details, and to check if the respondents were

accurately understood to overcome this. They recorded responses with respondents' permission, transcribed them later as a group to interpret them. Conducting interviews at various stages during a design project resulted in continuous collecting and analysing data in-depth. Students shared their interpretation with other cohorts to crosscheck if there were any biases of interviewers or respondents to ensure the reliability of data.

Focus Groups (FG) is an interview type in which a group of respondents participate in a discussion. FG helps to understand and interpret a topic from the perspective of participants as a member of a group. Some participants were inspirational in pursuing a topic in greater depth when they were comfortable in the group. Students noted how participants encouraged each other to discuss freely and fruitfully, sometimes dominating the discussion too. They learned to play two roles as an interviewer: first as a moderator and then as a note-taker. The moderator inspires the participants to contribute actively to the dialog while guarding the group's focus, and the note-taker writes field notes of the discussion with activities or movements that were not captured by audio/ video recording. Some groups placed a cohort in their FGs to ensure the focus of the interview and later to crosscheck interpretations, but some were unable to do so as their products were meant for a group that knew each other.

Strengthening skills in FG allowed students to study a conversation and thought pattern of people in a more natural way than in one-to-one interviews. Students noted FG as a better fit for studio projects for being cost-effective and less time consuming with many participating in one session. They noted that FG could be observer dependent and subjective as some participants swayed the others during sessions and drove the discussion in a direction they favour thus glossing over other's views. Knowing the drawbacks, students found to be objective in using FG throughout their design process. Their ability to discuss design projects with the potential end-users significantly improved.

Observation or collecting data through observing a phenomenon can be done at the initial stage of a study and then later to confirm what was observed earlier (Dean 2019). Qualitative researchers use *systematic observation* and *participatory observation*: former to collect reliable data and the latter to reveal intricate relationships in a phenomenon by becoming an active participant. The most significant advantage of participation is that the researcher observes what people may do rather than what they may say by being in immediate contact with them. Students did not passively record observations like a camera, but inevitably interpreted them thus sometimes resulting in various discrepancies. The damage control was done by asking a few of them to observe the same phenomenon to share their thoughts. Systematic observation can be objective if it uses *observation schedules* to structure an observation. A schedule structures data collection, thereby making them more legible and useable, and helped students to focus on what is being observed thus saving time. Students developed schedules using the priorities in their design tasks.

Students used participatory observation to build a deeper familiarity with a context and observe it within its natural settings. By producing context-sensitive results, dexterity in observation helped them studying a phenomenon without the restrictions of schedules or other protocols that could limit the scope of an observation. This technique is vastly dependent on the ability and experience of the researcher. The strength of a researcher remaining covert is preserving the naturalness of the setting (Barley and Kunda 2001). The researcher should not become a spy to deceive the focus group. Urban design students inserted their cohorts in groups that were invited to participate in design charades and respondent meetings to understand how their products would be received by the assembled group. This exercise was successful as groups expressed their ideas freely, and students could self-assess their designs constructively. As a result, their designs became empathetic and creative.

Case Study focuses on one instance of a phenomenon that is being investigated. Its strength is offering an in-depth insight of that instance. Students had been using case studies to justify their design solutions rather than as way of investigation, sometimes even manipulating case studies to convince their critiques. A case study could reveal multiple factors, events, and relationships that occur in a real-world situation by focusing on one instance in a natural setting. It must be stressed that the instance had existed before, and the researcher should study it within its own context to understand the inherent processes of that instance. The researcher should determine the required type of a case study: *exploratory, descriptive,* or *explanatory* to refine research questions and/or to test hypotheses. Students practiced several case studies to deduct results.

Questionnaires are inexpensive and appropriate for gathering simplified and standardised data. Students were familiar with questionnaires and knew how to formulate questions to collect straightforward data that is brief and unambiguous. They found age, gender, cultural roots, incomes of various

groups, etc. by using questionnaires. Yet, their questionnaires were found to be incomplete for lacking background information about researchers, their affiliations, or detailed instructions to respond. They were exposed to samples of open and closed questions: a closed question with researcher determined set of permissible answers in advance, and respondents can answer yes or no, whereas an open question is one without predefined answers. Open questions allow the respondents to present their own views. Closed questions bring answers quickly and can be analyzed with statistical methods. They do not allow for nuances in the answers as the respondent only can answer by choosing from predefined alternatives. Open questions allow for more elaborate and creative answers, but answering and analysing those answers are time-consuming. A questionnaire that includes both, closed questions for collecting basic data and open questions for gathering subtle and complex data, was more fruitful. Both types were incorporated in the design process. Closed questions carry the risk of getting researcher biased responses as the available answer-options are predetermined. It was difficult to predict an acceptable response rate, as some respondents ignored to complete questionnaires.

Students were coached to carefully formulate questions to be brief, relevant, specific, unambiguous, and objective (Peterson 2000). Pilot studies were conducted at studios before distributing the real questionnaires, using a small number of test subjects to represent the actual respondents to determine if the given instructions were adequate, questions were clear and unambiguous, predefined answers were exhaustive, and if the questionnaire could be completed in a reasonable amount of time. Students used the internet to administer questionnaires, using web-based tools to design, distribute, and analyse them.

Experiments as a research strategy can investigate cause and effect relationships. Students were first reluctant to this type as it reminded them of laboratory experiments. They said that their designs cannot be tested in labs. It was demonstrated how experiments could establish a relationship between a factor and outcomes to formulate a hypothesis by using the notions of dependent and/or independent variables. They compared hypothesis to initial images and found how an independent variable corresponded to a cause and a dependent variable corresponded to the outcome after practicing them in the studio. An independent variable may affect more than one dependent variable in some cases, or the independent variable has a causal effect on the dependent variable, so the latter is dependent upon the former. Students tested more than one variable in developing a design project thus reiterating the fact that design thinking is a cyclic process. They noted how this method could be used to introduce, remove, or change the value of an independent variable, but experiments cannot prove if a hypothetical product would be acceptable in a social context though they can manage links with intended user groups.

Students were requested to conduct experiments that start from a naturally occurring situation and a hypothetical solution for the identified problem: for example, urban design students designed an in-fill in an urban setting and used virtual reality to test if there was a cause-and-effect relationship in terms of aesthetics. Experimental method necessarily involves a social group, and hence can be useful in assessing the social implications of design (Pattern 2017). The advantage of external validity of field experiments such as their potentials of generalizing results was stressed in studios. Students found their relevance in the final stages to fine-tune a design hypothesis.

Surveying sampling is a method that maps a context, and thus has a broader coverage and provides an overall view of an area of interest (Denscombe 2014). It is useful in collecting primary data such as examining group activities, beliefs, attitudes, etc. at the initial stages of a study. Its success depends on how best a researcher collects data on a narrow and well-defined topic. Surveys are less suitable for studying complex phenomena in-depth. Students used survey to find out the responses on a design product but could not establish the reasons for those responses. They conducted surveys by telephone, internet, email, and social media. The selected strategies restricted the social group. Students, who conducted face-to-face surveys, found that some respondents did not always reveal required data as they got distracted. An *observational survey* was introduced as a more complex means to view people as participants. Students were requested to assess the interaction of social groups and design products in different contexts. They underlined *literature surveys* as a sound step to initiate their studio projects, leading towards formulating an observational survey, and noted identifying samples and determining the number of samples to see if findings can be applied to a larger group. Using both *representative samples* and *exploratory samples;* first to reflect a mirror image of the population and second not to represent its population but to gather information to explore a new area, students found the second option as more conducive. They confessed to using that strategy to determine the appropriateness of their designs in a social setting.

Action Research (AR) was introduced to students to address practical problems appear in real-world settings. It strives not only to generate new scientific knowledge but also to solve problems that people face in their practices. This, focussing on a practice and its possible changes, could stimulate active participation of practitioners. AR allows one to reflect on research completed, especially the results for a local practice in addition to generating new knowledge to decide whether to carry out a new action research cycle. Doing research is intertwined with making changes in action research and this can happen simultaneously. Practitioners may even initiate and sponsor action research as their knowledge and actions are essential resources for a design. This strategy can make distinctions between technical, practical, and emancipatory studies: technical aiming at functional improvements; practical to improve practitioners' know-how of themselves and their work; and emancipatory while including the purposes of technical and practical strategies also aims to help people to critically evaluate and reflect upon their practice within its social and organisational context. Students found its strength in self-education, self-reflection, and self-assessment as conducive to their learning. They identified *emancipatory action research* as a more complete option for their tasks. They realized the challenge of using AR to generalise their results, which were found to be closely tied to one or a few local practices. Students discussed the disparities, which resulted because both the participants and researchers failed to remain impartial. The aim to practice this method with prospective employers did not bring sufficient results due to their time constraints. Yet, students confessed to developing their ability to conduct AR profitably.

Students used virtual reality to practice *Simulation* as a research method within their school premises. Since simulations can study an imitation of a real situation or imitation of the behaviour of a real-world process or system, they invited potentials users of their products while some used cohorts from other programs. Simulations are used to train professionals when the real-world process can be expensive or hazardous. In this case, it was used for analysing and making predictions by reproducing situations to assess the behaviour of people. As the sophistication of computers increases, more complex simulations can be carried out remotely. Students preferred virtual reality as a practical means to run their studies and uploaded their simulations in the forms of games to attract a wider response. They documented the methods rather than the results for future uses.

Academic writing in design studio

Greek philosophers noted three stages in composition: invention, disposition, and style, or in other words, prewriting, drafting, and revising. Design process that students learn in studio contains these three steps. They are given studio projects to find solutions to a defined problem as a way of learning a design process (Hettithanthri, Hanse and Munasinghe 2022). Each exercise has a problem that deserves in-depth research into its purpose and context (Dizdar 2015). It is therefore a research assignment that is required to be methodically conducted, with a defined problem. Designing a chair for a waiting lobby of a theater requires exploring who would use it, under what circumstances, what time and for how long. Obviously, the expected comfort from this chair is different from one at the waiting lobby of a hospital or an office. Students develop their ability to find the most significant aspects of a product and end-users' thinking to employ the most corresponding method to reveal the focused aspect of a design problem, so that their solution would be empathetic and unique. Designer could use methods to test the conjectured solutions by engaging the intended users to complete a more rationalized solution. This journey to find a design solution has countless obstacles or cul-de-sacs. Documentation helps students to avoid and overcome such obstacles in the future. Design schools require students to compile design reports to demonstrate their design thinking, but students feel that their examiners or employers hardly read those reports. Some schools adopt fixed formats for design reports thus making students' input more like filling the blanks. Those reports hardly include research methods or results but technical data. They do not include data, claim, and warrant, the three items of an argument in their design process (Toulmin 1958). Their training has been to swiftly move towards a design concept and then to collect information to fine-tune that concept.

Academic writing is non-technical writing intended for a wider audience. Writing in the studio should not be limited to designers since others may also be interested in reading. The key characteristic of scientific writing, which is a two-way communication, is clarity. It should be noted that research is not complete until the results have been discussed and communicated to an intended audience. The audience should be able to perceive the validity of what is written. Studio projects are not scientific experiments that need to be communicated to a larger audience. The knowledge a designer produces by engaging in the design process should not be devalued and wasted. Design solutions may address

end-users, but they hardly communicate the obscured constructed knowledge to an audience beyond those users.

Communication through writing has been occurring for centuries. The first journals may have been published over 100 years ago, and the widely practiced IMRaD format used for scientific writing has been adjusted for decades (Day 1994). Scientists of the past used to write and publish more descriptively than analytically before this format got their attention. Among the disadvantages of descriptive writing was the difficulty of assessing what had been used as methods were not explicitly discussed. Today, most journals and academic institutions use IMRaD like formats. Students can adopt this as soon as they start their design process, or the collection of data. Their defining a design problem in relation to the potential user or the program to be facilitated in the design or the context in which the design would be used, could be included in the introduction. They could scrutinize several methods to investigate and collect data before selecting the most appropriate method of study. Also, documenting the reasons for this selection could be extremely useful, so that they could self-assess their design process. The result in their study could be a sketch diagram or a mock-up that would be further tested using other methods. Studio teaching includes interim critiques as continuous assessments to test the progress of students. Those critiques could assess their writing too. Finally, students could compile a discussion based on their constructed knowledge when they intend to communicate through writing. Design studios urge students to conduct precedent studies on products, contexts, and literature reviews as the point of departure. Our studios guided students to document those stages to observe the change of their attitudes to design studio learning.

RESEARCH FINDINGS

Improved student engagement and their enthusiasm to learn an empathetic design thinking approach was the most significant finding by studio teachers. We also noted students collaborating with other students crossing the boundaries of their studios, especially when they were part of the same school. Studio critics noted that research dexterity made students consider themselves as socially responsible professionals. Their opportunity to work with real-world helped them understand the needs of end-users and how to integrate those needs. At the same time, they became more analytical and keener on producing a rationally constructed product over one that is stylistic or esthetically pleasing. Research dexterity strengthened their knowledge base and as such made them more accomplished in producing unique design solutions. It was important to note that more than 80% of students preferred observation and interviews to collect data while over 50% were involved in participatory observation and conducting in-depth interviews. More notably, students used their investigation at different stages of a design task thus continuously involving end-users. Writing dexterity reinforced their design thinking further as their self-assessment became stronger and they did not want to make any vague statements.

Urban design students noted Ethnographic analysis as a germane strategy to study the value system of end-users as it provides with opportunities to working closely with them. They, becoming aware of the challenge of being objective in observing a culture, practiced strategies to respond to those who may perceive a researcher in such a way that prevents from disclosing information. Students shaped ways of perceiving or interpreting information without being tainted by their own values. In studios, they were asked to write about their backgrounds, gender, beliefs, and values, and then to look at others' independent of their own. Students engaged in those exercises to develop their ability to be open-minded in studying end-users, and preferred the critical school for strengthening design approach by evolving a critical attitude to reveal unstated assumptions that are taken for granted in a culture (Van de Lindern et.al. 2016). Design studio teachers and critics noted a clear indication of involving empathy in students' design thinking due to EA dexterity. Students, having noted the extensive time required for EA, made attempts to develop their own techniques by sharing data or using ICT tools to save time. Most notably, urban design students found more in-depth data by using simulations in small samples.

The increasing collaboration among different student groups was a positive sign of research dexterity. Interior design and product design students using Grounded Theory (GT) for small-scale projects and dealing with end-users more closely, used observation and focus group interviews extensively. Product design students also used surveys and prototypes to an extent permitted by their time constraint. Students noted that GT dexterity helping them to fine-tune design thinking to develop a unique product empathetic to end-users, especially when they collaborated with other groups. They developed exercises to work with real-world people outside their confined studios and used unstructured questionnaires to support data collection. Studio critics found that the improved knowledge in categorizing end-users, helped students to produce empathetic designs. Their improved enthusiasm in collaborating and sharing data resulted in considering interior design and product design as an extension of building design.

Architecture students, having already been exposed to Pheromenological Analysis (PA), were eager to learn this method further. They comprehended the evolving patterns of contextual meanings by shedding their own preconceptions, common sense, everyday beliefs, and theoretical assumptions to grasp other's lived experience. PA dexterity generated results that were legible and applicable to a larger audience. Students found that PA's ability to be free from theories allowing them to be empathetic and creative, and noted parallels between EA and PA in focusing on individual meanings and identity within a social setting and enjoyed mingling with potential end-users of their products. Their dexterity facilitated them to combine different methods and using observation and interviews as well as simulations at various stages thus showing improved enthusiasm and collaboration of other students.

Students found that collaborating across their fields was important to understand end-users. They noted how different groups concluded the needs of end-users, depending on their expertise and focus. They also enjoyed going out of their confined studios and working with real-world people and contexts. They agreed that research dexterity gave them confidence to go out and work with end-users. They, as a group, understood the significance of practicing the methods used to collect in-depth data, and mostly used observation and focus group interviews.

It was found that students started revisiting their knowledge construction process and decisions, paving a way to make more rational and thoughtful products after they were encouraged to write their decision-making process. They were inclined to claim final design products as their own and not something guided by their teachers. The aim of design education is to facilitate students developing a design thinking process of their own. This was largely supported by writing. Some students acclaimed that the design process they developed was more important than the products they presented at the end of a design assignment. They emphasized that their cyclic design process could help them designing any product in any context. Studio teachers noted focused design thinking while studio critics, who assessed the design process along with the product, found a marked improvement in students' design capacity. Both teachers and critics noted that research and writing dexterity helping students to fine-tune a design process that they can claim as theirs.

DISCUSSION

The study aimed at integrating research in studio teaching to enhance its pedagogy. It was intended to introduce basic concepts of research methods, data collection and analysis to design studios. It was emphasized that research dexterity is a way of improving students' ability to self-assess their design process and to empathize with end-users. Having selected twelve design studios from programs of architecture, interior design, product design, and urban design, students were exposed to qualitative research methods as their design thinking approaches should include societies and humans (Creswell 2009). Priorities were given to the introduction of research methods while making attempts to convince students to learn academic writing to compile their constructed knowledge. Having documented their investigations and results, students found that it is a useful exercise to improve design thinking. Most importantly, studio teachers found that there is much potential to grow design thinking knowledge if studio teaching were more scientific. Interpreting studio projects as research tasks made students understand the scope and limitations of research space. The vastness, diversity, complexity, and variability of a context, in which students would engage, demanded due diligence to produce unique products, thus needing research. Studios exposed design students to qualitative research methods as strategies to collect and analyze data. Students were informed of the significance of continuing their data collection and analysis through out the design process to produce more empathetic designs.

The relatively low uptake of methods makes it important to communicate to the society how to judge the quality of research through evaluative criteria commensurate with interpretive research. Without explicit articulation of criterion and descriptions of how a study meets these evaluations, there is a risk of being held to standards underpinned by other scientific presuppositions. Students noted challenges and limitations when conducting their research. These challenges included the degree of detail and time it takes to gain institutional human ethics approval, gaining access to an appropriate work site for prolonged durations, the substantial time investment for students collecting data in the field, and developing rapport and trust with participants.

As the contexts in which students produce designs is complex, there were logistical and physical constraints on when to observe or where to be located while observing. Due to the scope of this paper, those challenges and limitations have not been expanded upon. Other topics of interest aligned to observational research that also have not been unpacked in this paper, including commensurate theoretical frameworks and approaches to analysis or ethical considerations. The aim was to discuss observational research as a potential method. Students found examining a phenomenon in context through research unlocking their thinking and scientific writing providing them with an opportunity to formulate a cyclic design process. Their organizational culture, work practices, learning habits, pedagogical spaces, and motivation changed, resulting in focused insights to technologies, materials, events, or processes.

Convincing schools, studio teachers and studio critics to assess writing was difficult as they had been practicing a conventional way of training students to become practitioners rather than thinkers. A few schools turned down the request to run experimental studios as they did not see the usefulness of research dexterity in design pedagogy and did not have time to deviate from their set curricular. Some argued that if students carry a portfolio of written works rather than drawings, illustrations, models, etc., for interviews, their future employers would not be convinced. This study did not cover prospective employers extensively but a few. More than 30% of them were prepared to read about students' design thinking process. They agreed that design dexterity is essential for students and writing completes students' design process, yet preferred employees with drawing skills and software skills as their practices would have to deal with clients.

This study aimed to find how pronouncing a studio project as a qualitative research task could propel students to ask different questions from their end-users or to investigate hidden links in social phenomena within which their products are positioned. It was noted that qualitative research methods that promoted students intermingling with their end-users was a successful way of encouraging their learning.

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IMPORTANCE OF CONSERVING MUGHAL RIVER FORTS AT NARAYANGANJ, BANGLADESH: A UNESCO CRITERIA BASED PUBLIC OPINION ANALYSIS

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ABSTRACT

Preservation of historically important buildings is a growing practice throughout the global North. In Bangladesh, however, public knowledge and support for the preservation of historic places are still lacking. There seems to be an obvious deviation from the UNESCO standard in that, as the majority of conceptual adaptations of heritage protection laws appear to overlook context, values, and history. Law enforcement and structural significance are given greater weight in Bangladesh than intangible aspects like historical impact or regional identity. Its traditional and extinct character, its creative genius and technological triumphs from the past, and, altogether, its remarkable value are all neglected. This leading to a lack of public awareness and inadequate reach for law enforcement. To showcase the Mughal river forts, this article provides two case studies: Sonakanda fort and Hajiganj fort. The first section of the paper discusses the context of the area, local urban identity, and historic relevance in order to define the scope of the study. After then, a comparison was made for heritage protection, between Bangladesh's current legal framework and the global standard. Finally, in order to address and reconcile these gaps in reality, public opinion was sought. Eventually, a few suggestions and recommendations were discovered for upgrading of those antiquated historical regulations, landscape development, environmental policies and safeguarding such urban heritage structures, the majority of which are in jeopardy because of the rapid urbanisation tendency and public awareness.

Keywords: Mughal forts, heritage preservation, local identity, urban context, public awareness.

INTRODUCTION

The locations of every river fort show some interesting significance that establishes an important connection between Mughal history and the greater Dhaka region. They can bring the conception of unique and lost connectivity that they established in a hostile land to light and reveal a straight-line progression, from Idrakpur fort at the south to Dhapa fort at the west, to Beg Murad fort in the east to Jamalpur fort in the north, and other extinct forts at further points of Bengal (Taylor, 1840). These river forts, along with the trade centres, are definitely the witnesses of such an era, which reflects the expansion time of the world's most prosperous dynasty, its conquest and failures in Ahom kingdom, and subsequently, the military strategies associated with defensive shelters in a faraway and troublesome province in innovative ways (Doza, 2015). It also resembles how the Mughal engineering knowledge and technological advancement of north Indian territories inspired road network establishment here and stretched its dominance in the watery topography of Bengal with adaptive communication modes: river forts, bridges and inclusion of strong naval fleets in the army (Ball, 1925). The Mughal Empire's desperate clinch of Bengal was something exceptional for its wealth; such a defence and stronghold strategy was never implemented in any other parts of India, and has no parallel in South Asian history. If Mughals are considered intruders, then their main focus was revenue collection with opportunities

for expansion of the empire and establishing profitable monopolies in businesses like betel leaf, war elephant, slave trade, silk, and muslin (Karim, 1995) rather than the 'well-being' of the local Bengalis. The huge wealth of Bengal needs to be exploited to run a vast empire; scholars believe that 50% of India's revenue was collected from Bengal. The taxation survey of Raja Todar Mal and the climatic survey of Abul Fazl were implemented immediately to achieve the results of new land reformation and annual tax collection according to the local solar calendar by considering agriculture and harvesting times (Heaney, 1968). This period saw astonishing agricultural productivity, rapid Islamization led by Sufi practices, and tremendous population growth in Bengal (Mowla, 2003).

The regional history of whole eastern India was changed due to the presence of these river forts; for example, the Portuguese were driven out of Bengal for the presence of this fort (Sircar, 1971), while the English were able to establish their colony due to the weakening of Mughal influence and the emergence of independent nawabs in Murshidabad, and above all, the question of the extraction of Bengal's treasure trove (Mehta, 2005). Most importantly, Dhaka, the capital city of today's Bangladesh, could not have been a successful and prosperous city without the support of this river fort network, which ensured safety (Mohsin, 1991; Rapson et al., 1937). The city's pro-industrial economy was achieved by maritime supremacy and trade through an obedient feudal system comprised of Hindu landlords where various craftsmen used to gather in tax-free zones of the city core to make the city viable (Mamun, 1993; Dani, 1962).

However, it is evident that not all of the pre-existing Afghan forts, known as Garaz, were converted; only major junctions of the river route were chosen. Once built, captured, and occupied, all acted as strategic expansion posts of the Mughal occupation in Bengal and beyond. These acted as expedition posts to conquer Assam, Tripura, Chittagong, and Sylhet to include the territories with mainland India (Chakma, 2006; Majid, 2016). Also, the Mughals developed a triangle of defence to control the entrance pathway of Dhaka via Khijirpur, controlling a waterway route of mayhem creators like Portuguese and Burmese pirates that connected the Dholai River (mistakenly regarded as a canal today) and the Shitalakshya River as these were the main entry routes of the waterway (Begum, 2002). Today, the major issues that the forts are facing are that reminiscence of all other forts has already vanished, while the existence of major forts is dilapidated due to the lack of public awareness and authority's mismanagement. Hopefully, all of these Mughal archaeological sites could be easily included in UNESCO's World Heritage List as heritage series. Including these forts as a series of monuments in the nomination process for such a list would be a prior recommendation from this study requiring dedicated research (Ahmed, 2023).

AIMS AND OBJECTIVES OF THE RESEARCH:

This first objective of this research is to identify the scope of the effectiveness of UNESCO benchmarks or similarly moulded standards in Bangladesh's local heritage context. Secondly, this study will try to understand how locals perceive and experience the Mughal river forts of medieval Bengal in today's urban context; are they aware of the value, authenticity, and integrity of these forts. Awareness and recognition can help protect relics in the future with public support. Such investigations will help to trace the level of public awareness for heritage conservation in Bangladesh implying attitudes to other similar heritage at risk throughout the country. Finally, to find out key factors and reasons for deterioration and risk in the existing situation of heritage conservation and preservation, the study re-examine the failures and shortcomings of existing law enforcement and heritage management (not economically but strategically) and gives suggestions and recommendations accordingly.

SCOPE AND LIMITATIONS OF THE RESEARCH

The scope of the research is to identify distinguished characteristics and context specifications, to analyse the morphology of the river forts along with the urban fabric in Narayanganj based on public opinion through pictographic survey, and technical documentation. The study tries to eradicate the misunderstandings of current laws for heritage protection and recommends some amendments for future betterment. The benchmark should follow UNESCO criteria, and the concept of authenticity and integrity should be included in Bangladesh's existing heritage laws to upgrade heritage management. Scopes might provide a decent framework for intelligent solutions that will then be similar to global standards, and employment in tourism. The limitation of this research is that it is considering only two river forts in Narayanganj district of Bangladesh to reach a convenient scale of study within a feasible time frame, although there are lots of Mughal forts scattered in the Dhaka region and also in some other parts of this country. It acknowledges that such studies should be conducted on a nation-wide scale to derive the overall consequences of the problem for all heritage sites in the country.

METHODOLOGY

To achieve the first objective, this study will establish a framework for identification and analysis of the article's development; thus, a thorough review of previously available literature will be conducted. Studies from various sources (reviews of related books, previous literature, articles) and field surveys on two heritage sites of river forts in a district adjacent to Dhaka were done. Moreover, UNESCO world heritage listing qualifying criteria, as prime parts of the research technique, will include the main comparing tool for this study. The researcher has conducted a questionnaire survey at both historically significant river forts in Narayanganj using a simpler version of questions generated from UNESCO criteria. Next, for identifying the existing gaps of law enforcement to protect heritages in Bangladesh's situation, UNESCO criteria of 2004 and the National Heritage Protection Law of Antiquities from Bangladesh Government were studied and compared. Finally, to validate the scholars' claims public opinion was obtained through a variety of combined techniques, for better comparison. Additionally, site surveys and documentation helped to find the extent of heritage demolition, vandalism, and encroachment in buffer zones for further analysis. These two river forts were chosen due to their neighbourhood differences: sustaining in rural and urban contexts. Situated in different comparable environments, Hajigonj fort is located in the Narayanganj city corporation area, while Sonakanda fort is in the municipal area, and both forts are separated by the river Shitalakshya.

To achieve the last objective, the study derives suggestions and recommendations, alongwith identifying challenges and threats.

LITERATURE REVIEW

Criteria From UNESCO To Preserve International Heritage

The Criteria for Selection is the benchmark of UNESCO to evaluate any heritage site around the world. For information, there are six cultural (1-6) and four natural criteria (7-10) to be included on the World Heritage List and sites must be of outstanding universal value and meet at least one out of ten selection criteria. These are inscribed below in Table 1 (UNESCO-WHC, 2004).

Now, in this study, questions from 7 to 10 were omitted as the aim is not for dealing with the natural criteria of heritage. It simplified the cultural criteria subjects into easy understandable questions so that the common people can give their own opinions. For example, the 1st criteria subject was formed with a simple question that asked about the creative and genius masterpieces of the Mughals compared to modern days. Similarly, the second criteria were transformed into a simple question to investigate their view about Mughal architecture or technology developments and how exchange of ideas occurred in these heritage. Regarding the extinction of cultural tradition, the 3rd question included uniqueness or exceptional testimony of heritage for fetching

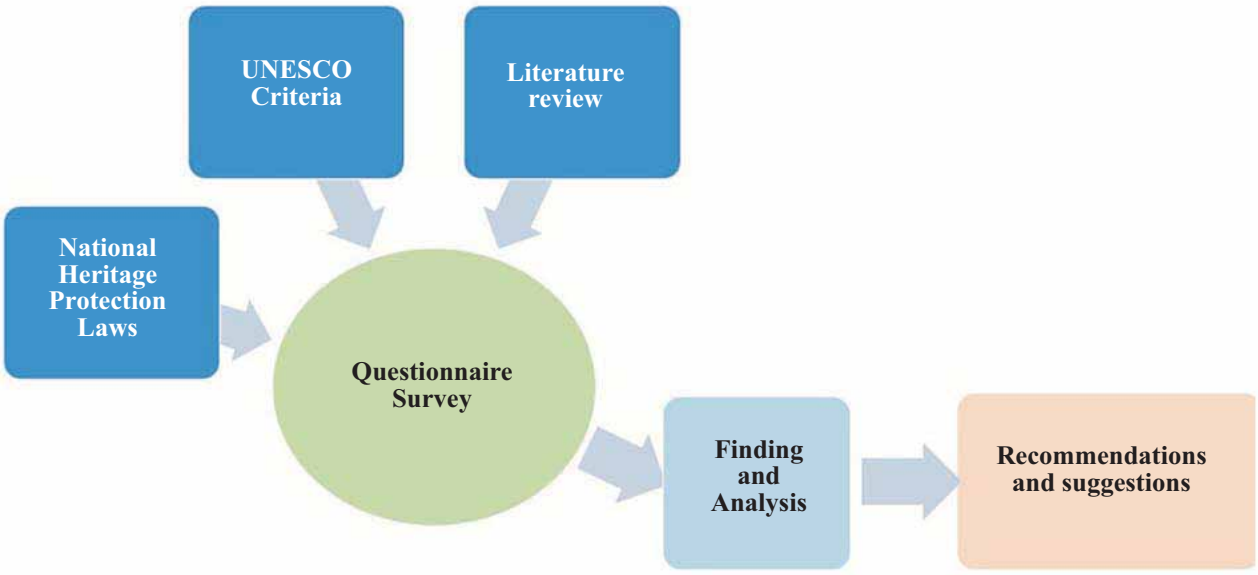

Figure-1: The Methodology Flow Chart of the Research.

Table-1: UNESCO Criteria for Selection of World Heritage Explained in the Operational Guidelines for The Implementation of the World Heritrage Convention at, https://whc.unesco.org/en/criteria/.

Category	Criterions	Potentials
1. Cultural criteria	Criteria (i)	to represent a masterpiece of human creative genius;
	Criteria (ii)	to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;
	Criteria (iii)	to bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;
	Criteria (iv)	to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;
	Criteria (v)	to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;
	Criteria (vi)	to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance (The Committee considers that this criterion should preferably be used in conjunction with other criteria).
2. Natural criteria	Criteria (vii)	to contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
	Criteria (viii)	to be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
	Criteria (ix)	to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
	Criteria (x)	to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

general opinions of respondents according to 3rd criteria. Like this, to derive the outstanding value of the Mughal forts according to 4th criteria, people were asked regarding their knowledge about whether they acknowledge these forts as significant stage of human history or not. For 5th criteria, public opinion was sought for comprehending the significance value of river and waterway routes for the survival of these heritage sites. For the last criteria, which includes living traditions and associated culture of Mughal heritage in relevance to public life, a simplified question was formulated to generate public opinion about whether they are aware of the ideas, beliefs, artistic, and previous literary works of Mughal river forts.

National Heritage Protection Laws in Bangladesh and its Limitations

The Constitution of the People's Republic of Bangladesh's Part II, describes about the 'Fundamental principles of state policy' and its 23 section clearly declares that the state is bound for conserving and protecting the right of cultural traditions and heritage in Bangladesh. It states under the title of National culture: "*The State shall adopt measures to conserve the cultural traditions and heritage of the people, and so to foster and improve the national language, literature and the arts that all sections of the people are afforded the opportunity to contribute towards and to participate in the enrichment of the national culture*" (LoB, 1972).

Under constitution, an Act was regulated to consolidate and amend the law relating to the preservation and protection of antiquities; was published in 1968 in erstwhile East Pakistan. The section 2 (c) of this act, defines "antiquity" with the means- *"Any ancient product of human activity, movable or immovable, illustrative of art, architecture, craft, custom, literature, morals, politics, religion, warfare, science or of any aspect of civilisation or culture*". Additionally, its section 27, gave right to all the citizens to enter historic sites, known as- 'Right of Access' to protected and immovable antiquities. It states, "*Subject to the provisions of this Act and the rules made thereunder, the public shall have a right of access to any immovable protected antiquity maintained by the Government under this Act*". After the Liberation of Bangladesh, in 1976, the same antiquity act remained with the change 'Bangladesh' and its dependent relevant matters (LoB, 1968). During 1986, a gazette was published as the amendment of a draft rule, which indicates that places of worship and shrines must remain their original characters and provides three guidelines for visitors under the draft rule number 6 (Bangladesh Gazette, 1986). Moreover, The Bangladesh National Building Code, 2006 stipulates in sections 1.5, 1.16, and 3.8 that structures and locations with historical or architectural significance ought to be preserved. This regulation also stipulates that a building must have been in use for at least 20 years after it was finished. According to Chapter 3 of the Bangladesh National Building Code of 2012, the rehabilitation, regeneration, and adaptive cultural reuse of urban, rural, and architectural heritage must be compatible with the sustainable use of natural and human resources. Additionally, it specifies that the approving authorities must establish a buffer zone next to the heritage building that is at least three metres wide and free from any construction or establishment of comparable types in the surroundings (Talukdar; 2010).

State of the problem: Urban heritage

Constructed heritage conservation is an idea, it proposes future construction that combines both conservation of the old and modernity in their use. Preserving ancient urban contexts with unique character derived from physical, sociocultural, and historical features—all are parts of cultural antiquity. These integrate the settings, and were rooted in historical evolution, thus include various aspects: terrain, natural components, resident customs, streets, hedges, buildings, present uses, place names, monuments, and archaeological sites (Rifaioðlu and Neriman, 2007). For the importance of urban heritage, a conservation management plan ought to be in place and action, so that it can serve as a roadmap for the upkeep and usage of historically significant sites in the cities. Going forward, they may include guidelines for any new construction (Avrami et al., 2000). In Bangladesh, historic preservation is not effectively practiced, and the relationship between a historic building and its urban surroundings is generally disregarded, not recognised or utilized and even ignored (Ali, 2008). As a result, in developing countries like Bangladesh, preservation methods prioritise appearance and use over the true local context and spirit, which is the opposite trend if compared to the Western world. Urban heritage faces various challenges if they are disturbed and cannot preserve their proper meanings to convey in particular urban contexts, as both its 'closeness' (architecture itself) and its 'openness' (spatial relation to surrounding urban spaces through inlaid landscape) many make it 'inactive' and fraught with challenges due to suffocation (Bhuiyan, 2016).

Mughal fortification heritage mid-Bengal

Why did the Mughals come to Bengal? Bengal was the wealthiest province of India, called 'Hell full of divine gifts', however it had a very rebellious character. Due to its geographical isolation, six month-long monsoon, and sudden flood-prone topography, it was the most costly and well-waited land to be conquered by the Mughals. Although, Emperor Akbar the Great won the decisive Rajmahal Hills battle with the last Afghan ruler of Bengal, Daud Khan Korrani, in 1575; the rest of the 12 landlords made it very difficult for them to penetrate the whole country. The Mughals learned how to enrich their naval fleet and win battles without horses in Bengal. It took nearly another century to grab their stronghold, and it is said that 1610 was their real victory berth when they were able to establish their capital in Dhaka and appointed their first Subedar, Islam Khan. Bengal did not frustrate them, as it provided nearly half of the Mughal Empire's total revenue during its peak time of power. Thus,

Figure-2: Akbar Praising to Almighty on the Occasion of Bengal Conquest, Mughal Miniature.
Source: Alamy.

to consolidate their power, they decided to build river forts in Bengal (Karim, 1995; Sirkar, 1947; Stewart, 1971).

These Mughal forts are situated mainly in modern districts like Narayanganj, Munshiganj and Dhaka. It is critical to comprehend how Bangladesh's river forts differ from those in other regions of North India (AHB, 2011). However, all other Mughal forts in northern India included residential units and thus, were called palace forts. But in Bengal, only Lalbagh was designed according to residential purposes, while others were just kept for the chain of defence. If materials are considered, stone was used in the structure of Lalbagh Fort (especially in arches) which is a palace fort—as casting materials to add strength to its masonry's brick core. Lalbag is also unique, as the whole complex of walls assumed the character of battlemented parapet, which is not present in other Mughal defence buildings in northern India (Doza, 2015). Several important defence functions, like bastions and elements like the elevated artillery drum, were also introduced to these river forts to facilitate clear vision. Sometimes, towers were erected near the riverside for better observation. But in Idrakpur fort and Hazigonj fort, all of which have cylindrical bastions over circular bases, which are very exceptional practices for Mughals. Both the Lalbagh and the Sonakanda forts consist of polygonal bastions. But the difference is, riverfront bastions are comparatively bigger in form, and the bastion on the land side is a bit smaller (Alam and Polin, 2022).

A unique example of river fort is Idrakpur fort, at Munshiganj; as it has a pond inside the complex and the whole building is made of brick walls. Perhaps bricks were made using the excavated earth from the pond digging. Additionally, its bastions are uncommon and round in shape. Moreover, the basement chamber could only be found in this fort, not elsewhere. Situated 15 miles from south-east corner of Dhaka city, on the bank of the Ichamati River; this fort was a later addition to the network and it might have been built by governor Mir Jumla (Dani, 1962). With the capital moving from Dhaka to Murshidabad in 1717, the construction of river forts and other defences in eastern Bengal was mostly discouraged by rulers, if not; absolute shut down of further development. It highlights, the final element in this network of river fortifications was Idrakpur fort (Begum, 2002).

CASE STUDY 1: HAJIGANJ FORT

This fort is located in Hajiganj in Narayanganj on the western bank of the Sitalakshya river and is also known as Khizrpur Fort. It was originally constructed as a water fort, where the old Buriganga river meets with Sitalakshya river. It might have been constructed shortly after Islam Khan founded Dhaka as the Mughal capital in 1609 AD. It was designed as a countermeasure against the Harmad (Portuguese) and Magh (Burmese) raids (Khan, 2012).

The quadrangular fort is made up of a pentagonal curtain wall with rounded corner bastions that is machicolated deliberately for muskets. A rampart walkway rising to a height of 1.22 metres is located on the inner side of the curtain wall. The base of the wall is itself punctured by several musketry holes. There is a stairway leading up to the rampart level within each corner bastion, and the merlons have bigger openings between them for gun firing. A free, tall, square brick column in the corner of the fort quadrangle

Figure-3: Hajiganj Fort, Narayanganj, An Exceptional Shape.

was, once a watch tower. This column's existence connects the fort's myth, for having an underwater connection with other historical water forts around this region. One of the fort's key features is the elevated platform where cannons can be placed. The fort's lone and detached little entrance to the riverbank side implies that the river served as a primary means of communication. The rectangular structure covering the pentagonal doorway has etched rectangular arches on both sides. Lotus finials are used to embellish the top of that gateway. The absence of any other building within the fort suggests that its occupants and soldiers utilised tents as a makeshift dwelling during the war and this fort was only used during the rainy season probably, when pirates were anticipated to raid (Khan, 2015).

CASE STUDY 2: SONAKANDA FORT

Near the Hajiganj fort, on the eastern bank of the Shitalakshya river, is a Mughal river fort called Sonakanda. It appears as though Mir Jumla is credited with founding this fort but no other inscription or proof of its date has been discovered yet. It is clearly a mid-17th-century fort, evidence based on stylistic parallels with other Mughal river forts in and around Dhaka, it could be estimated (Iqbal et al., 2023). The defence wall of the fort is 3.05 metres high and 1.06 metres thick. It consists the enormous artillery platform, which has inner and intermediate bastions and is quadrangular in shape, spanning 86.56 metres in width and 757 metres in length. Four corner bastions are prominent features of this river fort. The bastions of this fort are octagonal in plan, in contrast to those of the forts at Hajiganj and Idrakpur. Thus, this fort is unique by its own, without any moats like Jangalbari fort of Kishoreganj (Jahan, 2021).

Figure-4: Sonakanda Fort, the early model of river forts.

Additionally, a five-foot arched entrance leads to a circular artillery platform with a stairway on the west side. These platforms were a novel element of the Mughal river forts in Bengal; they could easily house a large calibre cannon directed towards the assailants emerging from the river. The platform is comprised of two circles, the inner circle measuring 15.70 metres in diameter and the outer circle measuring 19.35 metres. It is encircled by high walls those stand 6.09 metres tall. With a diameter of 4.26 metres for the eastern wing and 6.85 metres for the two others on the western wing, the corner bastions on the western wing's two sides are larger than those on the eastern wing. The fort consists of two main sections: a massive rampart wall that is reinforced by several narrow and broad openings. The other, and most significant, component is an elevated outwork on the western face. In the court, there is no permanent structure other than the artillery platform. The walls all around averaging one metre in height, machicolated merlons crown its upper portion. There is only one entrance gate to the fort which is situated on the north side. Some scholars describe the entrance gateway's tall arch used to have four centres, which gives better options for observing the enemies in water ways. Plastered from inside, the arched doorway features many plastered panels on both sides of a rectangular frame (Begum, 2015).

It is also thought by the scholars that Sonakanda fort served as a model for the remaining forts; it was just an ideal and practical shape for all Mughal river forts of Bengal. Sonakanda has an additional circular form in front and is a large rectangle. Canons are altered using this circle. There are four octagonal bastions at each of its four corners. This brick building set common benchmarks for river forts: the symmetric arcade gate with its high stairs, central courtyard, bastions at each corner, altars and plazas for cannons, watch tower, and thick wall formed of perforated merlon. The merlon units of the walls have same height but varying widths. The rectangular panels made with a half circle above the rectilinear arcade planes at the entrances are seen as a typical ornamental element shared by all the Mughal forts, signifying their royal qualities. There are also some patterns resembling "petals of lotus" on top of the parapets (Begum, 2002). So, it could be easily said that Afghan forts, called Garaz; have been influinced by the Mughals during 16th century such as their single elevated entrances, through main portals and silhouettes embellished with merlons (Doza, 2015).

QUESTIONNAIRE SURVEY

A structured questionnaire was used to survey the population in order to generate primary data. These questions were meant to gauge the respondent's viewpoint regarding the importance of prioritising different subjects (historic elements in the urban context) for grabbing the public opinion (about preservation of historic structures) for any research (Ruslin et al., 2022). They were to assess their relevance by using a ‘provided number scale’ that went from "not important" to "very important" for evaluation, provided print copy of the questionnaire with Bangla translation. The sampling strategy was random; respondents were asked suddenly whether they were willing to answer these questions or not. A total of 25 people were interviewed in each case study area. The participant parameter mostly included the locals of the neighbourhood and tourists from distant city quarters coming for afternoon and evening walks; most of them were found to be residents of the same district, Narayanganj, but only 4 persons came from capital city, Dhaka. It means, not that many tourists from the rest of the country value these historical monuments. Only an exception was found in the adjacent tomb of Bibi Mariam of Hajiganj Fort, where 5 people were interested in giving answers. This was due to their illegal accommodation and settlement in a heritage site, and their fear of getting uprooted. They maybe are considered dependent on this heritage site as they were occupying it for living. Only 3 persons were bachelor degree holders; one was found in Sonakanda Fort, and the rest two were found in Hajiganj Fort for this survey; the rest were either students or school dropouts who work in lower-status jobs, aged above 45. The age of the respondents was in the range of 18 to 65. Total 40 men and 10 women were interviewed in two sites, result was prepared considering the total number as 50.

The interviews took place in public areas around Hajigonj Fort in Narayanganj City and Sonakanda Fort in Bandar Municipality on a random basis. 25 people were interviewed on each site; all were over the age of 18. The distribution of the questionnaires was also done randomly, based on their willingness and interest. The objectives of the survey were explained to the respondents first, before any questions were asked to them. The inhabitants' perception for the significance of various preservation attempts regarding historic structures in various urban contexts; is shown in Table 1. The term heritage building is referred to here as "the river forts." Most importantly, the intenational UNESCO criteria was connected to local interpretation; they were explained simply to outline general people’s understandings in simple language.

Moreover, the purpose of this survey, in this study was primarily to gain insight on the public sentiment about Mughal heritage and their proper conservation and protection. Recently, in December 2022, a Mughal bridge dating from 1740 was demolished for the sake of rural development by the Local Government Engineering Department (LGED) of the Government of Bangladesh at Golapganj of Sylhet (The Daily Star, 2022), and a sudden attack on Boro Katra, a Mughal caravan Sarai dating from 1640, was partially demolished by a private owner who got a lease for 99 years from the Capital City Development Authority (RAJUK) and is currently an adobe for 2000 illegal people occupying its different parts (The Daily Star, 2024). These two alarming incidents ignited great controversy and debate among heritage scholars about the responsibility of government officials and how Bangladesh could protect its Mughal heritage in future. This study's questionnaire survey aimed to outline public opinion of whether they know about Mughal heritage and it they recognise their historical and tourism values. The process included random questionaire of inhabitants and tourists, cover ingrauous category of gender, age, social, local, and educational status. During the survey, there were some unavoidable limitations. People felt shy to answer, and especially, hesitant to talk about the encroachment of heritage property, as the politically powerful leaders and

corrupted government officers may be supporting these actions. Many people also did not know what heritage is or whether it is important for conservation, and for some, demolition is expected, as they believe the old buildings are inhabited by ghosts, so it's good to knock them down! Most of them did not know the real history; rather, they liked to make their own exaggerated stories without any logical base.

After that, it is important to understand that, for any property that may be included on the prestigious World Heritage List, the World Heritage Committee of UNESCO wants to know about the heritage's current state, which should meet one or more of their inscribed main criteria. The UNESCO list of criteria are the basic 10 benchmarks to evaluate any heritage internationally. Criteria 2 and Criteria 4 are more important for this study, as UNESCO put all these river forts on its tentative list on May 17, 2023; on the basis of these two important criteria, public opinion was sorted. This study will try to mould the questionnaire according to the shadow of UNESCO criteria so that we can identify lack of awareness of general people corresponds with the intellectual point of view coming from global context, the public responses were tabulated in table 2.

FINDINGS AND ANALYSIS

The built elements of the river fort sites and the logical interaction between their location and accupants are undermining the historical essence of the overall area. The relationship between the river forts and the surrounding landscape, its boundary properties, the outstanding value, and the creative ideas and technical advances behind all these heritage structures are fading. It is as a major threat to their authenticity and integrity. Most importantly, this will be a problem for including them in the World Heritage List (WHO List) of UNESCO. For that, public opinion

Table-2: SurveyRespondents in Two Mughal Forts of Narayanganj District.

Criteria Number	Questions	Degree of significance				
		Not Important	Slightly Important	Neutral	Important	Very Important
1	Do you think it's a masterpiece? Were Mughals more creative and genius than modern days?	16%	7%	50.5%	25.5%	1%
2	Does this fort show interchange of developments in architecture or technology?	12%	15%	62.5%	5.5%	5%
3	Does this fort show interchange of developments in architecture or technology?	10.5%	20%	37.5%	30%	2%
4	Is it an outstanding example of a type of building which shows significant stage of human history?	50%	12%	20.5%	6%	1.5%
5	Does it represent the culture that includes an outstanding example of a traditional river use?	10%	15%	25%	30%	20%
6	Is it relevant to public? Is it anyhow related to your living traditions, with ideas and beliefs, with artistic and literary works?	5%	10%	30%	45%	10%
7, 8, 9, 10	Not relevant to river fort heritage and public opinion, thus were omitted during the field survey (only for natural sites).	0%	0%	0%	0%	0%

regarding advantages and disadvantages between the heritage buildings and the surrounding landscapes are major conflicting aspects. Because the approaches to encroach heritage lands rather than protecting the "spirit" of such urban heritage are conflicting. For Mughal river forts, identifying and maintaining the essence of the local contexts seems to be the most important challenge due to lack of public awareness. Vandalism is the most threatening aspect that was found in field survey. Another example is, the archaeological department's negligence in protecting the watch tower at Hajiganj Fort brings out their lack of responsibility. It was found that school students were dismantling the whole staircase of the Mughal watch tower, for playing cricket matches every evening, using bricks instead of wickets! It is a necessary recommendation that students of schools in early childhood learn how to protect and respect heritage from their cities to develop public and collective awareness for conservation and preservation.

Thus, public awareness is identified as a major threat in this study. As per the statistics of field survey, 50% of the respondents opted for 'not important' when answering the question related to historical connection and outstanding universal view, which comprises the motto of criterion 2, the site that UNESCO already included in their tentative list. This finding is shocking, and it implies that people don't care about heritage around them and may be directly involved in vandalism or encroachment on its surrounding land if they get the chance. They are also transferring these ideas to the next generations. For the question of another vital criterion, which is criterion 4, related to architectural value, human achievement and creative genius of past, most respondents remained 'neutral' with 62.5% people not caring about it.

The antiquity acts of 1968, 1976, and 1986 have secured the status of heritage, fortunately. But these acts do not include the UNESCO benchmarks for this nation's 'protected' heritage, causing confusion for law enforcement and

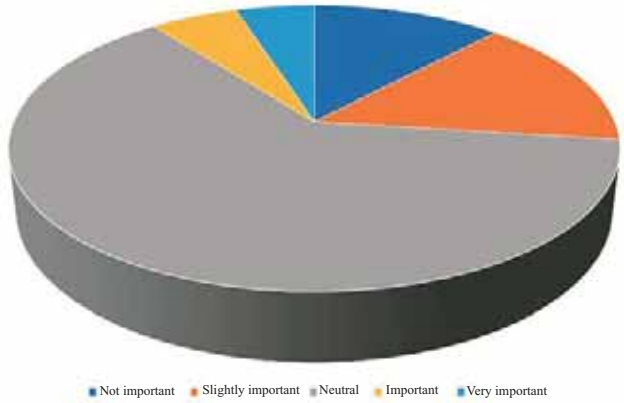

Figure-5: Criteria 2: Architectural Achievement of the Post.

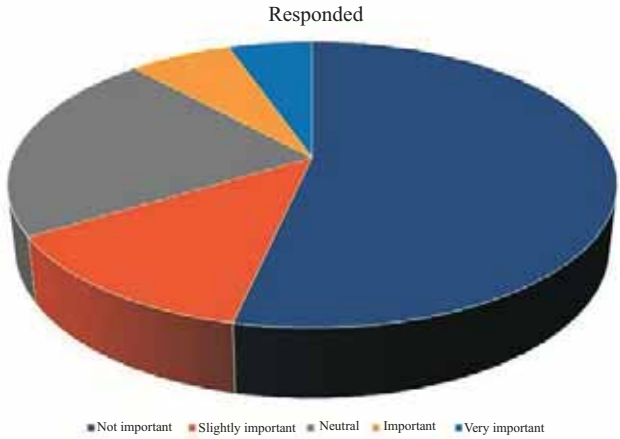

Figure-6: Criteria 4: Outstanding Stage of History.

Figure-7-8: Graffiti Art on Heritage Wall (Left) and Corner Bastion Converted as Dustbin (Right) at Sonakanda Fort, Bandar Upazila, Narayanganj.
Source: Tarik Sajib, 2022.

Figure-9-13: Criteria 4:

Poor People Started to Live in Heritage Complex (Left Top),

Corner Bastion Converted to Police Station and Commercial Retail Storage (Right Top),

School Going Students Taking Bricks of Watch Tower for Playing Cricket (Middle Row) and

Dumping Household Wastes in Front of Entrance (Bottom) at Hajiganj Fort, Narayanganj City Corporation Area.

Source: Md. Afnan Hossain

implementation of protection endeavours. The 27-section of the 1968 Act preserved public accessibility for entering heritage through its 'right of access' was something hopeful. Its section 2 (b) gives a definition of "ancient": means belonging or relating to any period prior to the preceding hundred years. This is not a good and empirical definition at all. The 1976 Antiquity Act was actually a direct improvisation from the 1968 Act. Not much was added in the new rules; only the word 'Pakistan' was substituted with 'Bangladesh' as was evident and unavoidable because of

the country's independence. The question is, why was the local context of heritage preservation not introduced in replacement? Additionally, the 1986 Act included some draft rules only, and its point number 6 derived some guidelines for visiting religious heritages! In all these acts, concepts like authenticity, integrity, and outstanding national value need to be included to comply with international standards according to ICOMOS, Nara and Venice Charters and global requirements with adequate principles for analysis, conservation, documentation and structural restoration of all architectural heritage of the country. This should also follow the Global Mandates to support the protection of cultural heritage of all types: movable and non-movable heritage (ICOMOS, 2003). It is now a pressing demand of time that an own National criterion for Bangladesh's heritage is generated, following the guidelines and basis of UNESCO criteria.

Comparison of survey data, public opinion, and insufficiency in heritage law or lack of updates in such laws related to heritage preservation, highlights that pragmatic solutions to fill these gaps seem like a far cry. Meanwhile, most of the heritage in cities may be knocked down in time, and the authority may not have enough proofs and any legal basis

Figure-14: Map of Greater Dhaka Region in 1778. Prepared by James Rennell. It shows Dhalaj Canal connected Demra with Postagala.
Source: Tarik Sajib

to protect them in future due to the absence of contemporary criteria concepts for the preservation of heritage, as existing national laws are not sufficient. In the future, especially in urban areas, there will be no private heritage left for future generations and public heritage will be further dilapidated. Bangladesh as a nation of ancient civilizations with various layers of historical period will be at an enormons cultural and historical loss.

SUGGESTIONS AND RECOMMENDATIONS

In recent years, the Bangladesh government has taken initiatives to revive its canals in urban areas, which are filled due to rapid urbanisation and mass pollution of waterbodies. The act for protecting natural drainages was introduced in 2000 and is called the Water Resources Conservation Act. It states, 'Natural wetland' means the place declared as flood-flowing land as any river, canal, depressions, pond, stream, or fountain indicated in the master plan by the government gazette or any flow of water, and such kind of land that conserves rainwater should be re-included in the context. The Hatirjheel water reservoir project in the heart of Dhaka city was a very successful and epoch-making incident for such an urban canal re-excavation project. This re-excavation was possible because of the implementation of that act. It was monitored through the joint venture of

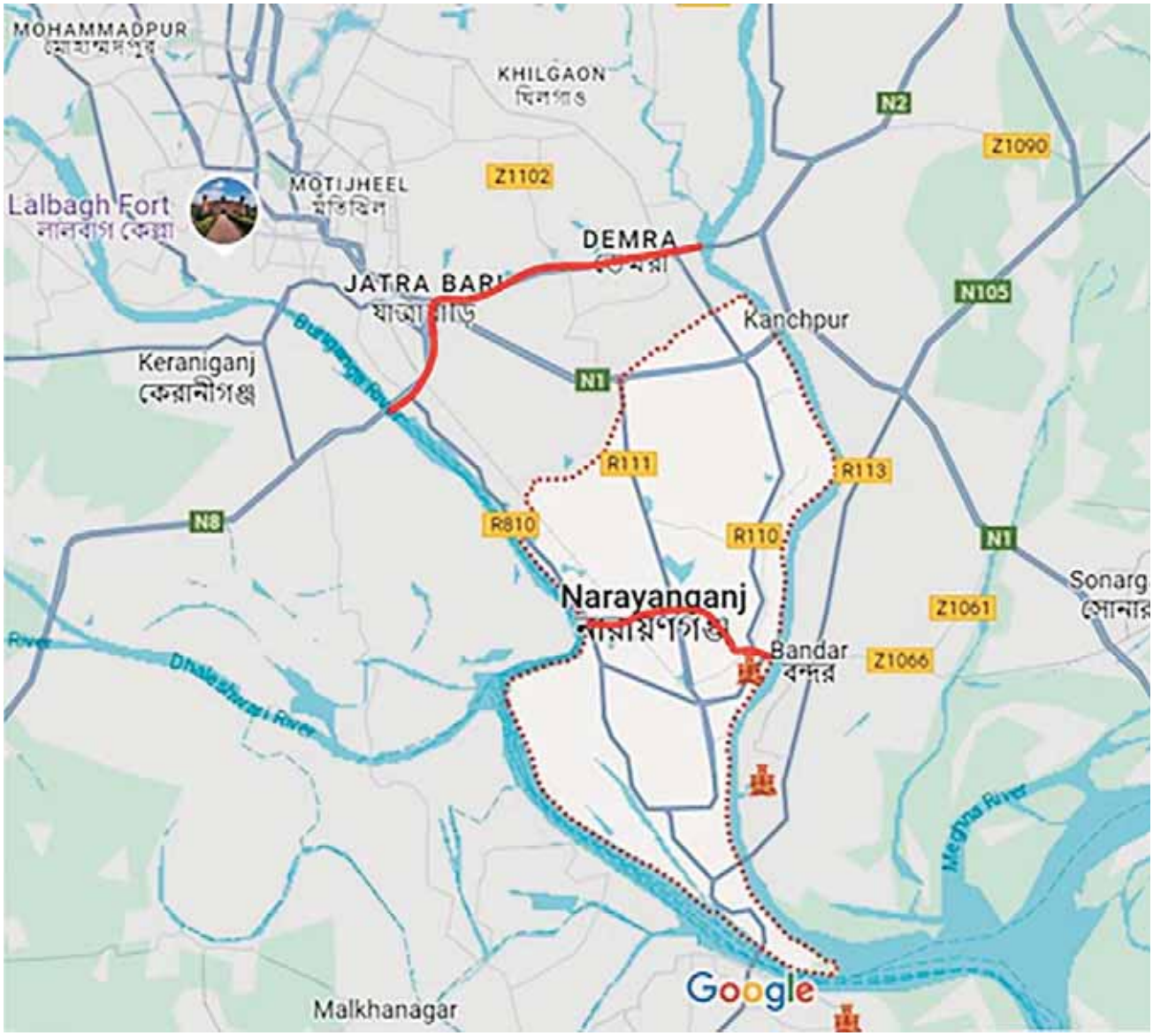

Figure-15: The two Mughal water routes, extinct today; should be re-excavated to integrate Mughal Heritages of Greater Dhaka Region.

various state parties, foreign aid, government authorities, and other stakeholders. The surrounding area benefited from it largely; there is no water flooding in the streets, and it is working as a vast retention pond in the middle of the capital city for its natural drainage system and regenerating wetland around it. Waterway was re-established and inhabitants are using water taxis as alternative to roads which are less time consuming compared to road communication as streets of Dhaka are full of traffic congestion (Ahmed, 2017).

Such a great example could be implemented to revive the historic waterways of two ancient Mughal navy routes, from both touristic and environmental purpose. These are the historic routes like Dholai canal (Tarabo to Postagola via Demra) and an extinct canal (Hajiganj to Fatullah) which were traced so far (Khandakar, 2012). Once excavated and acquired properly, a heritage trail of the waterway is possible to reintroduce where foreigners may get a chance to ride on traditional Bajra (Burges) vessels and have snacks like Bakarkhani (well-preserved and dried bread), staying in tents during nights with Mughal lifestyle. The Mughals used to stay in tents on their way to Dhaka from Delhi and vice versa during 16th century. Such a proposed heritage trail could be transformed into a good tourist hub, and Bangladesh may earn a lot of foreign money by providing cutting-edge touristic facilities and heritage tours. This is how environmental issues might help to integrate the historic monuments of Dhaka from a single platform. Such invigorated stimulation and flourishment of economically vibrant tourism definitely need sustainable strategies from environment and heritage specialists together, if the government wants to make options for good revenues.

CONCLUSION

Bangladesh's heritage regulations are found insufficient, and the concept of conservation is non-existent knowledge in public realm. In urban settings, the problem is more acute. For historical preservation, raising public knowledge for connecting heritage buildings to their local urban context is essential for its survival. The majority of the nation's heritage protection laws focuses on old buildings and their material aspects, with little attention paid to the surrounding intangible contexts. These are essential as worldwide criteria for assessing any heritage. Such approach includes things like exceptional qualities, creative brilliance, or technological advancements in human history, which is absent in the general vocal people's understanding. Moreover, due to increased urbanisation, historically important structures are likewise receiving little attention and are increasingly vulnerable to vandalism and demolition due to unplanned development. Furthermore, if residents are aware and educated, the relationship between social context and historic buildings can show how urban environments can be changed, environmental features like waterbodies, rivers and canals can act as conservation instruments, proving economic sustainability via heritage and eco-tourism. According to this analysis, the Mughal forts are historically significant buildings that can preserve the authentic essence of the greater Dhaka region. This study outlines the gaps and failures in current practices between local urban context, public opinion and heritage restoration. Combining these factors together in accordance with UNESCO standards may create a cultural enlightenment for the nation.

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EXPLORING ROOF STACKING IN EXISTING BUILDINGS TO ACCOMPLISH SUSTAINABLE ARCHITECTURE: A CASE STUDY APPROACH

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ABSTRACT

The main challenges confronting the global community includes environmental degradation, resource depletion and population growth etc. These challenges are posing a significant threat to human life at global scale. The positive impacts outlined in the Agenda 2023 are strategically designed to address the aforementioned concerns, recognized as the root causes of numerous challenges. Among these challenges, urban sprawl stands out as a critical issue requiring sustainable solutions. Upgradation in the context of constructing on top of existing structures (roof stacking) is more desired sustainable approach to make cities sustainable and resilient. Roof stacking (RS) can be a good response to the rapid urbanization of city centers and can reduce large urban footprint and higher levels of CO2 emissions. This research is based on exploratory method to find the parameters that makes roof stacking an efficient and sustainable approach. The study reviews previous literature on the roof stacking of historic buildings, establishing a set of standards through content analysis, for evaluating three particular buildings (Irving Street Brewery in Australia, Hearst Tower in United States of Amercia and Fahle House in Estonia) as case studies. The research analyzed the seven key aspects of sustainable architecture as examined in the article are heritage, technology, materials services, form, fenestration, and access. The findings demonstrate that, while each of the three cases is distinct in design, all successfully integrate the old with the new by adhering to the seven performance parameters. This approach contributes to achieving sustainable architecture, highlighting roof stacking as a viable and effective strategy for addressing urban sustainability challenges.

Keywords: Sustainability, roof stacking, sustainable architecture, existing buildings, old structures.

INTRODUCTION

A multitude of challenges is converging in the world today, posing a threat to the fundamental existence of mankind. In this context, the Sustainable Development Goals (SDGs) presented by the United Nations are of paramount importance, as they comprehensively address the problems that the world is currently grappling with (Jensen, 2022). The 11th Sustainable Development Goal emphasizes the imperative of making existing cities safe, resilient, and sustainable. It can be deduced that ensuring the sustainability of cities is a pressing need in the current times. Numerous challenges are posed in the endeavor to make existing cities sustainable.

Primarily, one of the issues faced by existing cities is urban sprawl. Ongoing research is dedicated to exploring strategies for achieving sustainable urban densification. Among these strategies, roof stacking stands out as a viable approach to enhance the sustainability and resilience of both cities and buildings (Amer & Attia, 2017). Roof stacking has been

proven to reduce energy consumption by 17% (Amer and Attia, 2019).

Roof stacking is a strategy utilized to increase urban density and cater to the escalating requirements of urban communities. It entails constructing extra floors atop the existing buildings' rooftops . Roof stacking, with its long history primarily in European cities, has proven to be a sustainable strategy for accommodating people . Following the COVID-19 pandemic, there has been a heightened importance placed on adding floors to the rooftops of existing buildings. The demand for usable space within buildings has shifted, leading organizations to seek additional office floors to accommodate social distancing measures . It can be concluded that roof stacking offers a sustainable solution across various aspects.

Secondly, existing cities often have a significant number of old buildings in their inventory (Pitarch et al., 2020). These existing buildings are consuming a significant portion of a country's energy worldwide (Hwang and Tan, 2012). Sustainability cannot be solely achieved through the design and construction of new, greener, and sustainable buildings. The impact of a newly constructed green building on sustainability takes time to materialize. It is estimated that a new building can demonstrate energy savings and its influence on sustainability after a time span of approximately 26 years, as opposed to utilizing existing buildings (Che Husin et al., 2019). The building sector accounts for 40% of global energy consumption. Despite this significant percentage, there are ample opportunities for reducing emissions on a large scale within this sector (Hwang and Tan, 2012). In brief, the sustainable upgrading of existing buildings offers numerous advantages and plays a key role in enhancing the resilience and sustainability of cities.

It can be concluded that upgrading old buildings stands as a sustainable approach to making existing cities more resilient and sustainable. To address the growing needs of the population, roof stacking emerges as a sustainable strategy for enhancing existing buildings, presenting a preferable alternative to new construction. Moreover, this method aligns with the principles of resource conservation and urban sustainability, contributing to a more environmentally conscious and adaptive urban landscape.

This research centers on the concept of roof stacking as a sustainable approach for the gradual improvement of existing buildings. Building professionals should prioritize recent data and techniques to make informed decisions, given the heightened awareness about sustainable development, in order to contribute to the overall sustainability of buildings (Hwang and Tan, 2012). As mentioned earlier, the refurbishment or upgrading of energy in existing buildings represents the future of a sustainable building approach, primarily because existing structures constitute a significant portion of the built environment. Roof stacking has been identified as an effective strategy in this context (Knippers and Speck, 2012).

The research concentrates on the factors contributing to roof stacking in existing buildings to achieve sustainability. The study aims to achieve the following objectives:

- To identify various performance parameters that impact the ability to enhance old buildings with sustainable architecture and energy performance.
- Exploring and investigating the sustainable architecture and key aspects that make existing buildings sustainable.

MATERIALS AND METHODS

This study employed an exploratory approach to achieve specific objectives, utilizing a methodology grounded in theoretical case studies. The study's scope involves conducting a literature review as the first step to identify performance parameters for the sustainable enhancement of existing buildings through roof stacking. The research then advances with an analytical examination of three chosen cases, aligning with the parameters identified in the literature review. The analytical study culminates with an explanation of how the integration of new and old features contributes to the sustainable upgrading of existing buildings. The research concludes by identifying key variables that must be taken into account in the sustainable upgrading through roof stacking of existing buildings, utilizing an exploratory research approach. Figure 1 shows the framework of research.

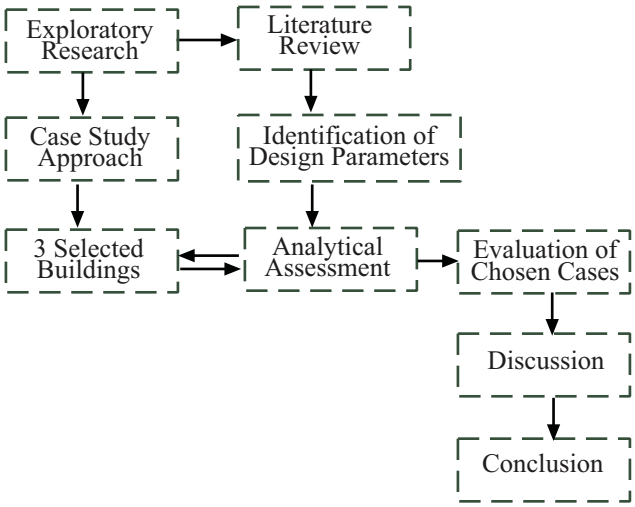

Figure-1: Framework of Research.

RESULTS AND DISCUSSIONS

A Performance Parameters of Roof Stacking to Achieve Sustainability Through Literature Review

The following matrix illustrates the breadth of the literature examined in order to identify important aspects related to building on top / roof stacking of already-existing structures. The first step of the data collection ends with the establishment of criteria to assess the 3 selected cases.

Existing literature plays a pivotal role in exploring the diverse factors that need consideration during vertical extension of existing buildings to attain sustainability. Key aspects emphasized include materials, technology, heritage preservation, services, and the seamless integration of old and new elements, with specific attention to form, fenestration, and access. The initial aspect delved into is the adoption of energy-efficient and sustainable technologies for the upgrading of existing buildings (Maclean, 2012). Climate-friendly features such as thermal insulation in roofs and walls, laser, and prismatic panels, owing to their capacity to enhance comfort and energy efficiency, fall under the category of sustainable technologies (Cutler et. al.,2008).

The architectural legacy of any building should be protected while adding extra floors on the roofs of existing buildings (Maclean, 2012).One way is to design new structures with elements, features and structural components that complement old buildings (Busch, 1991). Heritage and sustainability have a strong relationship and go hand in hand due to fact that some buildings and places bear the heritage value beyond their architectural significance.

Material selection is important aspect in achieving sustainability and providing stability to buildings technically (Busch, 1991). Selection of green materials require the qualities of strength, moveable and detachable components (Roth, 2012). Lighter materials are preferred while roof stacking like steel and glass (Peck, 2008).

Services have been identified as a crucial component of sustainable architecture, and it is recommended that architectural divisions should be separated for warmth, venting, and climate control. Moreover, all hydrocarbons must be categorized in accordance with its end use, energy consumption must be at least 90% (Cutler et. al., 2008). Moreover, installation of automatic meter readings is mandatory to evaluate energy performance (Arango, 2011).

Integrating the new structures and components with old ones is a challenge and in most cases, is not achieved in ideal manner (Andreescu et al., 2016). The conjunction is necessary to achieve the optimum relationship between the ancient and new buildings, especially through emphasizing aspects like architectural fenestration, shape, and access. Increased prevalence is the term used to describe how openings, primarily windows and doors, are arranged on a building's façade. Good daylight design greatly benefits from thoughtful fenestration opening orientation or layout (CHPS, 2002).

Table-1: Matrix of Aspects Revealed Through Literature Review.

Books	Key Aspects						
	Access	**Form**	**Fenestration**	**Heritage**	**Materials**	**Services**	**Technology**
Maclean, A. 2012. *Up on the Roof: New York's Hidden Skyline Spaces*. Priinceton Architectujral Press	●	●	●	●	●		●
Peck, S., 2008. *Award Winning Green Roof Designs*. Schiffer Publishing.	●	●	●				●
Busch, A. 1991. *Rooftop Architecture - The Art of Going Through The Roof*. Henry Holt & Company.	●			●	●		●
Bloszies, C. 2012. *Old Buildings, New Designs*. Princeton Architectural Press.		●		●		●	
Roth, M. 2012. *Roof Architecture and Design*. Braun Publishing				●			●

Journal Articles	Key Aspects						
	Access	Form	Fenestration	Heritage	Materials	Services	Technology
Bose, S and Sarkar, S. 2015. "Top Floors of Low-Rise Modern Residences in Kolkata: Preliminary Exploration towards a Sustainable Solution," *Current Science*, 109, No 9(2015): 1581-1589.				●	●		●
Hwang, B. G., and Tan, J. S. 2012. "Green building project management: obstacles and solutions for sustainable development," *Sustainable development*, *20*, 335-349.				●	●		
Knippers, J., and Speck, T. 2012. "Design and construction principles in nature and architecture." *Bioinspiration and biomimetics*, *7*, No 1, 015002.	●	●	●	●	●		●
Andreescu, I., Gaivoronsch, V., & Mosoarca, M. 2016. "Old and New – the Complex Problem of Integrating New Functions into Old Building," Procedia Engineering, 161, 1103-1108.						●	●
Cutler, B. et. al., 2008. "Interactive selection of optimal fenestration materials for schematic architectural daylighting design." *Automation in Construction* 17, No. 7: 809-823.	●		●		●	●	●
Kwon C., 2013. "Form or performance in sustainable architecture," *International Journal of Sustainable Building Technology and Urban Development*, 5, No 1: 21-27		●					
Arango et. al., 2011. "Architectures" *Journal of Information Architecture*, 3, No 1: 41-47		●		●	●		●
CHPS Best Practices Manual. 2002. "Day-lighting: Day Light and Fenestration Design."	●	●	●	●	●	●	●
Case Studies							
Irving Street Brewery	●	●	●	●	●	●	●
Hearts Tower	●	●	●	●	●	●	●
Fahle House	●	●	●	●	●	●	●

The north facing windows in southern hemisphere are desir able for good daylight and south facing windows require protection from high altitude sun via horizontal overhang. The east and west facing windows are not desired due to low altitude sun (CHPS, 2002).

An integral element of the building-on-top strategy is the structural construct, which appears to be linked to the arrangement or shape of the building (Kwon, 2014). Formwork is considered a fundamental occurrence that imparts meaning to the observer, involving the physical shaping of the surroundings and material objects in people's environments. Morphology focuses on the visual elements of a structure, encompassing features such as brick walls, wooden columns, stained glass windows, stone-paved pathways, copper roofs, and garden designs, among others (Arango, 2011).

Patterns can be constructed by incorporating various elements, such as a window being constituent part of a wall. Building elements like brickwork, porcelain, and gravel, while individually distinct, collectively constitute both entities. Despite their differences, these elements contribute to the overall composition of the patterns.

Connectivity is another important element of architectural sustainability (Peck, 2008). The incorporation of accessible technology that improves disabled people's usage of buildings is emphasized (Roth, 2012). By removing obstacles like uneven or slippery surfaces, steep hills, and heavy doors, access solutions should also make it possible for people to get where they need to go quickly (Peck, 2008). The inclusion of these publications helps to provide a wider perspective on sustainable architecture because it highlights additional crucial building components that are important for realizing sustainable design.

Case Studies: Introduction

In this section, the three selected buildings are assessed based on the criteria established in section B. Their reason for selection is that these are projects of renowned architects and acknowledged among the world's most sustainable structures in relation to roof stacking. In order to accomplish architecture integrity, three cases have been critically analyzed in this section using roof stacking. (See table 2 for construction details of three cases)

Table 2 is showing the basic information about the 3 selected buildings. Irving Street Brewery is a project upgraded by Tzannes Associates in 2015 by building a trigeneration power plant on the roof top. The original brewery building was developed by Tooth & Company in 1900. It provides an illustration of how a heritage-listed building can be transformed into a hydroelectric plant (Dunn, 2015; Wilkinson, 2019).

The Hearst Tower is acknowledged as a first sustainable building in New York City in 2006 and was awarded LEED Gold certification the same year. The project was conceived by Norman Foster. The steel and glass structure were constructed on the top of an original brick masonry building designed by Joseph Urban in 1928. This building on roof top approach makes it the first green and sustainable office building in the city (Partners, 2012).

Fahle House received attention because of its multiple challenges like risk factor from real estate point and controversy generated from point of heritage conservation. It was originally developed by Architect Erich Jacoby as a voluminous boiler house in 1926. The Fahle House complex encompasses a six floor apartment on the roof top of an old limestone building and makes it a perfect example of roof stacking (Architects, 2016).

Table-2: Information on Case Studies.

Case Studies	Location	Date of the Host Building	Date of Addition on Top	Building on Top	Architect Associated with Addition on Top
Irving Street Brewery	Sydney Australia	Designed by Maurice Halligan and F. H. B. Wilton in 1900 and Constructed on 1910	Completed in 2015	Power Plant	Tzannes Associates
Hearst Tower	New York, U.S.A.	Constructed in 1928 by Architect Joseph Urban	Construction began in 2003 and ended in 2006	Offices	Norman Foster
Fahle House	Tallinn, Estonia	Constructed in 1926 by Architect Erich Jacoby	Completed in 2007	Apartments	KOKO Architects

Table-3: Common and Different Features of the Three Cases.

Elements	Irving Street Brewery	Hearst Towers	Fahle House
Heritage	Protects heritage	Protects heritage	Protects heritage
Technology	Employs recent technologies	Employs recent technologies	Employs recent technologies
Materials	Employs steel	Employs steel and glass	Employs glass
Services	Offers energy efficient services	Offers energy efficient services	Offers a range of services such as offices, restaurants etc.
Form	Diagrid form	Conical form	Cubic form
Fenestration	Horizontal fenestration	Vertically located concave glass windows	North-side facing windows
Access	Offers access from bridge	Offers access from escalators	Offers access from staircase

Table 2 shows that one of the 3 selected cases continued with the same use of the old building by adopting roof stacking strategy, i.e Hearst Tower. The other 2 buildings i.e Irving Street Brewery and Fahle House were designed initially as factories. Irving was re constructed on top to provide space for tri-generational plant which produces electricity from gas. Fahle House, on the other hand, is transformed to house apartments to provide homes to residents. Hearst Tower is a unique case in this research in the context of adding very large number of stories on top of the old building i.e 46 storeys. Hearst Tower shows that reusing old buildings through roof stacking, the building can achieve maximum height like 42 storeys.

Comparative Analysis of features of the three cases

Table 3 is showing a comparison among the 3 selected cases in terms of performance parameters of sustainable development identified after literature review in section B. The results are discussed according to afore mentioned parameters in table 3 one by one and all the 3 cases are discussed as under.

Figure-2: Irving Street Brewery.
Source: http://architectureau.com/articles/irving-street-brewery/

Heritage

The cultural values are transferred to future generation through physical artefacts and heritage buildings in a society (Knippers and Speck, 2012). The Irving Street building represents the marvelous example of heritage conservation adopting the roof stacking strategy and extends the old building in vertical direction. This project comes under adaptive reuse. Efforts have been made to amalgamate trigeneration plant over the roof of the original brewery buildings (Figure-2).

The designers of Hearst Tower depict the excellence in the preservation of heritage through the addition of space and light. The elegant tower of steel and glass rests on the roof top of original stone building making this project an example of sustainable conservation of heritage value. The original façade look is preserved and newer addition as roof stacking has been balanced with old one (Figure-3).

The 3rd case of Fahle House also contributes in preservation of old factory building by conserving the historic interior and surfaces of walls and floors where possible. This project further represents roof stacking as a sustainable strategy by establishing a six-story apartment building on top of the old steam generator (Figure-4).

Technology

The energy design of any building is very important and if designed carefully, can contribute to buildings' sustainability. The optimal internal environment can be created by employing renewable energy system (Knippers and Speck, 2012). An inner-city mixed-use neighborhood benefits with use of Irwing Brewery Buildings through its efficient technology for hot and cold water supply. Similarly, Hearst Tower has attained a 40% reduction in total energy

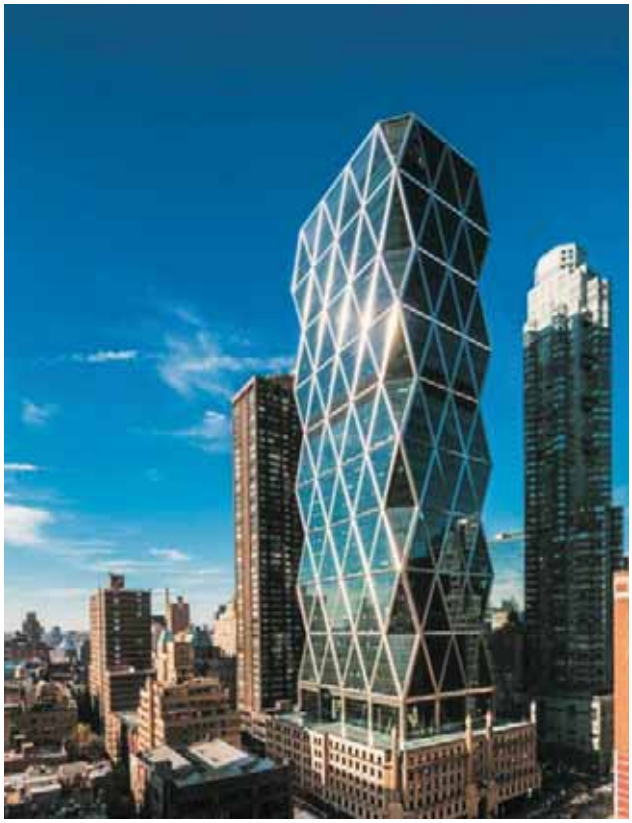

Figure-3: Hearts Tower.
Source: https://www.skyscrapercenter.com/building/hearst-tower/2245

consumption through different energy saving mechanisms, making it a unique case in terms of sustainable upgradation. Fahle's house does not achieve reduction in energy consumption as compared to the level of the other 2 cases. The requirement of artificial light is reduced by introducing the glass block on the upper floor of the new construction to receive ample daylight.

Materials

The use of ecological and recycled materials is very significant in attainment of sustainable architecture. Materials not onlycontribute to durability of a structure but are also vital to achieving sustainability (Hwang and Tan, 2012). The Irving Street Brewery Building has been upgraded by roof stacking with the addition of floors made of external metal mesh. In this regard, refurbishment of building considered the use of ecological light weight material (Figure-5).

The Hearst Tower has incorporated steel in the roof construction to incorporate the light weight characteristic of the material. This proved a sustainable strategy in its upgradation. The Hearst Tower uses four-story triangular

Figure-4: Fahle House.
Source: https://www.archdaily.com/780385/fahle-house-koko/569874d4e58ece22610000b5-fahle-house-koko-image?next_project=no

Figure-5: Integration of Materials.
Source: https://www.meinhardt.com.au/news/irving-street-brewery-up-for-aia-nsw-award/

frameworks, as opposed to the traditional steel beams found on many skyscrapers (Figure-6).

The Fahle building also exemplifies the efficient use of environmentally friendly materials in the pursuit of sustainable architecture. The structure is built on limestone

Figure-6: Use of Steel in Hearst Tower.
Source: https://www.fosterandpartners.com/projects/hearst-headquarters

Figure-7: Integration of Limestone Wall and Glass.
Source: https://www.kaidohaagen.com/photo_17316879.html

wall and integrates glass in the construction of the upper component. The employment of glass on the upper part serves to reduce extra weight and loads, and allow penetration of natural light into the building (Figure-7).

Services

Hearst Tower has achieved 26% reduction in total energy consumption than traditional construction due to employment of sustainable and efficient services like rain water collection system at the roof top to collect 1.7 million water gallons every year and the sensor adjusted artificial lighting system that adjusts with available daylight. In terms of services, Fahle House offers more services due to alteration in the plant interior for re arrangement of rooms. The services and offices are located in the old building.

Form

The expanded metal mesh fabric that covers the cooling towers creates a striking visual contrast between the old and new. The somewhat homogeneous fabric that envelops high-rise residential slabs and towers stands in stark remembered contrast to these wonderfully comprehensive forms. The cooling towers at Irving Street Brewery, which are perched atop the historic building, exhibit the building's distinctive architectural form. For instance, the tri-generation cooling towers employed in the renovated structure are its most distinctive feature. The zinc-mesh covering these six curving cooling towers was made specifically for them. The mesh's transparency is constrained to increase the form's solidity and provide permeability for cooling the towers.

Fenestration

Irving Brewery Street building bear clear glass fenestration in horizontal strip having horizontal louvers responsible for large amount of daylight avoiding glare. The Hearst Tower unlike Irving Street Building is composed of massive vertical windows having concave glass. This design admits large amount of daylight avoiding glare and also provide beautiful views of downtown. Fahle House has provision of good fenestration design with respect to daylight. Most of its windows are in the glass faced structure on the roof top of old boiler house and north oriented windows provide good daylight. It can be concluded that all the 3 cases are upgraded considering good quality daylight while designing windows.

Access

The Irving Brewery Street building has a unique feature as far as access to structure at top is concerned. The tri generation tower over the roof is accessed by a bridge (Figure-8).

The Hearst Tower offers a unique access inside the building. A welcoming lobby at the base of Tower which rises up to six floors in the form of atrium provides access to all parts of tower like a city inside (Figure-9).

In the case of Fahle House, the building boasts two entrances. One entrance faces Tartu Highway, while the second entrance is situated opposite to the first one and is conveniently located just two minutes away from a bus station. This strategic placement enhances accessibility for occupants and visitors alike. Efficient access design enhances usability while maintaining the functionality of the original building.

When developing roof-stacking elements on heritage-significant buildings, it is crucial to preserve the historical façade and maintain architectural integrity. Key restrictions include ensuring a setback to minimize visual impact, using compatible materials and designs that harmonize with the existing structure, and adhering to height and scale limitations to prevent overshadowing the original building. Additionally, roof stacking must respect visibility from key public viewpoints, ensure structural stability, comply with heritage

Figure-8: Access to Power Plant.
Source: https://www.architectural-review.com/buildings/irving-street-brewery-plant-in-sydney-australia-by-tzannes

protection regulations, and incorporate sustainable practices wherever possible. By balancing modern functionality with the preservation of historical and architectural significance, these measures ensure that the building's heritage is not compromised while integrating new, sustainable elements.

The roof-stacking forms in the three selected cases varied in their approach, each reflecting innovative strategies for maintaining the balance between the old and the new. Distinct designs, such as freeform structures or modern elements set back from the original footprint, were used to complement the heritage of the buildings. Facade designs, featuring innovative materials and finishes, were thoughtfully integrated to enhance the historical character while introducing modern aesthetics. These additions were not only aimed at improving energy efficiency but also incorporated technological advancements, which were harmoniously blended with the buildings' original designs. Thus, roof stacking not only served as a sustainable strategy but also as a means of preserving the historical essence of each site, as evidenced by the thoughtful interventions in the Irving Street Brewery, Hearst Tower, and Fahle House.

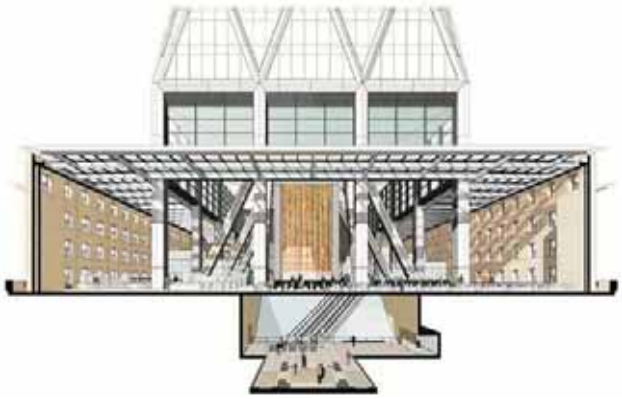

Figure-9: Sectional Perspective.
Source: https://www.archdaily.com/204701/flashback-hearst-tower-foster-and-partners/5038269e28ba0d599b00110a-flashback-hearst-tower-foster-and-partners-image?next_project=no

CONCLUSION

The study provides a comprehensive analysis of roof stacking as a sustainable architectural strategy, demonstrating its potential to address the challenges of urban sprawl and resource depletion while supporting the Sustainable Development Goals (SDGs). By examining three distinctive case studies including Irving Street Brewery in Australia, Hearst Tower in the United States, and Fahle House in Estonia, the research underscores the practical and theoretical value of this approach in making cities more sustainable, resilient, and adaptable to the growing urban population.

The selected case studies highlight the successful implementation of roof stacking by seamlessly integrating old and new structures. Each project preserved the architectural heritage of the existing buildings while enhancing their functional and environmental performance. This was achieved through adherence to seven key performance parameters: heritage, technology, materials, services, form, fenestration, and access. These parameters form the performance matrix, which serves as the foundation for promoting sustainability in roof stacking projects.

The findings establish a conceptual framework for roof stacking as a practical, scalable, and sustainable strategy. This framework emphasizes the integration of heritage conservation, innovative technology, material efficiency, service optimization, thoughtful design, and accessibility into roof stacking projects. By extending the vertical footprint of existing buildings, roof stacking addresses urban density challenges and aligns with broader sustainability objectives.

Roof stacking contributes to reducing urban sprawl, minimizing environmental footprints, and promoting resource conservation. Unlike new constructions that demand

significant energy and materials, roof stacking capitalizes on the embodied energy of existing buildings while extending their functionality. This approach transforms underutilized urban spaces into vibrant, functional, and sustainable environments.

Ultimately, roof stacking represents a forward-thinking strategy for sustainable urban development. By addressing the seven performance parameters, this strategy ensures a replicable model for upgrading existing buildings in an environmentally responsible way. Future research could expand on these findings by exploring the economic feasibility, climate-specific applications, and the potential for widespread adoption in large-scale urban planning. Roof stacking provides a viable pathway for creating sustainable, resilient, and livable cities while preserving architectural heritage and promoting resource efficiency.

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A MICRO-LEVEL AN ALYSIS: SPATIAL DISTRIBUTION OF URBAN PARKS AND QUALITY OF LIFE CONCERNS - A CASE STUDY OF GULSHAN TOWN

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ABSTRACT

Urban parks are essential for sustainable urban living, offering spaces that integrate nature with the built environment, while fostering social interaction, physical activity, and emotional well-being. This study examines the spatial distribution and availability of urban parks in Gulshan Town, Karachi, against the backdrop of rapid urbanization and population growth. Employing Geographic Information System (GIS) tools such as ArcGIS 10.8 and Google Earth Engine (GEE), the research maps green space per capita and evaluates it against international standards, including those proposed by the World Health Organization (WHO).

The findings reveal a significant shortage of accessible green spaces relative to the population, alongside notable spatial disparities influenced by socio-economic factors. These results underscore the inequitable allocation of urban parks and their broader implications for residents' quality of life. By offering a detailed analysis of park distribution and accessibility, this study provides critical insights into urban green space planning and recommends for evidence-driven policies to ensure equitable and sustainable urban development.

Keywords: Urban parks, spatial analysis, ArcGIS, proximity, accessibility, urban green spaces.

INTRODUCTION

Cities are complex ecosystems that depend on the integration of natural systems, such as urban green spaces, which serve as essential contributors by providing public amenities and supporting both mental and physical recreation, ultimately enhancing urban quality of life (Kendal, et. al., 2016). Cities of developing countries with well distributed parks is a worldwide imperative to improve the well-being of both present and forthcoming generations. Urban green spaces assume a pivotal role in delivering cultural ecosystems services within cities.

As urbanization continues to increase, it has become essential to prioritize green spaces within urban design to maintain population health, reduce pollution and quality of life. The environmental, social, and economic benefits of urban green spaces are crucial in achieving sustainable and livable urban environments in cities (Cicea and Pîrlogea, 2011; Gozalo et al., 2018; Littke, 2016).

While macro-level research highlights the broad benefits of green spaces, there is a critical gap at the micro level, particularly in assessing how well these spaces meet the needs of local residents. (CBE, Shehri).

The presence of accessible and inviting green spaces is a vital factor in shaping the welfare of urban areas (Unal, et al, 2016), as their proximity to neighborhoods has a key role in increasing quality of living conditions in cities (Ozkan, 2019; Cicea, Pîrlogea, 2011). Proximity to green spaces enhances the quality of life within neighborhoods, as

evidenced in various studies (Ozkan, 2019; Cicea & Pîrlogea, 2011). However, bridging this global understanding with local insights requires standards that help gauge park accessibility and distribution.

In this context, standards provided by organizations like the World Health Organization (WHO) - suggest a minimum of 9 square meters of green space per person within a 300-meter radius—offer an unbiased benchmark for creating equitable, sustainable urban environments (UN-Habitat, 2013; Alam, et. al, 2014; Abdulraheem et. al, 2022). Yet, the availability of parks within a walkable distance is equally critical in maximizing the benefits these spaces offer. Urban green spaces, particularly locality parks, offer urban residents convenient access to nature within their community (Pubaszek, 2023). These open areas, featuring trees, grass, playing fields, and playgrounds, serve as primary accessible nature oriented spaces, especially in densely populated areas. This study addresses this gap by analyzing the spatial distribution and tangible availability of park space per person in each Union Council (UC) of Gulshan Town using GIS buffer analysis. This approach helps identify areas where green spaces are insufficient and demonstrates how GIS can be used to analyze spatial distribution and make informed decisions for targeted interventions. By focusing on both the quantity and distribution of green spaces, this research emphasizes the importance of strategic planning to ensure equitable access and availability for all residents.

What is Urban Green Space?

The meaning of green space in urban areas has been a topic of debate, and there is no agreed-upon definition that applies universally. Each developed country has its own definition of what constitutes urban green spaces, as noted by Byomkesh et. al, (2012).

Urban Green [s] are green space[s] located in urban areas mainly covered by vegetation, which are directly used for active or passive recreation, or indirectly used by virtue of their positive influence on the urban environment, accessible to citizens, serving the diverse needs of citizens and thus enhancing the quality of life in cities or urban regions (URGE, 2004).

The importance of these spaces for promoting sustainable, healthy, and livable urban environments is highlighted by the definitions of urban green space provided by renowned institutions. While the definitions vary slightly in their wording and focus, they share a common understanding of green space in urban areas referring to patches of flora (vegetation) and trees in cities that offer a variety of advantages, including environmental, social, and economic benefits. They all agree that the value of urban green space is in providing opportunities for outdoor recreation, improving water quality and clean air, supporting biodiversity, reducing the urban heat island effect, and contributing to the overall quality of life of urban residents.

The Relevance of Urban Green Space and QoL

With 68% of the world's population expected to live in cities by 2050 (United Nations, 2018), it is imperative that public administrations and urban planners design livable, health-promoting environments with guaranteed access to green spaces (Reyes-Riveros, et. al, 2021).

Urban green spaces (UGS) are critical to addressing the ecological and social challenges posed by rapid urbanization, including urban sprawl, pollution, and biodiversity loss. Often referred to as the "lungs" of cities, they play a vital role in mitigating urban heat islands, improving air quality,

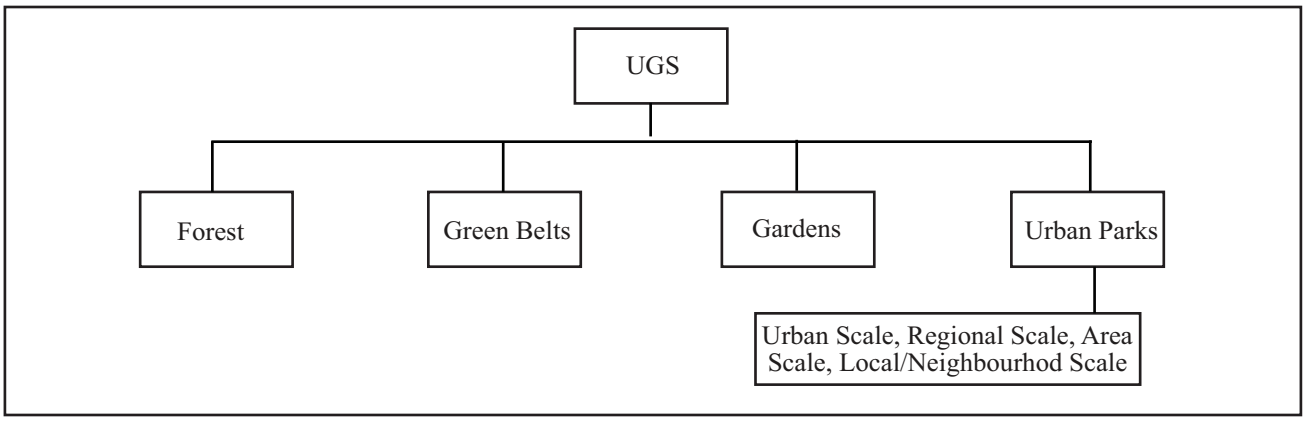

Figure-1: Classification of Urban Green Spaces (Kiani et al. 2014; Depanshi,2019).

Table-1: Definitions of UGS by Renowned Institutes.

Institution	Year	Definition
WHO(Brief for action)	2017	All urban land covered by vegetation of any kind. This covers vegetation on private and public grounds, irrespective of size and function, and can also include small water bodies such as ponds, lakes or streams (“blue spaces”)
WHO (Urban Green Spaces and Health: A Review of Evidence. Geneva)	2016	"Urban green spaces refer to land that is partly or completely covered with grass, trees, shrubs, or other vegetation, and that is open to the public for recreational or other purposes in an urban area."
European Environment Agency (EEA) Urban Sprawl in Europe: The Ignored Challenge. Copenhagen	2011	"Urban green spaces refer to all areas within or adjacent to urban areas, from public parks and gardens to street trees and green roofs, that are covered by vegetation and accessible to the public."
International Union for Conservation of Nature (IUCN) (Nature Based Solution to Address Global Societal Challenges)	2019	Urban green spaces are defined as green areas within urban areas that provide important ecological and social functions, such as habitat for wildlife, carbon sequestration, and opportunities for recreation and education.
The United Nations Development Programme (UNDP) UGS: A Guide for Sustainable Development in Africa. Nairobi	2014	"Urban green spaces are defined as areas of land within urban areas that are dedicated to preserving and enhancing the natural environment, providing opportunities for recreation, and contributing to the overall quality of life of urban residents."
The United States Environmental Protection Agency (EPA)	2020	"Urban green spaces refer to areas of vegetation and other greenery within urbanized areas, such as parks, gardens, green roofs, and street trees. They help to reduce the urban heat island effect, improve air and water quality, and provide social and recreational benefits."
International Federation of Parks and Recreation Administration (IFPRA)	2016	Urban green spaces are areas of land that are dedicated to the enjoyment and benefit of all members of the community. They may include parks, playgrounds, gardens, natural areas, and other green spaces that provide opportunities for active and passive recreation, social interaction, and relaxation.

conserving biodiversity, and reducing energy usage. Furthermore, their ability to enhance urban resilience by buffering cities against environmental shocks underscores their significance in creating sustainable, livable urban ecosystems. The United Nations emphasizes the importance of accessible green spaces as a core element of the 11th Sustainable Development Goal (SDG 11), which seeks to establish urban areas that are inclusive, safe, resilient, and sustainable. Worldwide, sustainable cities demonstrate a commitment to social and environmental equity by ensuring that all individuals, irrespective of race, age, gender, or religion, have equal access to urban green spaces. This emphasis on inclusivity is fundamental to building urban settings that enhance public health, social connections, and overall well-being (Abdulraheem et al., 2022; Chen, et. al, 2022; United Nations, 2016; Kendal, et. al, 2016). In addition to SDG 11, UGS also contribute to other Sustainable Development Goals, such as promoting health and well-being (SDG 3) and combating land degradation (SDG 15).

Building on this understanding, urban parks, particularly neighborhood parks, play a vital role in enhancing urban sustainability. Situated within residential areas and designed to be accessible on foot, these parks serve as essential open spaces offering significant social, ecological, and economic benefits. They provide recreational areas, strengthen community bonds, and foster social harmony by encouraging communication among residents. In doing so, neighborhood

parks not only support environmental health and livable urban environments but also contribute to a more cohesive and interactive society (Kiani et. al, 2014; Ozkan, 2019).

Connecting Urban Green Spaces to Quality of Life (QoL)

Quality of Life (QoL) is a complex and multi-dimensional concept that reflects the overall well-being of individuals, shaped by various physical, mental, social, and emotional factors. Scholars have offered diverse interpretations of QoL, emphasizing its subjective nature and dependence on individual perceptions (Kiani et. al, 2014; Mensah, et. al, 2016; Gouveia et al., 2019). According to the World Health Organization (WHO), QoL is defined as "an individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns" (WHOQOL Group, 1995). This definition highlights the interconnected role of cultural, social, and environmental contexts in shaping individual well-being. Meeberg, (1993) further elaborates on QoL as an "acceptable state of physical, mental, social, and emotional health," emphasizing its deeply personal nature and the need to address diverse aspects of well-being to enhance individuals' quality of life.

This understanding of QoL directly links to the role of green spaces in urban environments. The United Nations underscores the significance of quality of life as a cornerstone of sustainable development, integrating it into the Sustainable Development Goals (SDGs). This global framework addresses interconnected social, economic, and environmental challenges such as poverty, health, education, and ecological sustainability, all of which directly impact QoL. By prioritizing equitable access to basic services, ecological resilience, safety, and opportunities for leisure and cultural engagement, the SDGs aim to foster urban environments that promote well-being and inclusivity for all individuals. Notably, SDG 3 (Good Health and Well-being), SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), and SDG 15 (Life on Land) emphasize the critical role of urban green spaces in enhancing quality of life (United Nations, 2016; Gouveia et al., 2019).

Urban parks and open spaces are crucial for improving the quality of life for all urban residents (WHO, 2017, Hanson, 2017). Urban parks provide sizable natural areas for wandering and admiring, giving people a chance to get away from the hustle and bustle of city life and take a moment for themselves. This aids in lessening feelings of congestion and confined spaces. Parks, gardens, street trees, riversides, and private backyards contribute to physical activity, social events, mental relaxation, and stress relief, all of which are vital for a high quality of life in cities (Kwon et al., 2021).

For guaranteeing individuals' standards of life, cities must have readily available, beautiful green destinations. The interconnection between human habitation, work environments, and the sustainability of urban progress is inherently tied to this phenomenon in cities. This issue has gained significant attention in recent years as it has become an integral factor in ensuring urban life quality (Unal, et. al, 2016; Yang, 2013).

In terms of the specific effects and advantages of green spaces on the quality of civic life, numerous studies have shown that these effects are significant, widely acknowledged, and steadily increasing in documentation. UGS provide opportunities to improve health in urban settings in the following ways:

Physical well-being: This is attained through exercise and access to nature.

Mental well-being: Green areas help people feel better mentally by lowering stress and boosting concentration.

Social well-being: Achieved through involvement, community engagement, and participation (Yang, 2013; Rao, 2021).

Urban parks create cool islands, enhance air circulation, and mitigate the warming effects of impermeable surfaces. Through shading and evapotranspiration, vegetation reduces air temperatures, improves thermal comfort, and lowers energy consumption for cooling (Spangenberg et al., 2008). Research by Chang, et. al, (2007) and highlights the cooling intensity of parks, demonstrating their significant role in moderating urban temperatures and enhancing pedestrian comfort. Additionally, the distribution of green space within neighborhoods is key to lowering Land Surface Temperature (LST), with the cooling effects varying across different green patches (Qi et al., 2024). Urban parks also provide social opportunities and help develop social ties within local communities (Teimouri et. al, 2019; Rakhshandehroo et. al, 2015).

Nature can encourage outdoor recreation, neighborliness, social integration, and crime reduction. According to studies, people who live in areas with greenery and open spaces are more likely to forge better social ties than those who have no access to breathing spaces other than concrete (Duygu and Fatmau, 2014). By fostering positive social interactions

and community connections, urban parks play a vital role in enhancing the quality of life for city residents (Mensah, et. al, 2016). To meet citizens' needs effectively, these green spaces (parks) should be easily accessible and of optimal quality and quantity (Haq, Mohammad 2011).

Availability of Green Space per Person

The World Health Organization (WHO) recommends a standard indicator measure of 9m^2 of UGS per person and an ideal UGS value of 50m^2 per capita, along with a proximity measure of 300m or a 5-minute walk. These standards serve as benchmarks for planning institutions worldwide responsible for green space planning in urban areas. However, the size of UGS varies across different countries, with some countries like Belgium, Germany, and Australia having UGS that are nearly 200m^2, while in Spain, Macedonia, and some southern cities of Italy, the UGS size is around 4m^2. In Turkey, the UGS per person varies between 1 and 9m^2. According to the Siemens Green City report, Singapore is a prime example of effective spatial planning since it successfully combines a dense population with lots of green space (Bagherian, 015). Despite land scarcity issues in some cities, guaranteed adequate amounts of urban green space, the standards method is still a vital component of city planning and policy. (Maryanti et al., 2016).

People in densely populated cities who lack access to private gardens frequently rely on local parks for green space. High population density, on the other hand, can result in less green space per person (Rayman, and Goodies, 2020) so, every city should endeavor to provide an abundance of urban green space that goes beyond what is the basically required for improved citizen quality of life.

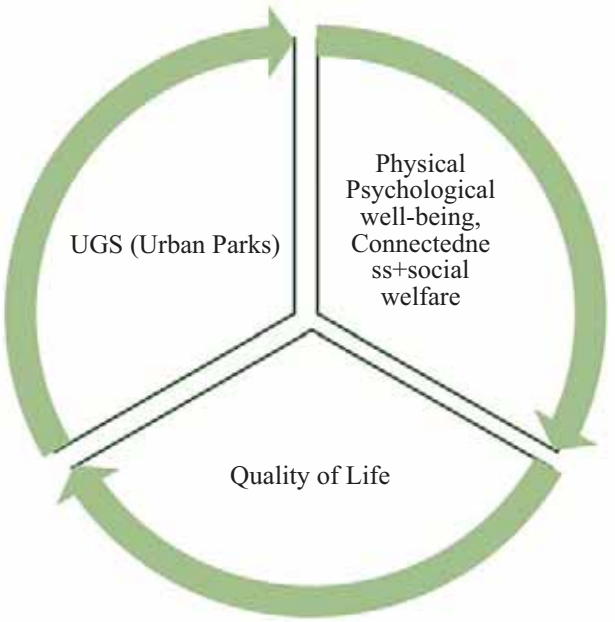

Figure-2: Conceptualized Relationship Between Urban Parks and Quality of Life (Kitheka et al., 2018).

Table-2: The Implementation of Urban Green Space Standards in Various Cities.

S. No.	Cities	Size (hectares)	Population	M^2/Person
1.	Greater London	4	1000 Residents	40
2.	Edinburgh	2.9	1000 Residents	29
3.	Cambridge	4.6	1000 Residents	46
4.	Washington	3.8	1000 Residents	38
5.	Minneapolis	2	1000 Residents	20
6.	Los Angeles	4.85	1000 Residents	48.5
7.	Kansas City	3.64	1000 Residents	36.4
8.	Bristol	1.0	1000 Residents	10
9.	India	0.8	1000 Residents	8
10.	Pakistan	0.52	1000 Residents	5.2

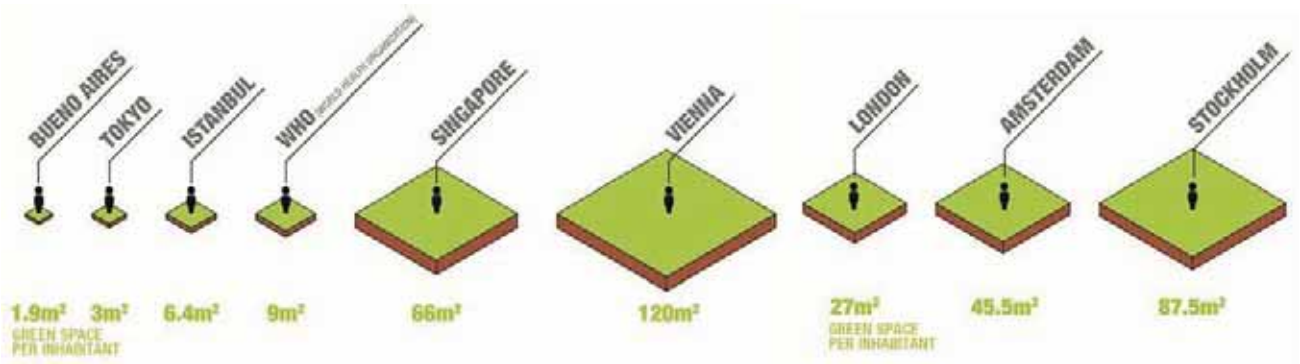

Figure-3: Showing Green Space per Inhabitant in Cities Around the World (Bagherian, 2015).

LOCAL CONTEXT

The City Karachi

Karachi, Pakistan's largest metropolis and the third-largest city globally (Zia, et. al, 2022), serves as the nation's economic and cultural hub. According to the 2017 Population Census, the city has a population exceeding 15 million, accounting for one-third of Sindh's population and one-fifth of Pakistan's urban population (World Bank, 2018). Unofficial sources suggest the actual population may be significantly higher. With a population density of 4,543 individuals per square kilometer over 3,527 square kilometers, Karachi faces immense challenges in urban sustainability.

Rapid population growth, coupled with unregulated commercial development, has significantly contributed to the loss of green spaces in Karachi, which now account for only 4% of the city's built-up area (Ah and Soh, 2020). Weak urban planning policies and the prioritization of construction over environmental preservation have further exacerbated this trend. Karachi's green infrastructure has undergone a significant decline, with research by the Karachi Urban Lab revealing a 40% reduction in the city's intermediate green cover over the 22-year period leading up to 2021. This trend reflects the rapid urban expansion and insufficient prioritization of green spaces, exacerbating environmental challenges such as urban heat islands, biodiversity loss, and deteriorating air quality (Mazhar, Abbas and Zain, 2024).

The environmental management of urban parks has been identified as a potential strategy to enhance livability and mitigate the adverse effects of diminishing green spaces in densely populated areas (Syed, et. al, 2024). The COVID-19 pandemic underscored the critical role of accessible green spaces in supporting public well-being and enabling social distancing during public health emergencies.

While Karachi is estimated to host between 1,100 and 1,600 parks, discrepancies in official data hinder comprehensive planning. The Government of Pakistan's 2000 report and studies by Qureshi, et. al, (2010) and Schetke, et. al, (2016) identified approximately 1,230 nature spaces, including formal and informal parks. However, these numbers remain insufficient to meet the needs of a growing population (Khan, 2019).

Study Area: Gulshan Town, District East

Gulshan Town, located in District East of Karachi, spans 55 square kilometers and has a population of 1.55 million, distributed across 15 Union Councils (Figure 4). It is one of Karachi's largest towns, characterized by mixed land use, including residential, commercial, and industrial zones, along with relatively higher green space coverage compared to other towns (KSDP, 2020). Notable parks include Aziz Bhatti Park, Safari Park, and Bagh-e-Karachi.

Urban growth in Gulshan Town reached 70% between 2005 and 2017, driven by rapid urbanization and population increases. This has intensified spatial disparities in green space availability and accessibility. The town's geographic coordinates are N 24° 55.244' E 67° 5.2897'. Gulshan Town, like many areas of Karachi, faces challenges related to green space availability. While relatively higher green space coverage exists compared to other towns, the increasing population density and urban sprawl highlight potential disparities in access and allocation. (Kiani et al., 2014; Abdulraheem, et. al, 2022; Pouya, and Aghlmand, 2022).

RESEARCH METHOD

To define the extent of the study area, the population per neighborhood based on the census data of 2017, as well as micro-scale data about neighborhoods like boundaries

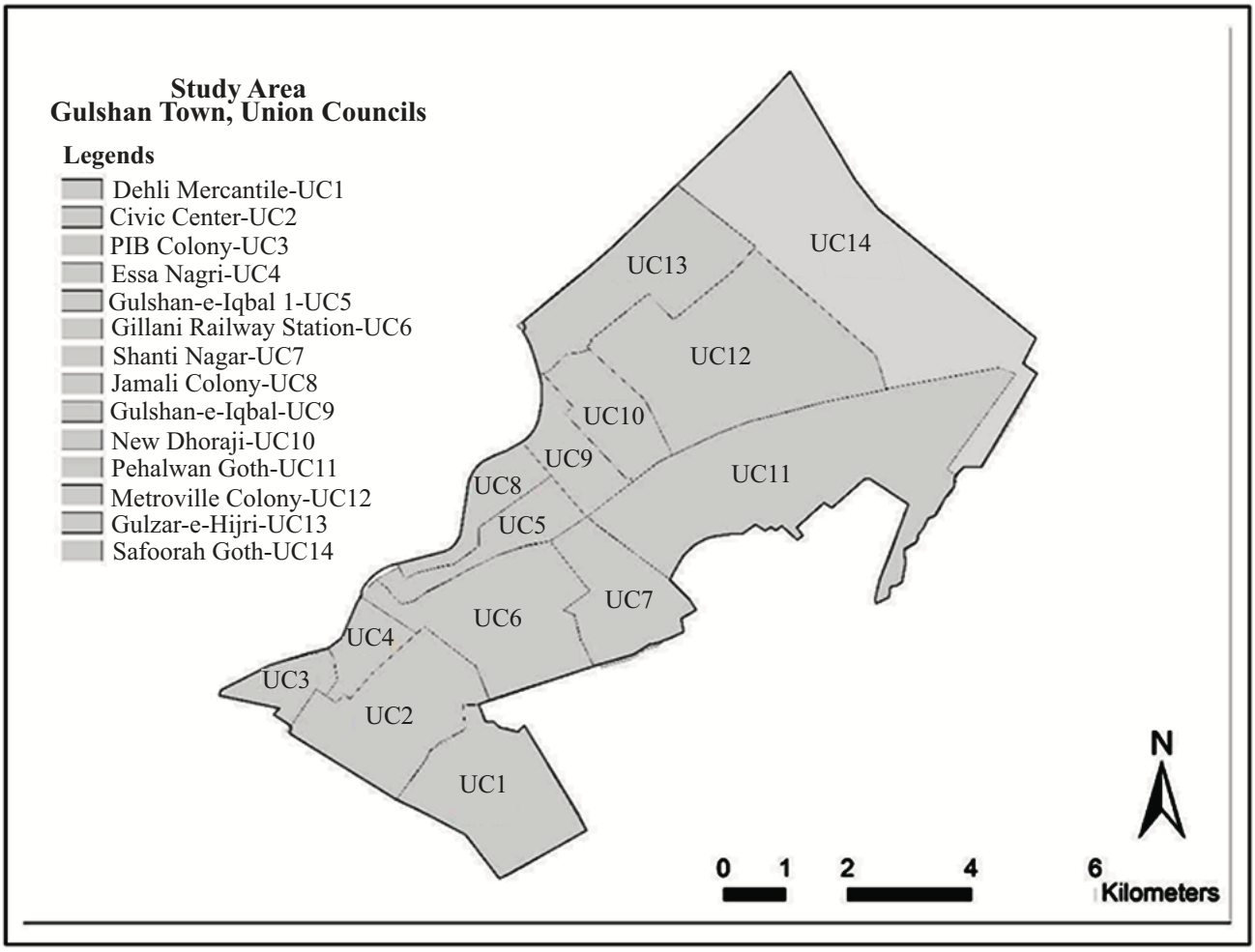

Figure-4: Showing the Union Councils of Gulshan Town.

(Almohamad, et. al, 2018) of the Union council, list of public parks of all hierarchic levels (City parks, neighborhood parks and pocket parks) were collected from the relevant departments responsible for the management of green areas in Karachi, namely District Municipal Corporation (DMC) East, Karachi Development Authority (KDA), and Karachi Municipal Corporation (KMC). These departments were approached to obtain comprehensive and reliable information pertaining to the study. The subsequent phase entails scrutinizing satellite imagery to pinpoint green spaces within the urban terrain that could potentially be absent from the existing data files. The research employed Geographic Information System (GIS) with a buffer zone approach and Google Earth Engine (GEE) as the main tools for formalizing the secondary data for primary research of urban parks distribution pattern and their availability. Utilizing satellite imagery from Google Earth Engine, GIS tools and techniques were employed to map the overall public parks in Gulshan Town listed or not listed. The mapping process aims to identify the overall pattern of green space distribution and assess the equitable allocation of these spaces throughout Gulshan Town. International guidelines suggest an average of 30 m² of green space per resident, with a range of 15-50 square meters, while the United Nations recommends 20-25 square meters per capita (Kiani, et. al, 2014). The World Health Organization (WHO) recommends 9 m² of urban green space (UGS) per individual, with a target of $50m^2$ (Abdulraheem, et. al, 2022; Pouya, and Aghlmand, 2022). These standards were used as benchmarks for evaluating green space availability and allocation in Gulshan Town, providing guidelines for urban planning and promoting the well-being of residents.

The mapping process was carried out on ArcGIS 10.8 to assess the availability of greenery per resident in Gulshan Town. Primary research included several key steps: the acquisition of urban parks data, which included park location, size, and type within each Union Council (UC) of the town.

Table-3: Population Density and Green Space Availability Analysis.

UC #	Name	UC Population	Population Density (km2)	Total Area Parks (m2)	Green Space Per Capita (m2)
UC12	Dehli Merchantile	110818	27704.5	38805	0.35
UC18	Civic Center	144606	36151.5	52122	0.36
UC19	PIB Colony	85835	85835	0	0
UC20	Essa Nagri	132729	132729	0	0
UC21	Gushan-e-Iqbal I	94892	47466	31853	0.33
UC22	Gilani Railway Station	131408	32852	52054	0.39
UC23	Shanti Nagar	99555	33185	33401.5	0.33
UC24	Jamali Colony	110,639	110639	13844	0.12
UC25	Gushan-e-Iqbal II	97020	97020	18299	0.18
UC26	New Dhoraji	36490	18245	37477	1.02
UC27	Pehlwan Goth	132717	13271.7	374264	2.8
UC28	Metrovil Colony	148849	21264.1	11056	0.07
UC29	Gulzar-e-Hijri	95959	23989.8	31810	0.33
UC30	Safora Goth	96911	8810	86605	0.89

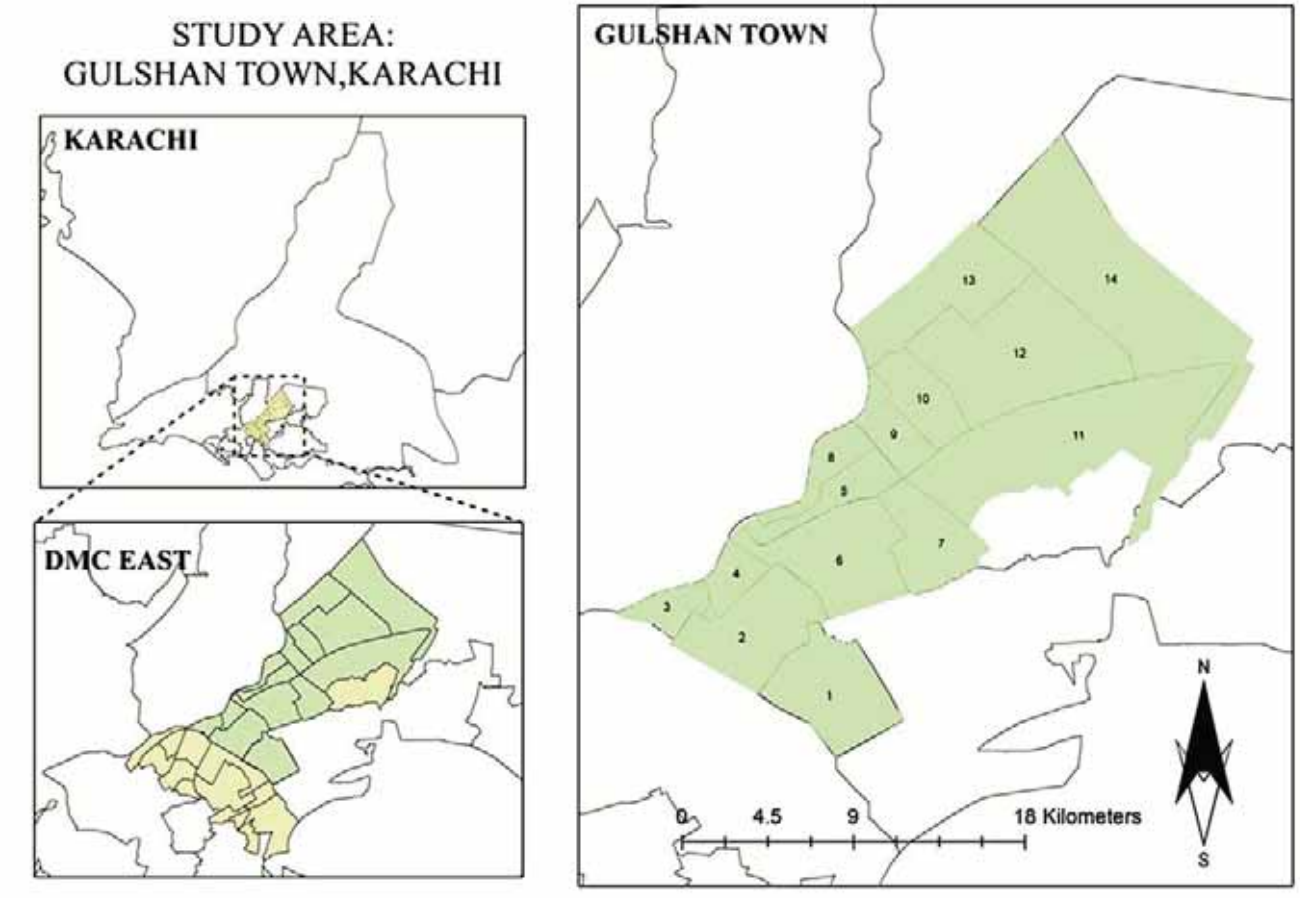

Figure-5: Study Area Map, Gulshan Town in DMC East, Karachi.

This mapping data was used to calculate the total green space area in each UC. Using the 2017 census population data (DMC East, PBS 2017), the amount of green space per inhabitant was calculated by dividing each UC's total park area by its corresponding population. Furthermore, a detailed analysis was conducted using ArcGIS person for each UC and compares with the minimum standard set by WHO for green space per capita. This comprehensive analysis provided detailed insights into the distribution, inequality, and accessibility of green spaces across different socio-economic strata and building typologies within Gulshan Town. The details of population and green space availability are in table-3.

RESULTS AND ANALYSIS

Mapping of Parks

The mapping of urban parks in Gulshan Town reveals a total of 165 parks, indicating a generally adequate coverage of urban green spaces distributed unevenly across its Union Councils (UCs), as shown in Fig. 6. However, significant patches within almost every UC are devoid of park provision. Safoorah Goth, located on the peri-urban fringe of Gulshan Town, stands out with the highest concentration of parks, hosting 43 green spaces. This UC predominantly consists of gated societies with more planned layouts, contributing to better park provision.

In contrast, UCs situated closer to the core city center, such as Jamali Colony and Gulshan-e-Iqbal-II, exhibit markedly lower park provision. Jamali Colony, despite having the highest population density, contains only two parks, one of which is inaccessible to local residents. Pehlwan Goth, with 23 parks, appears well-served but is an outlier due to the inclusion of the city-level Safari Park. If the exceptional case of Pehlwan Goth is excluded, its situation mirrors that of other densely populated UCs, which have limited availability of urban parks within walking distance.

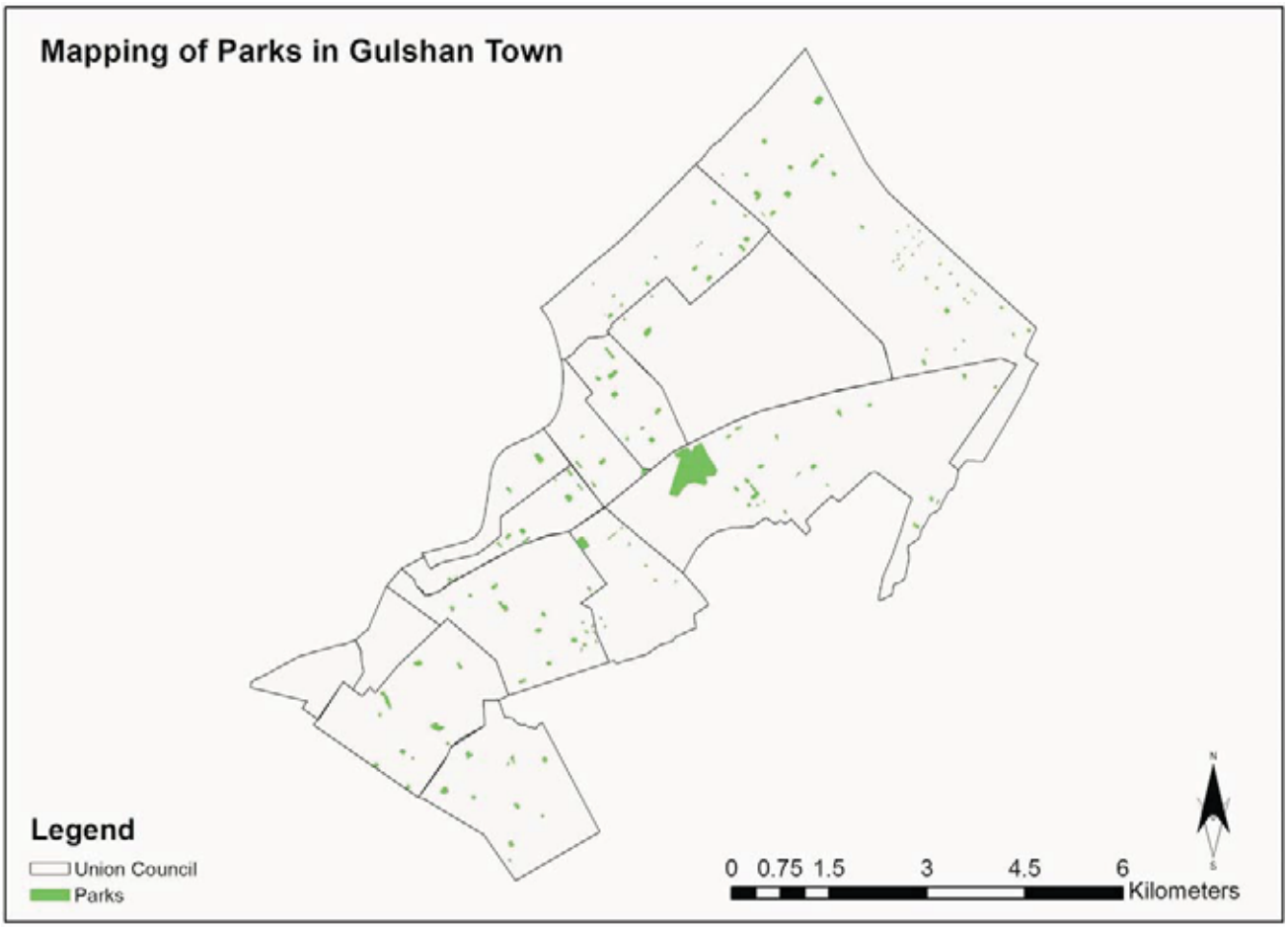

Figure-6: Mapping of All the Parks in Gulshan Town, Karachi.

Moreover, UCs like Essa Nagri and PIB Colony are particularly underserved, with no parks present at all. This observation further highlights a stark spatial imbalance in the availability of urban parks relative to population density across different UCs in Gulshan Town.

Moderate park availability is observed in UCs like Gulzar-e-Hijri and Gillani Railway, each with 16 parks. Conversely, Metroville UC presents a unique scenario; despite having significant green spaces within academic institutions and employee societies, these areas are largely restricted and inaccessible to the general public. This exclusion diminishes their role as public urban parks and mirrors the conditions of underserved UCs.

To assess park accessibility, a 300-meter buffer zone analysis was conducted using GIS to evaluate the coverage of parks within a walkable distance, as recommended by WHO guidelines (Fig 7). The analysis revealed that even UCs with higher park counts, such as Safoorah Goth and Gulzar-e-Hijri, fail to achieve complete coverage, leaving significant portions of the population without accessible green spaces. This inadequacy is particularly pronounced in UCs like Jamali Colony, Essa Nagri, PIB Colony, and Shanti Nagar, where the buffer zone analysis reveals significant areas lacking any accessible parks. Shanti Nagar, with its mixed socio-economic levels, showcases the challenge of providing sufficient public green spaces for all residents, particularly in neighborhoods with low socio-economic status and high population density. Similarly, in Essa Nagri and PIB Colony, neighborhoods with high population density and lower socio-economic status suffer from inadequate park availability and access.

The spatial analysis highlights a clear divide in park distribution between the peri-urban and core city UCs, with the latter exhibiting denser populations but comparatively fewer and less accessible parks. These findings underscore

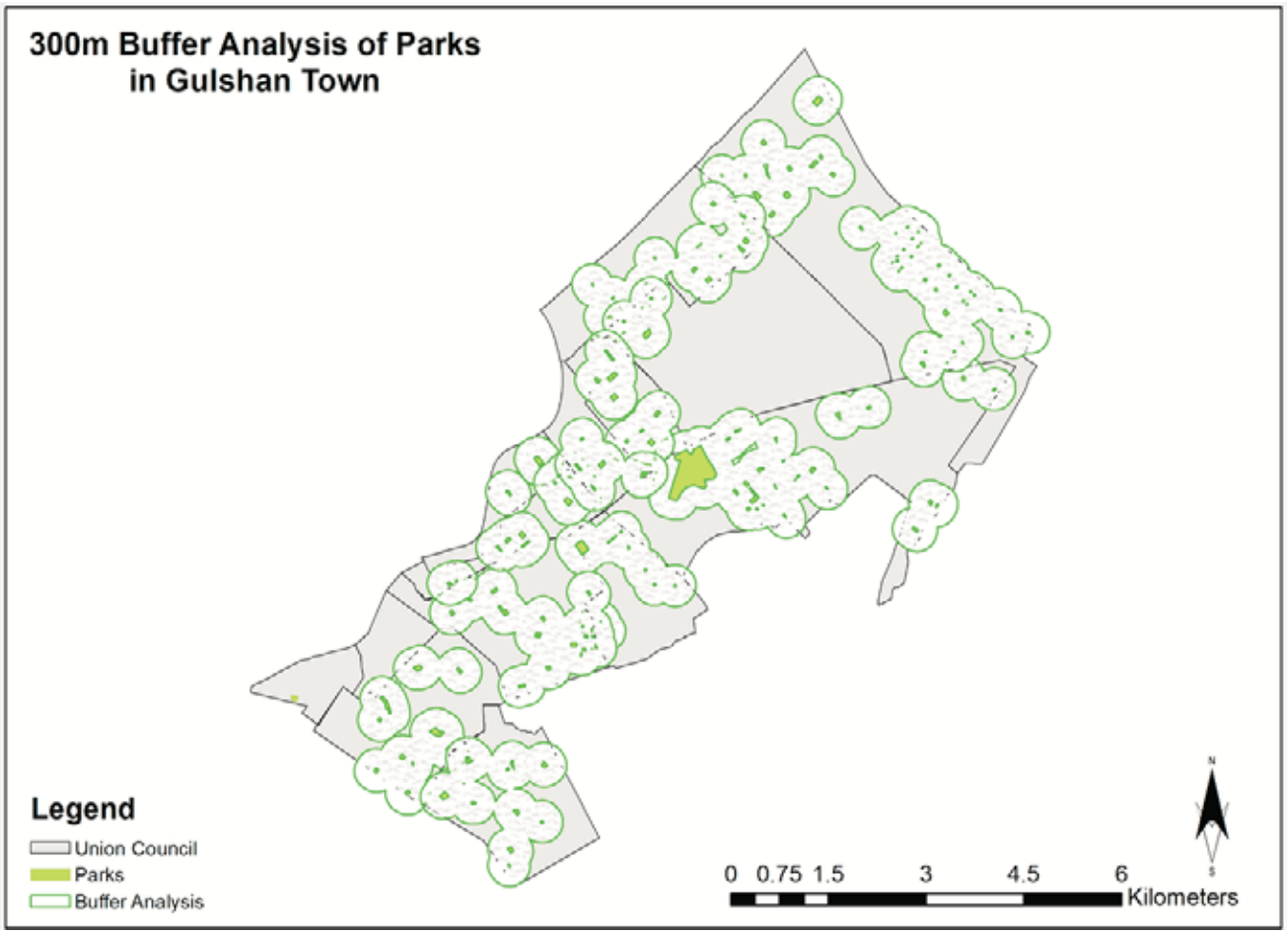

Figure-7: Urban Parks (UGS) 300m Buffer Zone Analysis of Gulshan Town.

the urgent need for planning interventions to improve park accessibility and equity across all UCs of Gulshan Town.

Population Density and Urban Parks

The insights from Figure 8 proved valuable in examining the correlation between population density and the availability of green spaces. The figure distinctly illustrated that regions with higher population density tended to have fewer to zero green spaces compared to those with low or medium population density. Furthermore, Fig. 8 revealed that areas characterized by high population density and limited green spaces were predominantly those encompassing primarily consisted of informal settlements or communities with low to average socioeconomic status.

These regions have been prioritized for urbanization, resulting in insufficient park maintenance and inadequate establishment of new parks. Consequently, this has generated an imbalance in the availability of urban parks.

Union councils like Dehli Marcantile, Civic Center, and New Dhoraji, characterized by moderate population densities, Additionally, they are moderate to affluent socioeconomic and are well-planned areas have relatively more parks compared to other areas, also their accessibility coverage is notably superior (Figure-7).

Despite the large park areas in UCs like Pehalwan Goth and Safoorah Goth, their distribution does not align with population density and urban accessibility needs. Mixed socio-economic neighborhoods like Shanti Nagar, along with low socio-economic areas, face challenges in ensuring equitable access to parks, particularly for lower-income residents who rely more on public spaces for recreation and well-being. This highlights the failure of authorities to provide equal access to green spaces for all residents, as recommended by the World Health Organization (Abdulraheem, 2022).

Urban Parks Availability per Person

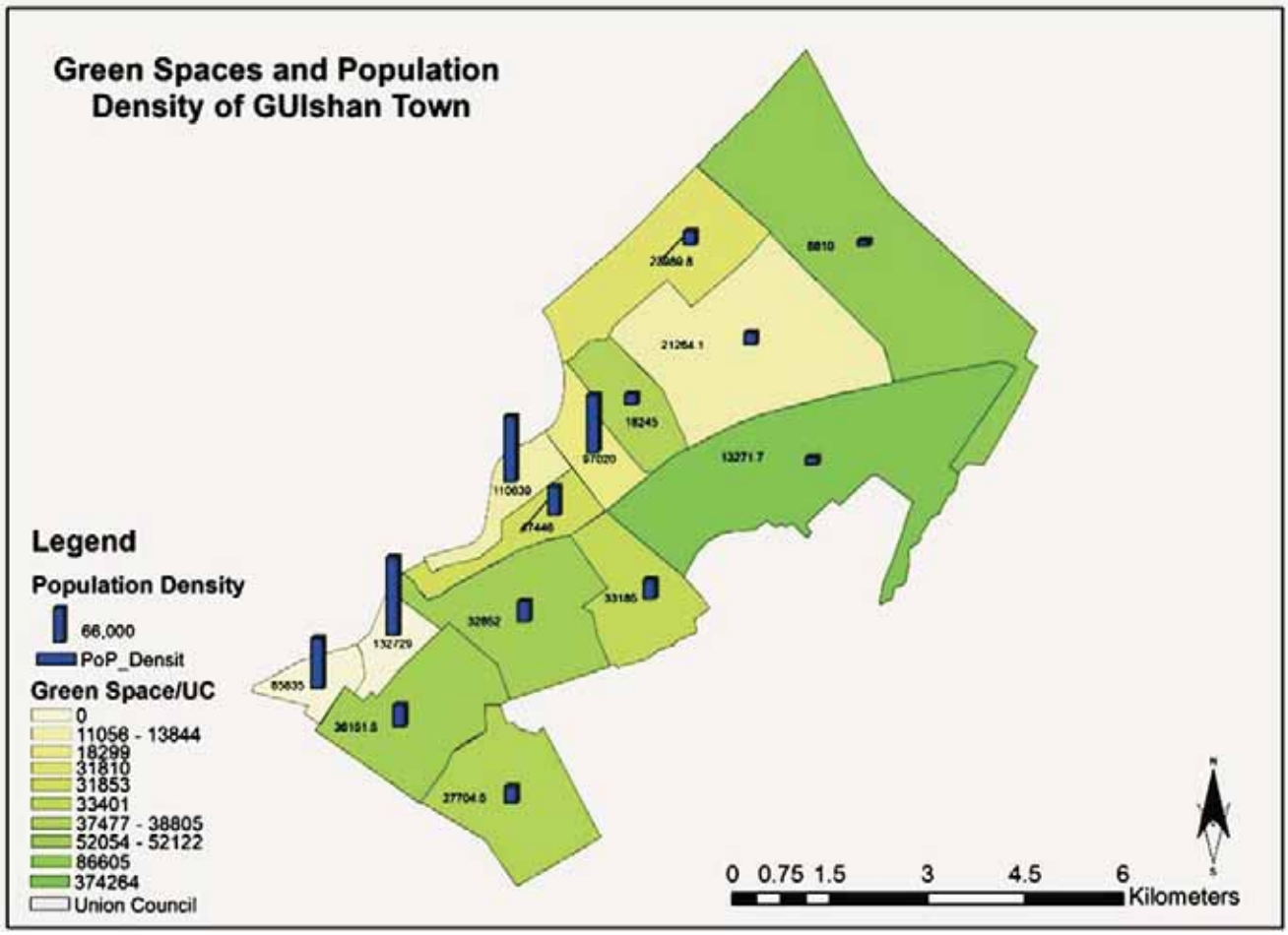

Figure-8: Green Space Availability and Population Density in Gulshan Town.

Gulshan Town, amidst a rapid population surge as per the 2017 Census, exhibits notable discrepancies in green space allocation among its Union Councils (UCs). The average allocation is 0.4 m² per person, falling short of the recommended minimum.

As detailed in Table 3, our analysis assesses adherence to the World Health Organization's (WHO) recommended standard of 9m² per individual for green space within Gulshan Town. The findings reveal a pervasive inadequacy across all UCs, none of which meet the WHO benchmark. This insufficiency is exacerbated by high population density and the lack of parks that fulfill WHO standards. The allocation of green space varies significantly across UCs. Pehlwan Goth stands out with 2.6 m² per person, largely due to Safari Park, while PIB Colony and Essa Nagri have no designated green space. New Dhoraji provides 1.02 m² per person, surpassing the average but still falling short of the WHO standard. Notably, New Dhoraji achieves 90% coverage in terms of population density and accessibility, although its parks are still insufficient in quantity. Safora Goth, located on the urban periphery, features numerous private builder communities and gated societies with substantial green space, yet these provisions do not meet the population's needs or established standards.

Figure 10 illustrates the distribution of parks per person through symbology in ArcGIS. Additionally, presents a multiple bar chart comparing the current green space in the study sites with the WHO's standard of 9m² per capita. The analysis indicates that the existing green spaces are insufficient to meet the needs of the population for an enhanced quality of life.

DISCUSSION

The analysis of Gulshan Town's green spaces demonstrates a pronounced disparity in their distribution and accessibility, reflecting broader global and regional trends. Globally, green space inequalities are especially pronounced in the

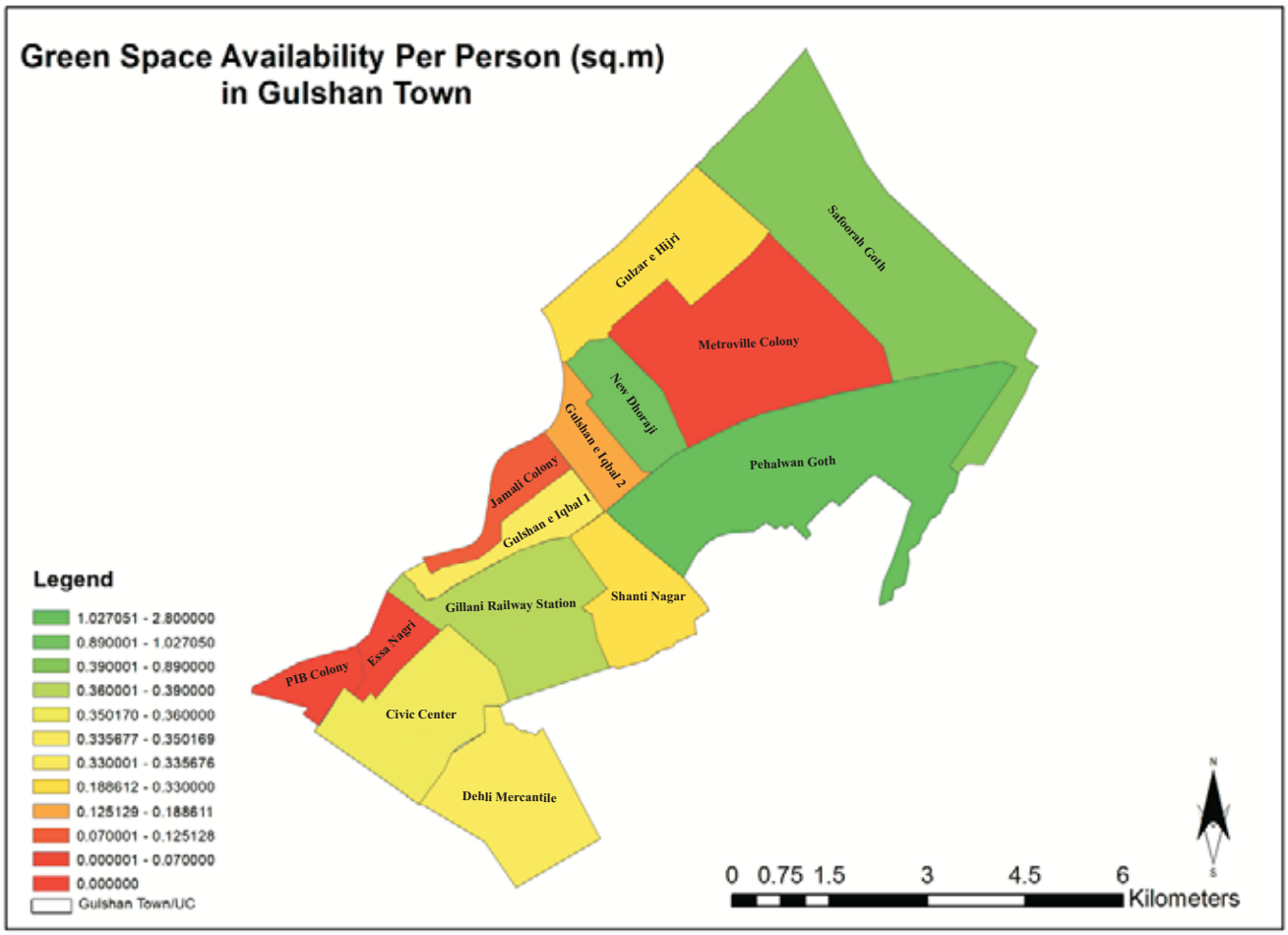

Figure-9: Availability of Green Space per Person in Each UC in Gulshan Town.

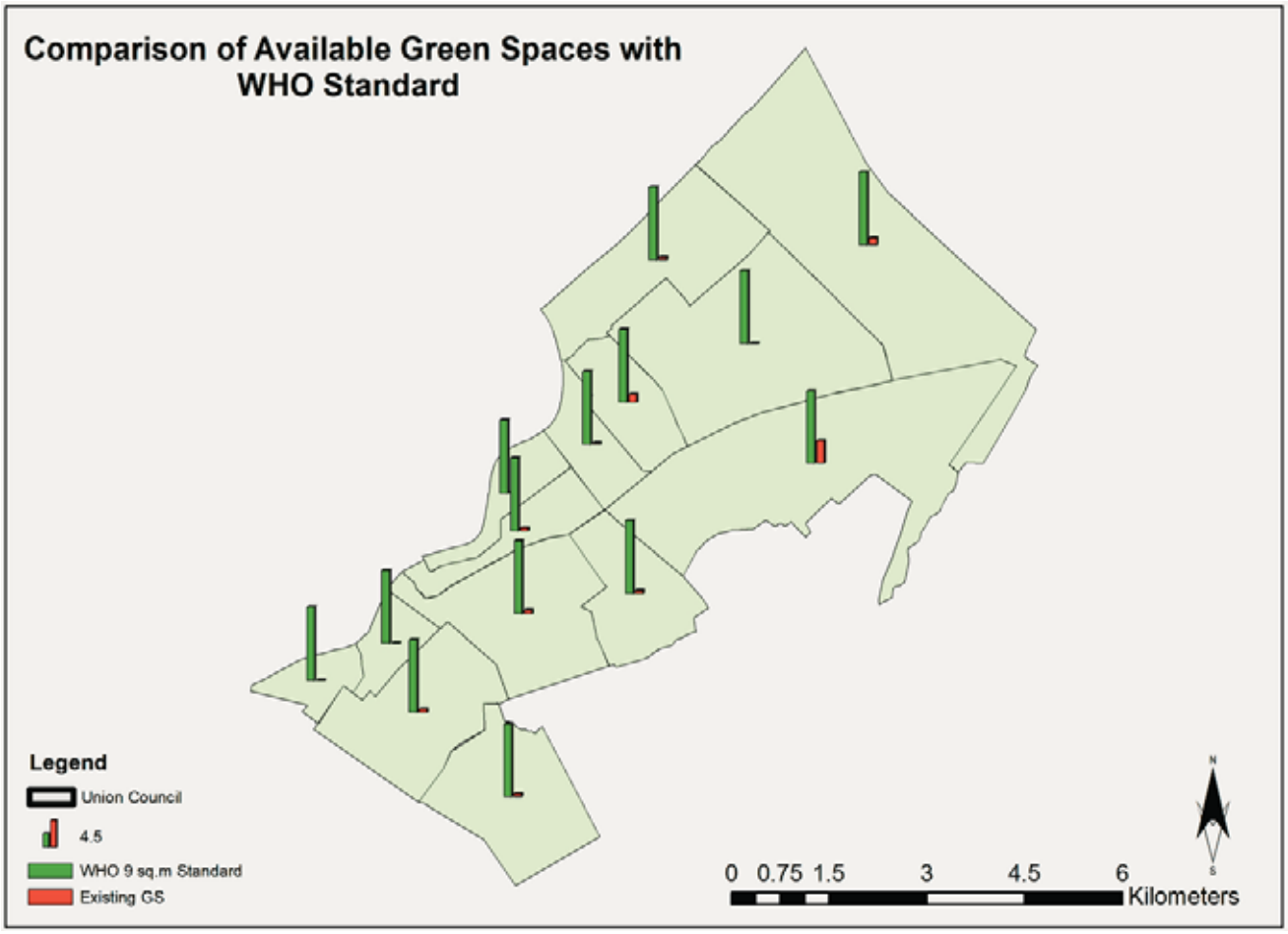

Figure-10: Comparison Between Available Green Space and WHO Standards per Person.

Global South, where the Gini coefficient for green space distribution is 0.47 compared to 0.27 in the Global North, and green space exposure is only one-third that of the North (Chen et al., 2022). This trend resonates within Karachi, where towns like Gulshan face significant shortfalls in green space availability, particularly in informal settlements and densely populated areas.

At the city level, comparative studies in Pakistan reinforce these findings. For example, only 1.89% of the total urban area in Peshawar (209.89 ha) is covered by parks, with five zones completely lacking parks, two of which are in the city center (Sultan, et. al, 2023). Similarly, in Lahore's Gulberg Town, only one union council met the WHO standard of 9 sq. meters of green space per person, leaving most areas underserved (Alam, et. al, 2014). In Karachi, Shah Faisal Town saw a marginal increase in green spaces (9,826.8 yd² between 2004 and 2009), but population growth of 48% since 1998 and encroachments diluted this improvement (Burke, et. al, 2012). These examples highlight the compounded effects of urban expansion and uneven spatial planning, issues that are clearly mirrored in Gulshan Town.

The GIS mapping and spatial analysis conducted for Gulshan Town revealed an acute shortfall in green space provision, with per capita availability falling far below the WHO-recommended standard of 9 sq. meters per person. This deficit is most pronounced in informal neighborhoods, where unchecked population growth, urban densification, and land encroachments have severely restricted residents' access to green spaces.

Unlike city-level studies that generalize green space distribution, this research provides a detailed micro-level examination, identifying disparities at the neighborhood level within Gulshan Town. This localized perspective is critical for urban planners and policymakers, offering targeted insights into underserved areas that require immediate

attention. These findings stress the need for equitable planning interventions to prioritize green space allocation in high-density and marginalized areas, fostering both social and spatial equity.

Limitations

This study primarily focuses on spatial distribution, with quality assessment of parks remaining a potential area for future exploration. Population data was drawn from the latest available census, which may not fully capture current dynamics. While the accessibility analysis used buffer zones, which provide preliminary insights, future studies could explore network analysis for a more nuanced approach. Despite these limitations, the study offers significant contributions to understanding green space equity at a neighborhood level.

CONCLUSION / RECOMMENDATIONS

This study provides a spatial analysis of urban parks in Gulshan Town, identifying critical deficits in their availability when adjusted for population density. While the buffer analysis indicates that spatial coverage might appear adequate, high-density neighborhoods, particularly in two Union Councils where no urban parks exist, face a significant lack of green areas per capita. These findings highlight the inequities in the distribution and accessibility of urban parks, emphasizing the need for targeted interventions to address these gaps.

The research also underscores the limitations of current urban planning approaches that often rely on generic benchmarks and fail to account for localized population density and community-specific needs. Through GIS-based mapping, this study offers granular insights into disparities, providing a foundation for policymakers to enhance the equitable distribution of urban parks, improve social well-being, and ensure compliance with population-based green space standards.

To close the existing gaps, urban park planning should shift towards evidence-based strategies that emphasize both the quality and accessibility of parks, alongside their quantity. Future research could extend this work by incorporating evaluations of park quality and advanced metrics of accessibility, furthering the understanding of urban park equity and strengthening efforts to create inclusive and sustainable urban environments.

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IMPACT OF COVID-19 LOCKDOWN ON AIR QUALITY AND URBAN HEAT ISLANDS: A REMOTE SENSING ANALYSIS OF PM2.5, NO2, AND TEMPERATURE IN LAHORE, PAKISTAN

Aqsa Qalb,* Aisha Khan, Suleman Sarwar,*** Rida Waheed******

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ABSTRACT

As the World was faced with the COVID-19 restrictions, in actuality the pandemic has been a blessing for the urban local climate of many metropolitan cities. This study has presented the condition of Lahore through utilizing remote sensing technique. Due to less usage of vehicles and the ban on commercial activities, the UHI or Urban Heat Island effect has lessened for Lahore city. Similarly, Pearson correlation built between the air quality (NO2, PM2.5, SO2) and Land Surface Temperature (LST) are used to understand the spatial urban variability of SUHI. LST change determination with the help of satellite images Landsat 8 Operational Land Images(OLI) from the year 2018 till 2020 was observed. There is a demonstration of decrease in mean temperature 23.82 C in 2020 while this ratio is 27.92 and 31.79 in 2018 and 2019. Future urban local climate can be predicted with the help of remote sensing techniques and the decreased value of air quality may be addressed by the city management for sustainable urban development.

Keywords: Urban heat islands, urban climate, land surface temperature, COVID-19, lockdown.

INTRODUCTION

The COVID-19 significantly changed the human behavior worldwide. Different measures have been adopted to control the virus from spreading more, and efforts are made to reduce interaction among unidentified infected and non-infected persons. It is cleared from the past studies that travel restrictions have demonstrated a positive effect in controlling SARS, Ebola, and bubonic plague outbreaks (Yasin & Gouda, 2020). A lockdown imposes a bound on all commercial activities, construction industries, institutions, offices, labor supply while also limiting disease spread and

health costs (Sasidharan et al., 2020). Lahore city is under the influence of rapid urbanization since the last couple of decades (Basheer & Waseem, 2022). Currently, severe environmental challenges exist due to changes in land use pattern, difference forms pollution which causes events like urban flooding and smog especially in developing cities. Urbanization has aggravated climatic changes, which further impacted the metaphorical development in the city. Urban sprawl is quite visible in the surrounding areas, which mixed the rural lands into the built-up urban developments. There are abrupt changes in the rate of urban growth in Lahore city (Abbas et al., 2018; Rana & Bhatti, 2018). The ecological, climatic, biological, and regional elements are disrupted by it. The urban heat island (UHI) is becoming prominent due to the cutting of green land and increasing built-up areas. UHI is primarily the main result of encroachment, which has further increased temperature overall. This has been the main theme of study for many researchers since decades. Heat islands temperature is higher than the nearby areas because of the heavy traffic generation likewise Airport, shopping malls and industries (Imran & Mehmood, 2020; Mentaschi et al., 2022).

The Punjab government implemented lockdown in Lahore on March 20 for quick response to prevent the spread of Covid-19 in the city by limiting unrestricted movement throughout the Punjab province. The decision to enforce the strict lockdown was made by the government due to of the drastic increase in COVID-19 patients in the city. Strict measures were taken for people interest, and people commuting without any purpose were compeled stay at to home. Strict rules more imposed at the city boundary and the entry and exit points of Lahore city.

Compelled a large number of researchers have examined the empirical relationship between temperature and COVID-19 (Gollwitzer et al., 2021). Most of these studies have investigated the impact of temperature and humidity on COVID-19 cases. On contrary, this study is a pioneer to examine the impact of COVID-19 on city temperature. Lahore is selected as it is one of the second highest populated and dense city of Pakistan. One of the studies (Gautam, 2020; Khan et. al, 2023, p. 20; Saha et al., 2022) suggest that due to lock down activities during COVID-19, air quality has been enhanced.

The aim of this study is to investigate the urban local climate in Covid-19 period with the help of Landsat 8 Operational Land Imager (OLI) images. Specifically, we aim to quantify the Land Surface Temperature and build its Pearson correlation with air quality indicators. Furthermore, we assess the improvement in urban air quality by calculating the extent of Urban Heat Island reduction during this period through remote sensing. The primary research questions are:

- How did the COVID-19 restrictions impact LST in Lahore?
- What is the correlation between air quality indicators (NO2, PM2.5, SO2) and LST during this period?
- To what extend to the urban air quality of Lahore improved and UHI reduced; post covid-19?

LITERATURE REVIEW

The COVID-19 pandemic began to spread globally in the second fortnight of December 2019. This disease swiftly spread throughout China, Italy, France, Spain, Germany, the Russian Federation, the United Kingdom, the United States, and India, as well as the UAE, Australia, Brazil, Argentina, and many other nations. It took lives of 1,147,000 persons and infected over 42,500,000 people as of October 25th. Given this urgency and the threat posed by this virus, the majority of the world adopted lockdown (full or partial) after March 2020, freezing pollution-effective economic sectors such as industry, transportation, tourism, and so on. This imposed measure resulted in significant economic losses all over the world, yet nature had the opportunity to refresh its surroundings, as revealed by Tobias et. al,(2020).

A significant and sudden drop in global carbon emissions was detected as a result of reduced energy footprint (Wang and Su, 2020), industrial production halt (Muhammad et al., 2020), public transportation disruption (Chen et al., 2020), and so on. A temporary pause in economic operations not only lowered carbon emissions, but also limited the discharge of numerous other greenhouse gases (GHGs) and pollutants such as sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and particulate matter 2.5 and 10 (PM 2.5, 10). In addition, a 25% reduction in CO_2, equivalent to 1 million tons of carbon, was discovered in China (Wang and Su, 2020). The megacity of Delhi, India, was the subject of research by Mahato et. al, (2020), who found that most areas of the city had significantly improved in quality. The air quality in the most polluted Indian cities during the COVID-19 lockdown was reported by Mahato and Ghosh (2020). According to Sharma et al. (2020), the AQI in 22 Indian cities showed improvements of 15–44%. According to Das et. al, (2021), during lockdown, the air quality in Indian megacities likewise improved by 50%, and during partial lockdown, the air quality hotspot was restored after dilution (Travaglio et al.,2021).

Human heat emissions and air pollution decreased as a result of the significant reduction in human activities during the COVID-19 lockdown, which had a significant impact on the urban heat island (UHI) phenomenon, a local climate change phenomenon in which temperatures in cities are higher than in rural areas due to urbanization. Changes in anthropogenic emissions and air pollutants have a considerable impact on land surface temperature (LST) (Qian et al., 2022). Despite a decrease in aerosol radiative forcing during the worldwide COVID-19 lockout, LST and air temperature did not rise as projected, and in some cases dropped in Europe and North America (Parida et al., 2021a). Similar conditions have been reported in Iran (Roshan et al., 2021) and India (Parida et al., 2021b).

MATERIALS AND METHODS

Study Area

Lahore city was selected as the case study area as it is the capital of Punjab and the second-largest city in Pakistan (figure 1). The city is currently experiencing bloating of transport sector development with new carpeted roads, flyovers, metro and orange line projects, rail tracks, road extensions, and other housing-related construction projects. Increased infrastructure development is accomponied with chopping down a massive number of trees. Furthermore, the city faces the challenges of smog, heatwaves and recent sandstorms which depicts the climate change impacts.

Data Collection Details

To analyze the spatial patterns of temperature variation in Lahore cloud-free Landsat-8 OLI was used for calculating the LST from 2018 to 2020 and all this data were collected on official US Geological Survey site (https://earthexplorer.usgs.gov/). Remote Sensing data was acquired for March and April month for the years 2018 till 2020 as corona lockdown started from March. Furthermore, a 5x5 filter of sharpening was used to remove blurring and increased image enhancement. Also, Data was obtained by the meteorological department to analyze air quality for the

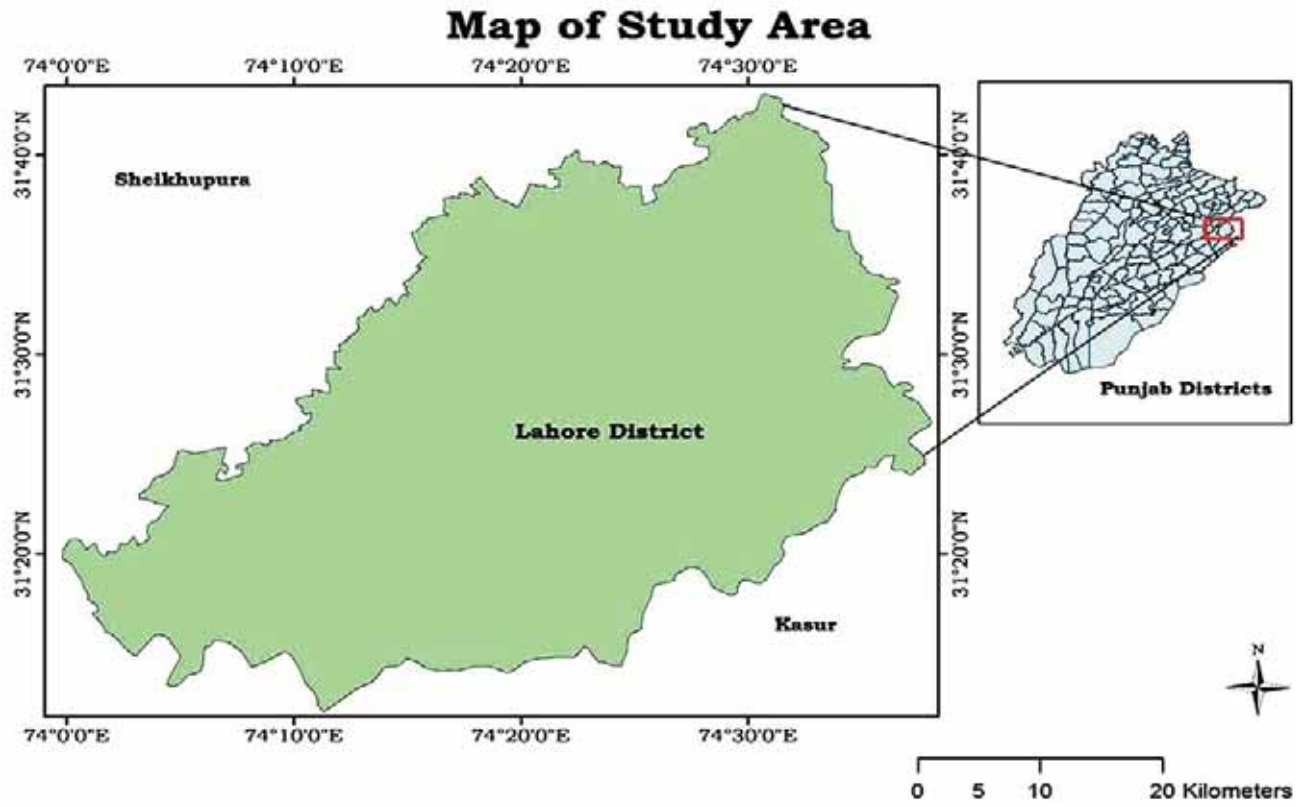

Figure-1: Sdudy Area Map of District Lahore.

overall two months' time period to check the difference of the environmental conditions in the time of lockdown.

LST Calculations and Abbreviations

LST is an important parameter to evaluate the environmental changes (Mustafa et al., 2020). Equation (1) to (6) explains the procedure to calculate the LST (Imran & Mehmood, 2020).

$$\frac{BT}{1 + (W) \text{ X } (BT / p) \text{ X In } (LSE)} \quad (1)$$

Where w represents the wavelength emitted radiance

p = he (1.438 X 10 - 2mK) (2)

Furthermore, BT travels upwards from the earth surface towards satellite and satellite captures it in the form of microwave radiation called Brightness Temperature. This was calculated as follows:

$$BT = \frac{K2}{\text{In } (K1/(L+1))} \quad (3)$$

As, BT is measured in temperature Kelvin, K1 and K2 are considered constant and its unit is watts / meter, L is spectral radiance in watts / (m sq * ster * um).

- If using Landsat 8 data then the value of K1 = 774.8853 and K2 = 1321.0789.

In the third step, Top of Atmospheric spectral radiance is calculated, whose details are in the metadata file:

$L\lambda = MLQcal + AL$ (4)

$L\lambda$ is the TOA. Its units are given as (Watts/(m² .sr.um), Pixel value is based on the Qcal, and ML = multiplicative rescaling factor and AL = additive rescaling factor of specific band.

- If using Landsat 8 data then the value of ML = 3.3420E-04 and AL = 0.10000. Furthermore, The Land Surface Emissivity (LSE) is calculated with the formula: LSE = 0.986 + 0.004 X PV(5)

Lastly, proportion of vegetation is calculated to estimate LST.

$$PV \frac{(NDVI - NDVImin)^2}{(NDVImax - NDVImin)^2} \quad (6)$$

The above equations are useful in predicting LST through ArcMap 10.8 and putting equations in raster calculator.

Surface Urban Heat Island (SUHI)

"Surface UHI" refers to warmer urban temperatures at the city level (Deilami et al., 2018). Surface temperature can be accessed by remotely sensed data. And it is measured with the help of satellites, so that the temperature of urban infrastructure can be measured. That's why Surface UHI is max during the day because earth warms quickly in the morning (Lehoczky et al., 2017; Zhang et al., 2023). All these steps are explained in the figure 2.

UHI = LST - LST (mean) (7)

RESULTS

Impact on Temperature

Extreme weather and climate events have wide ranging impacts on society as well as on biophysical processes. Many scientists from different parts of the world have linked increasing extreme weather events to global warming and it is assumed that intensities and occurrences of extreme weather will increase with the increase in global temperatures. Pakistan is the 5th most effected country (Nasim et al., 2018) by the climatic changes.

By delving deeper into the causes of spatial differences in UHI reduction, researchers discovered crucial elements that influenced the results. For example, variations in land use patterns, building density, and vegetation cover could all influence the efficiency of UHI mitigation. Understanding why particular locations face larger or smaller changes in UHI levels have allowed politicians and city planners to better customize their actions to meet the individual needs of diverse neighborhoods.

The temperature is considered to be a major factor in environmental evaluation of a city (Lau et al., 2020). The fluctuation in temperature creates a lot of changes in the city (Xie et al., 2020). Same is the case with Lahore city, climatic conditions are inter-changeable into different seasons with varying temperatures. The temperature trends are usually same each year but a significant change was observed in the temperature due to lock down of all commercial activities as well as automobiles and transport activities.

Comparing the pre-COVID-19 temperature and during COVID-19 temperature of Lahore during lockdown, a

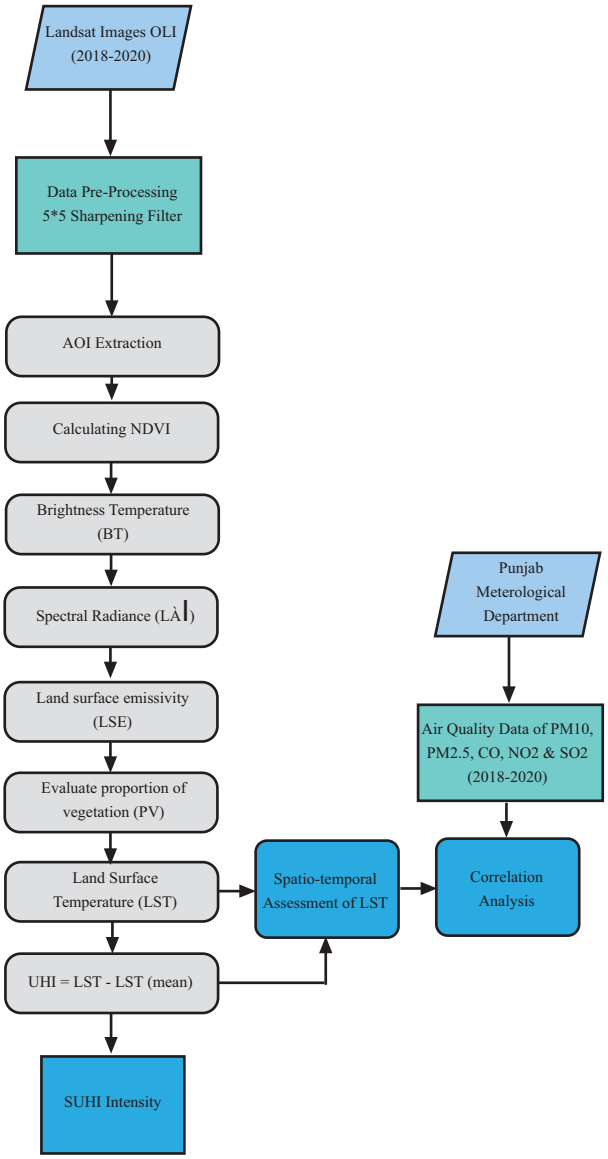

Figure-2: Methodological Flow of a Study.

significant change was observed as illustrated in figure 3 and 4. Resultantly, 33^0C temperature was observed in March 2020 during lockdown while this temperature was 42^0C in the last two years for the month of March. Also, in April month, decrease in temperature was observed during 2020, although 2018 and 2019 April showed higher temperature up to 42^0C. On the other side, if we compare LST mean, min and max temperature for the years 2018, 2019 and 2020 as shown in the figure 5 and 6. During lockdown in 2020, LST shows decrease in both March and April while rest of the years had shown increasing trends (Qalb et al., 2024). This evidently highlights that corona virus has had a great impact on living conditions and temperature as it has lessened

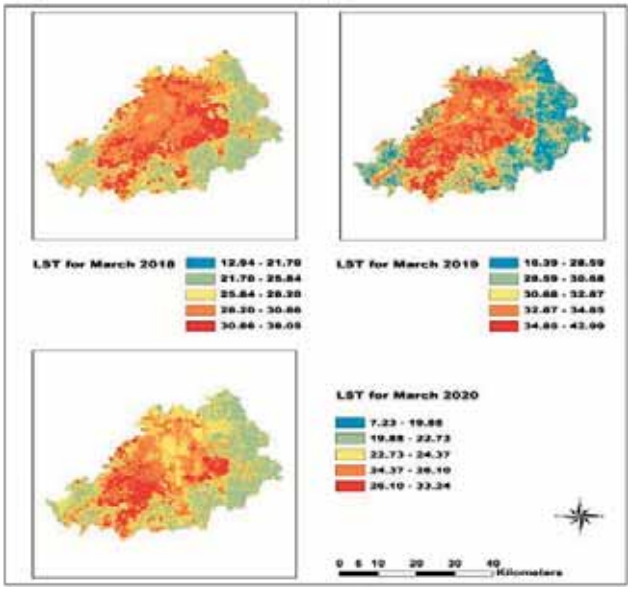

Figure-3: Lahore Surface Temperature (LST) for March 2018, 2019 and 2020.

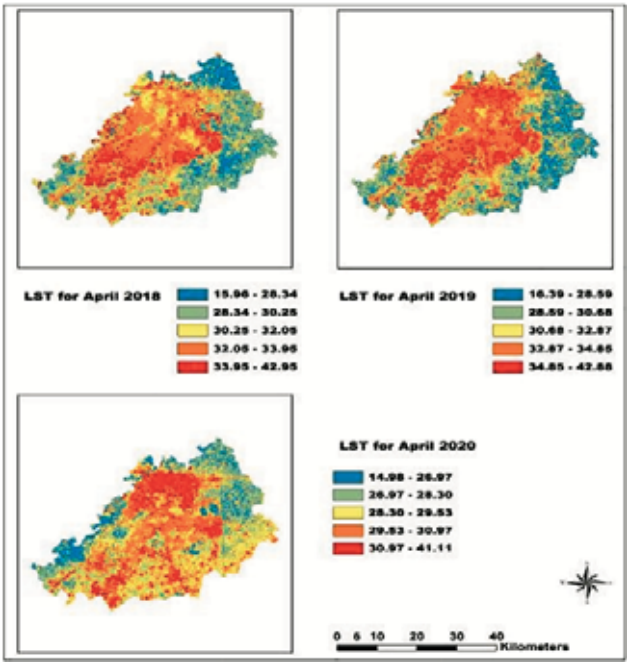

Figure-4: Lahore Surface Temperature (LST) for April 2018, 2019 and 2020.

the city's temperature (Basit & Shakrullah, 2019; Khan, 2021).

The study period was selected for 2018 to 2020 because COVID-19 pandemic starts in 2019, and the restrictions imposed during this time period provides a unique opportunity to examine the impact on air quality of Lahore and UHI effects (Qalb et al., 2024). Before 2019, Lahore was

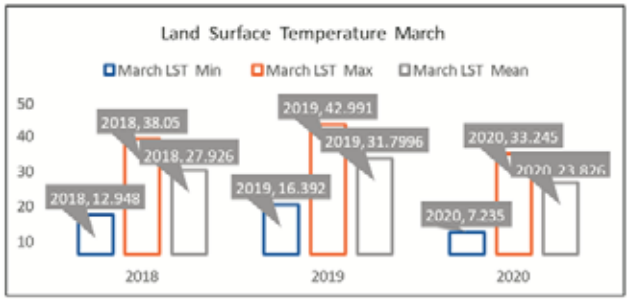

Figure-5: Lahore Surface Temperature (LST) for Marach 2018, 2019 and 2020, showing the minimam, maximam and mean values.

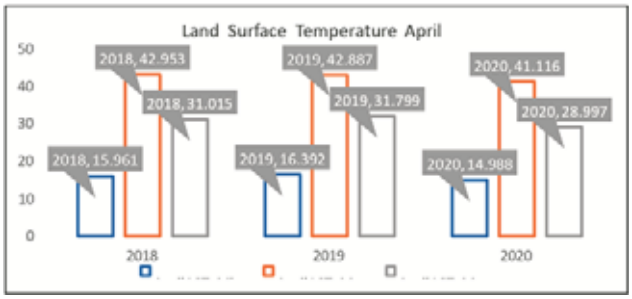

Figure-6: Lahore Surface Temperature (LST) for April 2018, 2019 and 2020, showing the minimam, maximam and mean values.

experiencing increasing trends of UHI due to rise in temperature and escalating traffic congestion (Imran & Mehmood, 2020). By comparing data from 2018, influence of COVID-19 restrictions on urban climate and air quality of Lahore was assessed. However, when the lockdown was implemented in the 2019 and 2020, we observed drastic decline in UHI. Specifically, the temperature data from 2019 still shows an upward trend because lockdown is not fully implemented. In contrast, April 2020 temperature shows a declining trend due to decreased vehicular movement and industrial activity. This dramatic shift supports the rationale for choosing the dataset from 2018 to 2020 as it highlights the direct impact of lockdown on UHI and urban air quality of Lahore. This study provides a unique insight into how human activities influence the urban climate.

Impact on the Heat Islands

During the COVID-19 period lockdown, significant decrease in LST is observed, and at the same time heat islands are lessened and shifted from inner city to the outskirts of a city as shown in the figures 7 and 8. During 2018 and 2019, UHI is at its peak but during lockdown, UHI zones diminish. Figure 7 and 8 highlight the UHI through remote sensing in ArcMap 10.8 (El Kenawy et al., 2021; Parida et al., 2021, p. 19).

Impact on the Air Quality

Many countries are imposing lockdowns to make safe residents from virus (Atalan, 2020; Chintalapudi et al., 2020). This has had a substantial impact on Lahore's environment. NO2 essentially gets noticeable all around, as the consuming of fuel and outflows from vehicles, trucks and transports are limited, power plants, and rough terrain hardware are not operational in many parts of the city. Less vehicles on the streets implies less pollution and ban of industrial and commercial activities benefits the overall quality of air in the city. Figure 9 and 10 shows the comparison between the air quality of year 2019 with 2020. A significant change in air quality can be observed.

The values obtained, which are shown in figure 10 and 11 are in accordance with Punjab Environmental Quality Standard. By comparing these we can conclude that air pollutants are showing decreasing trend. While the PM10 in March 2019 is reported at 119.95, in March 2020, the PM10 comes down to 32.72. For PM2.5, the value in March 2019 is 62.23 which turn to 21.72 in March 2020. The value for nitrogen oxide (NO) is 46 and 10.22, in March 2019 and March 2020, respectively. Figure 11 shows the fluctuations in air quality right after the lockdown ended. The observed changes in primary pollutants are linked to decrease in emissions during the lockdown period (Wu et al., 2020). Emissions estimates based on current activity levels suggest an overall decrease of Sulphur and carbon oxides, which was generated from road traffic, from industry and power plants. Therefore, it can also be said that poor quality of air and commercial and business activities relate with each other (Wang et al., 2020).

The COVID-19 lockdown has provided us with the positive opportunity to observe the impact of reduced human and industrial activities on air quality and the environment. During lockdown, a sharp decline was observed in vehicular emissions which led to noticeable improvements in the AQI as shown in the figure 9 and 10. These changes highlight the potential for integrating environmental considerations into future urban planning. Environmentalists and urban planners can use these insights to develop hybrid approaches to manage city. To create a balance between economic activities and environmental sustainability. Policies that promote cleaner transportation, greener spaces, roof top gardens and reduced industrial emissions to tackle smog and other environmental challenges, always positive growth of urban area (Graceetal, 2023, Thompson et. al, 2024). Such policies would not only help in the improvement of public health but also develop cities based on sustainable

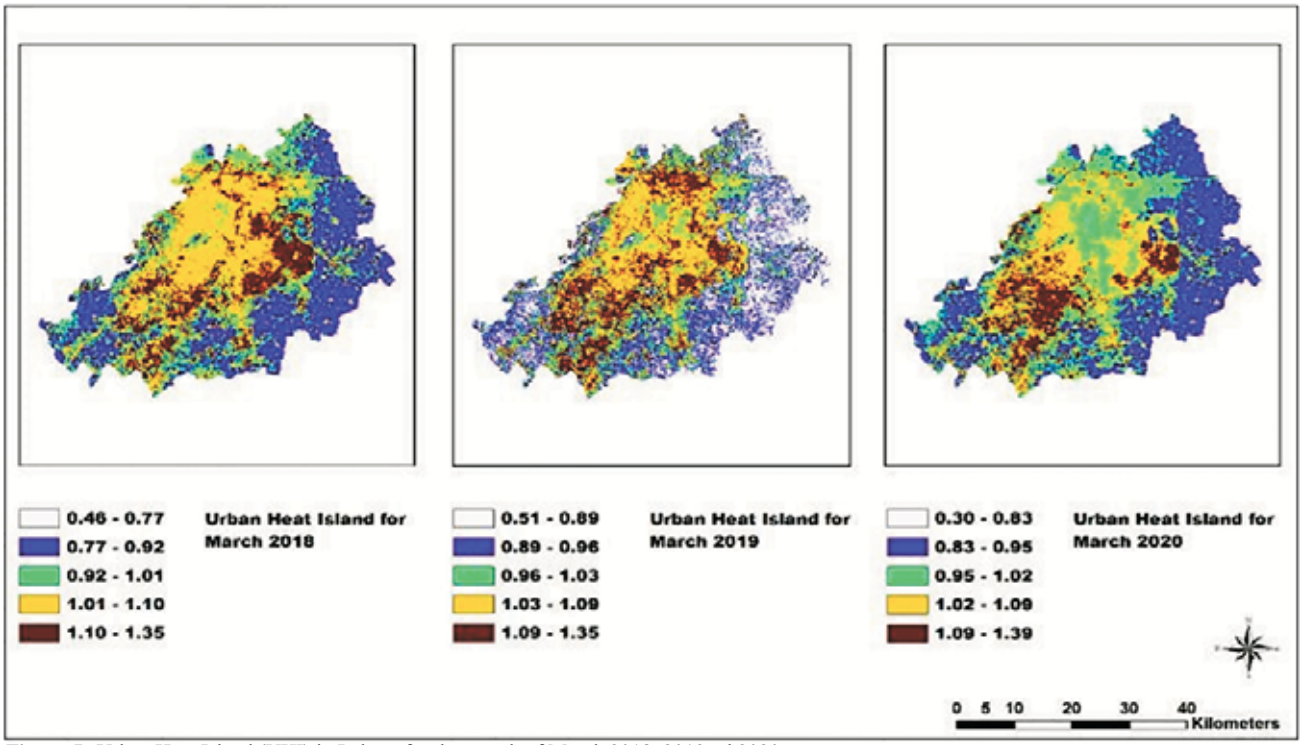

Figure-7: Urban Heat Island (UHI) in Lahore for the month of March 2018, 2019 nd 2020.

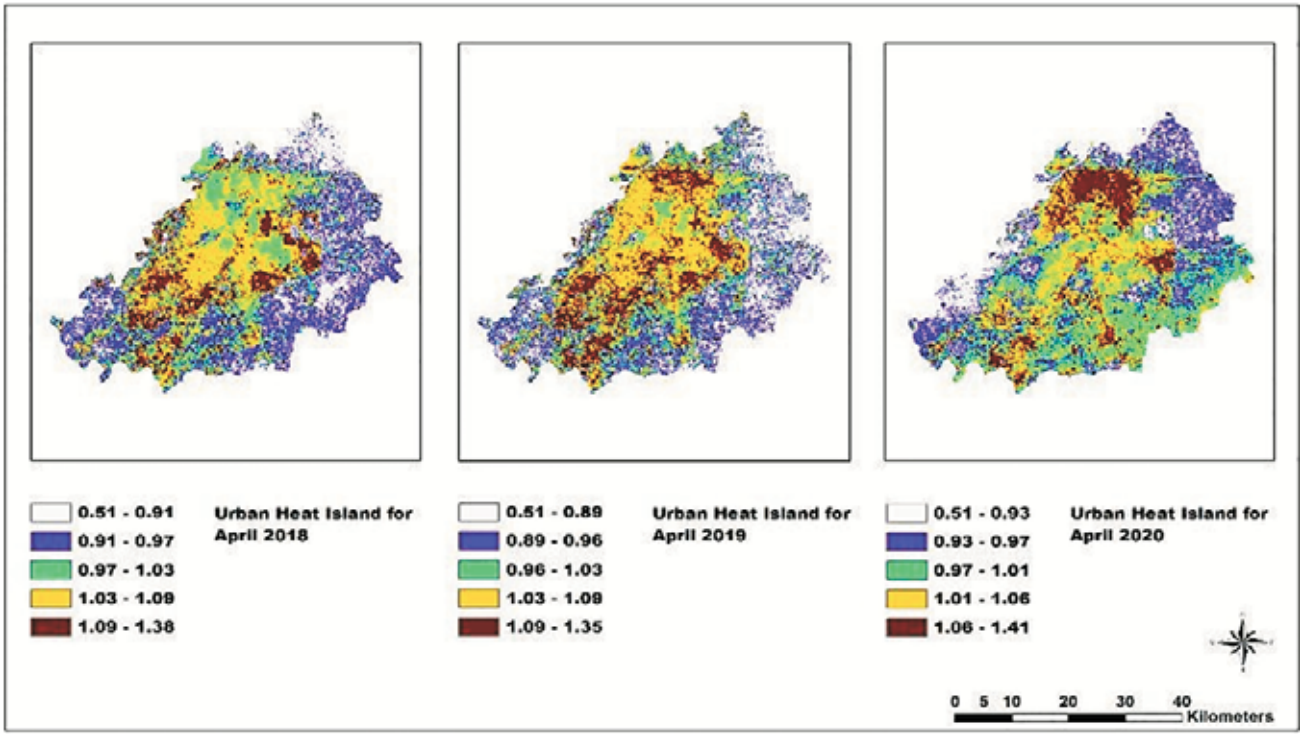

Figure-8: Urban Heat Island (UHI) in Lahore for the month of April 2018, 2019 and 2020.

Figure-9: Air Quality Comparison of Marach 2019 amd 2020 in Lahore, Showing Concentrations of PM10, PM2.5. CO, NO2, and SO2 and a Comparison with Punjab Environmental Quality Standards (PEQS).

Figure-10: Air Quality Comparison of April 2019 amd 2020 in Lahore, Showing Concentrations of PM10, PM2.5. CO, NO2, and SO2 and a Comparison with Punjab Environmental Quality Standards (PEQS).

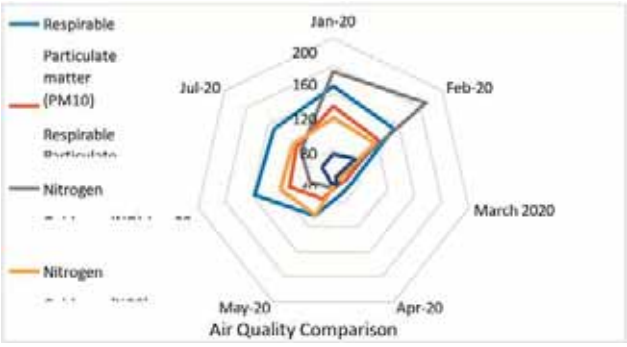

Figure-11: Air Quality Comparison in Lahore from January to July 2020, Showing monthly concentrations of PM10, PM2.5, CO, NO2 and SO2.

and resilient policies.

Potential limitations, such as seasonal influences, significantly affects the validity and reliability of study results. Seasonal impacts, for example, can cause biases in data collection and interpretation, resulting in incorrect findings. Changes in climatic circumstances, such as temperature or precipitation, had an impact on the precision of remote sensing observations, jeopardizing the research's integrity. Furthermore, potential measurement errors, such as air interference or sensor breakdowns, corrupted the obtained data, skewing the results.

CONCLUSION

Lahore being the epicenter of the pandemic during corona, was being closed down with partial opening of commercial activities, travel restrictions, and require its citizens to stay home beginning in late March 2020. The decrease in tropospheric NO2, in PM2.5 pollutants in the Lahore city.

Sstrict policies reduced human induced air pollution emissions in the City (Jin et al., 2016). Yet, significant reductions in primary pollutant emissions were observed in the city. This lockdown was economically disastrons and could not continue indefinitely, thus, so the government needs to find ways to reduce temperature and pollutants from the atmosphere of Lahore and ten there similar cities.

The present study conducted the correlation of different air pollutants in Lahore and their impacts on the heat islands through utilization of remote sensing techniques. Results shows negative LST as compared to mean temperature of 2018 and 2019 as described due to lockdown effect (García and Díaz, 2022). This reduced LST was directly linked with the air temperature calculated by the meteorological department and compared with Pakistan National Environmental Quality Standards. Additionally, high spatial-temporal variation of temperature in a city like Lahore, concludes that cities are highly vulnerable to climate changes and high pollution rates makes them attractive to analyze and do further studies in urban heat islands.

These findings highlight the importance of incorporating sustainable environmental strategies into urban planning. Moving ahead, it is important for city planners to implement measures such as increasing green spaces, promoting the use of public transportation, promote car-sharing options and enforce stricter air quality regulations by Environmental Protection Agency. Moreover, future research could explore the varying impacts of lockdowns duration on urban air quality and temperature across different regions. Reseavding the role of urban density, UHI due to industrial activities, and traffic pattern in defining air quality can help us to mitigate smog and improve overall urban quality of life for the citizens of a city.

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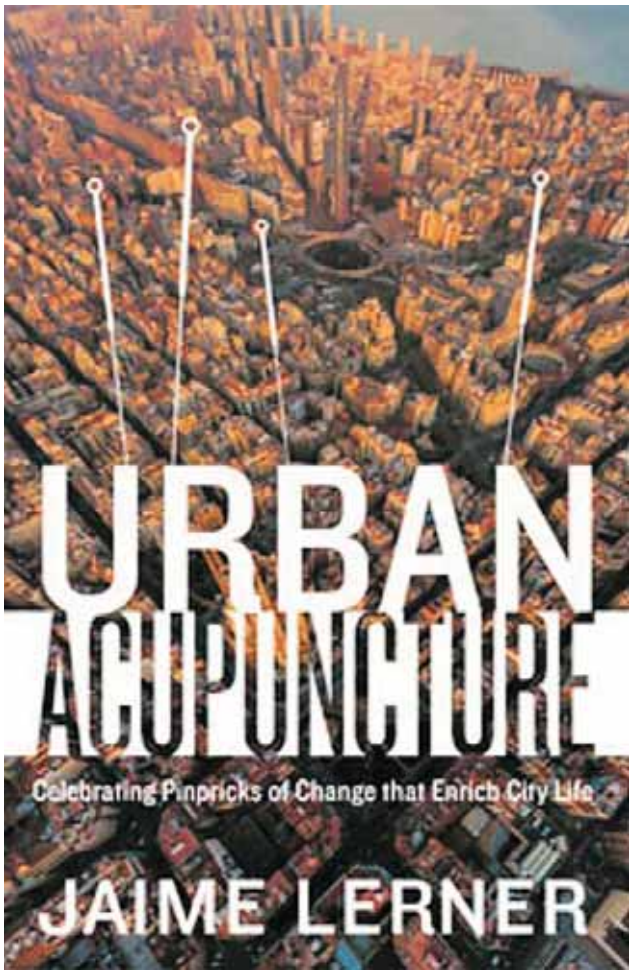
URBAN ACUPUNCTURE: CELEBRATING PINPRICKS OF CHANGE THAT ENRICH CITY LIFE

Jaime Lerner

Reviewed by Rabbia Tanveer*

BOOK REVIEW

Jaime Lerner's *Urban Acupuncture:* Recognizing small but significant improvements that enhance urban life is an excellent method to encapsulate the essence of incremental urbanism. Lerner, a globally famous architect and former mayor of the Brazilian city Curitiba in South America, persuades us of the enormous benefits of tiny changes in our communities. This book is more than just a guide to how urban planners might be inspired to enhance their cities.



Lerner is most focused on "urban acupuncture," which states that singular interventions could bring about widespread change. He cautions against the large, set-piece urban projects that dominate much planning discourse and instead makes his case for small-scale, quick victories at the local level to address what is sub-optimal but simply within reach. This shift in scale represents a refreshing departure from the dominant trend of large-scale urban development. It serves as evidence that even small adjustments can have a significant impact.

This narrative is conveyed through breathtaking visuals captured from many locations across the globe, showcasing the efficacy of uncomplicated measures such as establishing park-lets or vegetable gardens on rented land or implementing pedestrian-friendly roadway designs, in rejuvenating our communities. A literary urbanologist with a deep affection for cities and a comprehensive understanding of how people live in them, Lerner produces engaging, incisive prose with broad appeal. His writing is comprehensive and emotive, painting a vivid picture of urban evolution that inspires action.

The standout feature of Urban Acupuncture was Lerner's narrative. They have encapsulated stories from his term in Curitiba, which later rendered the city a blueprint of sustainable urbanism for emulation globally. These perfect "acupuncture points" that redefine urban living include the Bus Rapid Transit (BRT) system, pedestrian-friendly streets,

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and public spaces that serve as the venues for community interaction in Curitiba. These stories are mere examples of Lerner's principles in action, inspiring case studies that prove the workability and success of his method.

Lerner writes with a tone of optimism and practicality. He decries the problems such cities suffer today—mass congestion, pollution, and social inequity—but is convinced that careful, tactful interventions like this are key to solving these challenges. Both masterful and grounded, his vision provides any city leader, planner, or citizen with a practical roadmap. Lerner is infectiously optimistic, urging readers to see how change for the better really can happen in even the most complex of urban settings.

The book's design is stylish, pairing fitting photographs and illustrations to the text. These images act not only as demonstrations but also as motivators that inspire readers to believe how change was (for so long) more straightforward than it looks. In line with urban acupuncture, that book is an architectural intervention, and each photo and image, the balance of whitespaces, helps readers understand.

Urban acupuncture is also highly humane. Lerner stresses the necessity of public input and creating cities that correspond to their residents. His mandate is human-centered urbanism, city planning for people first and cars second, community above isolation, and creativity within rather than control without. This human-based approach is a seminal aspect of what Lerner stands for in his philosophy, that no urban intervention should only be powerful but also just and fair.

In this book, Lerner explores the psychological and sociological aspects of city living. He looks at how slight physical changes create urban environments that increase social cohesiveness, a sense of place, and what it means to live a good life. So, by approaching urban acupuncture from a humanistic perspective, Lerner addresses the emotional and physical aspects of city life and designs functional and nurturing environments.

To conclude, Urban Acupuncture is a philosophical, careful, and practical manual for improving people's lives in cities by creating more livable, just societies full of enjoyment. The urbanism, policy, and design community should take away from this project Jaime Lerner's statement that small answers the scale crisis by capturing it with creativity through human-centered processes. This book is a must-read for anyone who believes in the potential of cities to foster connection, innovation, and joy. Lerner's insights are as relevant today as when the book was first published, offering timeless wisdom for the ongoing evolution of urban environments. Lerner beautifully encapsulates his philosophy: "The city is not the problem; it is the solution."

Published by Island Press in September 2014, *Urban Acupuncture* (ISBN 978-1610915830) is a testament to Lerner's innovative thinking and practical wisdom, solidifying his legacy as a visionary urbanist and advocate for sustainable city living.

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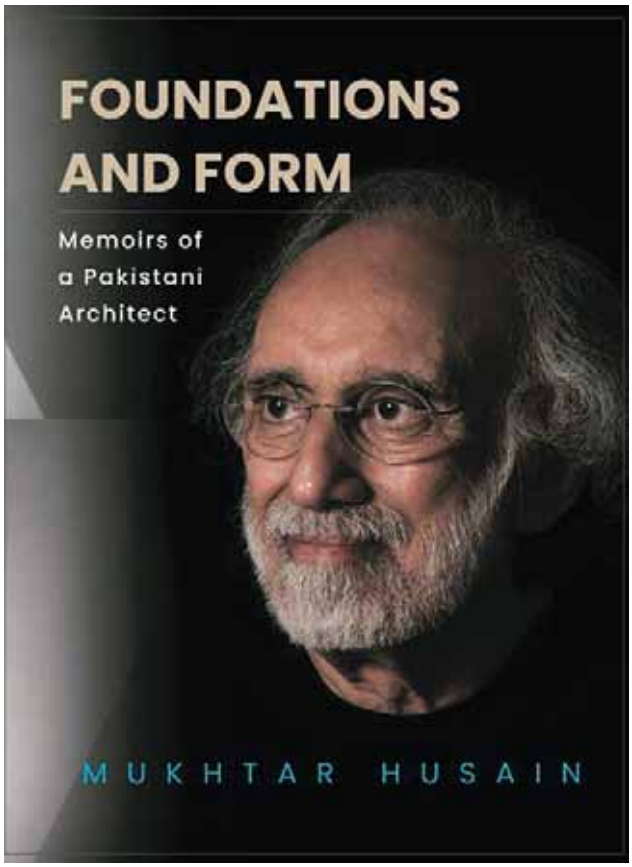
FOUNDATIONS AND FORM: MEMOIRS OF A PAKISTANI ARCHITECT

Mukhtar Hussain

Reviewed by Dr. Hira Qureshi*

BOOK REVIEW

Mukhtar Husain's "Foundations and Form: Memoirs of a Pakistani Architect" is a compelling and multifaceted narrative that intertwines his background, professional accomplishments, and the sociopolitical climate of Pakistan. On the surface, the title might suggest a technical investigation of architectural theory and practice. But as it turns out, the memoir is a masterfully written story that incorporates historical details, cultural views, and personal experiences as Arif Hasan, in the foreword, aptly describes it as a "story, lovingly told, of people, places and events".



The memoir opens with a moving account of Mukhtar Husain's family origins in Ujjain and Indore, and the significant effects of India's Partition on their life. His life tale begins with the relocation to Karachi, which captures the vibrancy and formative years of the metropolis. Mukhtar Sahib's path through many career turning points, such as his participation in the Aga Khan Award for Architecture, offers awareness of the difficulties and rewards of operating in a politically sensitive workplace. His observations on world events such as the Vietnam War, the India-Pakistan War of 1965, and Bangladesh's birth that provide his story with a more comprehensive background. His architectural career is explored throughout the book, highlighting the frequently turbulent connection between creativity and political realities resulting in unavoidable disappointment and flashes of spectacular triumph. The anticipation grows as we read his book, which is methodically divided into three comprehensive sections.

Mukhtar Sahib's personal and professional journeys are intertwined with Karachi's urban and social development. His life and career are described in detail in the first section, which is especially interesting because of its vivid anecdotes and reflections on his early years, his architectural education at the Middle East Technical University (METU) in Turkey, his travels throughout Europe and the Middle East, and his four-decade-long career as an architect in Pakistan. A very

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intimate level of detail is added to the story in the second part which centers on his family. It is evident how much he loves his children and his wife Rumana, a talented author, cultural historian, and graphic designer. It offers a genuine contrast to his career accomplishments that aren't covered in the other sections of the book. Also, his humility and spirit of cooperation are further demonstrated by the admiration and respect that he shows for Professor Kausar Bashir and Sir Arif Hasan. The final part, which highlights his strong bond with Karachi and details how the city changed from being well-run in 1945 to being in terrible condition today, is truly insightful and moving, as he nostalgically recounts moving through various neighborhoods and witnessing the city's infrastructural changes, from trams and double-decker buses to the city's ambitious but flawed urban plans.

Engaging insights can be gained from his experiences, which include the divergent views of German and French experts on the Jinnah Airport project and his fortuitous help to an Italian family at the Wagah border. Along with capturing these historical and political contexts, the book also covers major events in Pakistan's history, such as the assassination of Zulfiqar Ali Bhutto and the rise and fall of martial law, as well as the Vietnam War, political unrest in Turkey, and the Israel-Palestine conflict. He also offers a nuanced view of Pakistan's architectural landscape through suggestive descriptions and personal anecdotes. His architectural philosophy emphasizes sustainability, community-centric design, and the social duties of architects.

All in all, "Foundations and Form" provides an intuitive look at the life of a brilliant architect and the times he lived in, making it a valuable resource for sociologists and general readers alike. The autobiography presents a man who has accepted all of life's experiences and difficulties and who is eager to remake himself while looking forward to the future with hope. The book's strength lies in its heartfelt storytelling and detailed recollection of personal and historical events. Karachi's social fabric and changes over time are vibrantly described between 1950 and 1960, making it a treat to read. The way the author describes his educational background and career obstacles is motivational and informative. However, if the readers are unfamiliar with South Asian history or architectural vocabulary, the story may seem overwhelming. Although the author highlights his admiration for architects and contemplates viewing the world from an architect's perspective, details of his design philosophies and methods at times may have been further added to enrich his described viewpoints.

As a final poignant nod to his beginnings, the book offers a sense of resolution and coherence. The story touches upon universal issues like identity, endurance, and the search for meaning in an ever-changing world. The book provides inspiration and insight, making it an essential read for anybody interested in architecture and cultural heritage. The author's journey demonstrates the power of architecture to shape society and promote cultural identity. As you turn the final page, you are left thinking about the lasting impact of his work and curious to see how future generations will build on his legacy.

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- Low carbon impact buildings
- Secondary cities
- Sustainable architecture
- Urban ecology/ Urban renewal / Urban sprawl
- Urban sustainablity / Urban transportation
- Urbanization

BOOK REVIEW: Contributions for our 'Book Review' section are welcome in the form of a brief summary and a sample of the publication related to the field of archiecture, planning and development.

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