Building Control Regimes in Pakistan:

Policies and Practices

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Abstract

Building control is a system to ensure the safety, structural soundness and stability, fitness and sustainability of buildings, through the enforcement of building regulations. Pakistan's building control system operates across federal, provincial, and local levels, emphasizing land-use and building regulations. The government and development authorities ensure adherence to zoning laws, master plans, and land-use policies for sustainable development. They enforce licensing and inspection processes to maintain safety and compliance.

The rapid urban expansion and increasing commercialization of Lahore have introduced significant challenges in implementing effective building control measures. This research examines the performance of regulatory frameworks governing commercial structures in areas managed by the Lahore Development Authority (LDA), Metropolitan Corporation Lahore (MCL), and Lahore Cantonment Board (LCB). Using a mixed-methods approach, the study combines data from field surveys and interviews to assess adherence to regulations related to safety, accessibility, and sustainable development.

The analysis reveals varying compliance levels across jurisdictions, with LDA leading at 70%, followed by LCB at 64%, and MCL at 58%. While LDA shows higher adherence, inconsistencies suggest uneven enforcement. Conversely, MCL exhibits consistent but inadequate implementation,

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while LCB demonstrates moderate outcomes. Indicators such as spatial allocation and pedestrian pathways are identified as pivotal to regulatory success. Institutional bottlenecks, including administrative inefficiencies, external pressures, and a lack of transparency, further impede enforcement. Feedback from stakeholders highlights procedural difficulties, inadequate support mechanisms, and unmet public expectations concerning infrastructure quality and safety.

Benchmarking against cities like New York, Kuala Lumpur, and Mumbai, the study identifies Lahore's lag in integrating contemporary practices and sustainability standards. Recommendations include leveraging advanced technologies, harmonizing regulations, improving interagency collaboration, and addressing systemic inefficiencies. By implementing these measures, Lahore can progress toward resilient infrastructure and balanced urban growth.

Keywords: *cyber, security, technology.*

1. Introduction

Building control refers to a regulatory system that ensures that the buildings are safe for their occupants, have a sound structure and are fit for their intended purpose. In other words, building control is a system to ensure the enforcement of building regulations (Pakistan Engineering Council, 2021). It necessitates the existence of a systemized mechanism, under which the building control authorities issue permits for building construction, carry out inspections and check compliance with the building codes, by-laws and regulations. The key aspects of building regulations entail a multitude of stipulated standards related to safety and sustainability of buildings, such as their foundations, structural stability, ventilation system, drainage, fire safety, parking areas, right of way and accessibility (Local Authority Building Control [LABC], n.d.).

1.1. Understanding the Building Control Regimes of Pakistan

Pakistan's building control regimes operate through a diverse institutional and regulatory framework at federal, provincial, and local levels. It is fundamentally structured upon two key aspects of urban development; land-use/zoning and building regulations. The federal and provincial governments, in association with the development authorities and allied statutory bodies are responsible for ensuring safe and sustainable building plans in adherence to the master plans, zoning laws, and land-use regulations of metropolitan areas. Each authority has established specific licensing protocols and inspection mechanisms to fulfill these responsibilities (Ahmad et al., 2013b).

The Federal Ministry of Housing and Works is mandated with the acquisition, administration, and upkeep of federal government edifices, enforcing regulations for construction, requisition, and land governance (Ministry of Housing and Works, Government of Pakistan, n.d.). It supervises the formulation and execution of federal civil works and housing projects and administers the line departments including Pakistan Housing Authority Foundation (PHAF), National Construction Limited (NCL), Pakistan Public Works Department (PWD) and Federal Government Employees Housing Authority (FGEHA). Capital Development Authority (CDA), established under CDA Ordinance, 1960, is the civic organization responsible for town planning, building, and maintenance in Islamabad Capital Territory (ICT) (Capital Development Authority, n.d.).

At the provincial level, housing and urban development departments serve as the administrative departments for provincial development authorities and agencies, tasked with overseeing land use and building control within their respective jurisdictions. For instance, Sindh Building Control Authority (SBCA), extending its jurisdiction beyond Karachi to the entire province, Communication and Works, Physical Planning and Urban Development Department, Balochistan has the mandate of legislation, policy formulation, and sectoral planning on building control. Housing, Urban Development and Public Health Engineering Department (HUD&PHED), Punjab administers the development authorities in Lahore, Faisalabad, Multan, Gujranwala, Rawalpindi, Bahawalpur, Dera Ghazi Khan and Sargodha.

At the local tier, local government departments implement the local government acts of each respective province, under which metropolitan corporations and division/sub-division/district/union councils have been established. These local bodies oversee metropolitan development and building control, in adherence to their respective rules/regulations/by-laws.

The Building Code of Pakistan, 2021, issued by Pakistan Engineering Council (2021), establishes requirements for building construction and safety in Pakistan. The code describes key terms, categorizes different building occupancies and uses, and provides detailed construction and safety requirements for different occupancies to regulate building construction and safety of life. Development authorities in Pakistan, broadly ensure compliance with this Building Code.

Building control in Pakistan's mega cities, like Lahore, is becoming increasingly challenging due to rapid expansion, population growth, and commercialization. These factors have increased the need for effective building regulation. Lahore is managed by multiple development authorities, each overseeing specific areas, complicating urban development and enforcement. Studying building control policies and practices in such a dynamic metropolis, especially in commercial zones, is essential for improving governance and

infrastructure development in the city.

1.2. Development Authorities in Lahore

Lahore provides a unique case to evaluate Pakistan's building control regimes. The development agencies operating in the district are Lahore Development Authority (LDA), Metropolitan Corporation Lahore (MCL), Cantonment Boards (LCB and Walton Cantonment Board), Model Town Society (MTS) and Defense Housing Authority (DHA). The cluster of authorities has further been expanded with the introduction of Ravi Urban Development Authority (RUDA), Central Business District Authority (CBDA) in 2020 and 2021, respectively. Each authority has different areas under its jurisdiction, regulated by its own building by-laws/rules/regulations. The authorities, in addition to land-use planning, are mandated to approve the building plans, issue building permits, look after the construction activities, inspection and monitoring to ensure compliance, through set procedures. The building by-laws of the authorities have specific provisions regarding safety, sustainability and stability of buildings, including but not limited to the parking area, mandatory open spaces, safety elements, water and energy efficiency/conservation, right of way, etc.

A brief overview of the LDA, LCB and MCL is given below:

1.2.1. LDA

LDA, established as an autonomous body under the HUD&PHED, evolved from the Lahore Improvement Trust (LIT) through the LDA Act, 1975. LDA's mandate is to drive sustainable urban development in Lahore. Key domains under LDA's jurisdiction include housing and building control, traffic management, and water supply and sanitation, managed through its Urban Development Wing, the Traffic Engineering & Transport Planning Agency (TEPA), and the Water and Sanitation Agency (WASA), respectively.

LDA's building control management comprises the Director General, Chief Town Planners, Directors, and Sub-Engineers. Every building plan within LDA's jurisdiction is approved through process guided by the LDA Building and Zoning Regulations, 2019 (Lahore Development Authority, 2020). The process typically completes in 45 days, encompassing application submission (along with all the requisite documents and No Objection Certificates (NOCs) from other departments), review by architecture wing, site inspection, and final approval.

1.2.2. MCL

The Metropolitan Corporation Lahore (MCL) performs its functions related to municipal services and building control in district Lahore. MCL's Planning wing is responsible for approving building plans for residential, commercial, industrial, and agricultural structures, as well as issuing completion

certificates. Building plan applications are processed with approved timelines of 30 working days for construction approvals and completion certificates. Planning Wing is led by the Metropolitan Officer (Planning) and includes positions of Deputy Metropolitan Officers, Assistant Metropolitan Officers, and Building Inspectors. These officers and inspectors conduct compliance checks, monitor construction sites, and manage enforcement actions, including demolition of unauthorized structures and inspections of buildings.

1.2.3. LCB

The Lahore Cantonment Board (LCB) was established in 1850, serving as an important administrative organization in Lahore. Its inception is linked to the arrival of the British Army in the city officially marking LCB's establishment as a unique administrative unit. Over time, LCB developed further under the Cantonments Act of 1924, which led to the formation of a more structured administrative body.

The main goal of LCB is to manage urban administration and improve living conditions within the Cantonment. Its core responsibilities encompass a range of municipal services and management of land use and urban development. Approximately 80 personnel are deputed as building checkers, enforcement workers, and surveyors in its field formation (Lahore Cantonment Board, 2024)

1.3. Statement of Problem

An effective zoning and building control regime is essential for achieving sustainable urban development in Pakistan's major metropolises. Statistics confirm that the built environment of Lahore has increased twofold during the past decade (Aslam & Rana, 2022). High population density and urban sprawl have altered the land use patterns, increasingly converting the residential and agricultural lands into commercial zones (Jamil & Gulzar, 2022). Violations of building regulations, such as insufficient parking space creates traffic congestion (Aziz, 2018). Inadequate compliance with safety regulations has led to multiple catastrophic fire incidents, such as those at Pace Mall (2022), Hafeez Center (2020), and Shah Alam Market (2011). There is a need to evaluate the efficacy and enforcement of building control regulations controlled by different development authorities in Lahore and develop recommendations for policymakers for strengthening the building control regime.

1.4. Research Questions

1. How effective is the enforcement of building regulations in commercial buildings by different authorities in Lahore?

2. What factors contribute to improved building control compliance under the city's diverse regulatory framework?

1.5. Scope of Work

This study focuses on evaluating the building control regimes in Lahore, with particular emphasis on the enforcement and effectiveness of building regulations within commercial buildings. Given Lahore's rapid urban growth, increasing commercialization, and rising population density, this research aims to assess the compliance with building by-laws in the city's commercial zones. Special attention is given to the key aspects of safety, sustainability, and accessibility, which are crucial for ensuring the well-being of both building occupants and the general public. The commercial buildings have been selected as focus of this study because of stringent byelaws, as compared to the residential buildings, high foot traffic of not only the business owners, but also a large number of visitors, and employees increasing safety concerns. Furthermore, commercial buildings consume more electric and water utilities comparatively, leading to a higher demand for sustainability (Booth, 2020).

This study encompasses the evaluation of implementation of building control regulations in commercial buildings within the areas of jurisdictions of LDA, MCL and LCB which offer well-established building and zoning by-laws to be studied, making them suitable for a meaningful comparative analysis of regulatory control in the context of commercialization and urban development.

The findings of the study, based on the primary and secondary data, will help identify the gaps in building control regime in Lahore compared to the international best practices, providing valuable insights for policymakers, urban planners, and regulatory bodies. The study will also lay the groundwork for future research on building control in Pakistan's megacities.

2. Literature Review

Lahore, one of the rapidly growing metropolitans in Pakistan has more than 13 million population, with an average annual growth rate of 2.65%. The district expands over 1772 km², with a population density of 7338.68 per square kilometer, making it the most densely populated urban area in Punjab with 100% population proportion residing in urban settings (Pakistan Bureau of Statistics [PBS], 2023). It is well-established that the uncontrolled expansion of Lahore demands a massive infrastructure development to fulfil the people's needs. Conversion of agricultural lands to residential and commercial areas is one of the root causes of urban sprawl (Ahmad et al., 2013).

Building control and regulatory frameworks vary considerably across jurisdictions, reflecting diverse legal systems, climatic conditions, and urban development priorities. In the United Kingdom, the Building Act 1984 and subsequent Building Regulations establish mandatory technical standards for structural safety, fire protection, energy efficiency, and accessibility, with enforcement delegated to local authorities or approved inspectors (Ministry of Housing, Communities & Local Government, UK, 2024). In the United States,

building regulations are largely determined at the state or municipal level, with many jurisdictions adopting the International Building Code (IBC) developed by the International Code Council (2024), which provides a standardized set of requirements for design, construction, and occupancy of buildings. Australia's National Construction Code (NCC) integrates performance-based requirements for structural integrity, health, amenity, and sustainability, serving as a unified reference across states and territories (Australian Building Codes Board, 2022). Singapore enforces stringent controls through its Building Control Act, mandating submission of detailed building plans for approval and regular site inspections to ensure compliance with safety and design standards (Building and Construction Authority, 2021). These global precedents illustrate that effective building regulation systems combine clear statutory provisions, technical standards, and robust enforcement mechanisms, providing valuable insights for evaluating and reforming Pakistan's regulatory landscape.

Researchers have reported that uncontrolled urban expansion and ineffective building control have a reciprocal relationship, with both factors exacerbating each other (Sharkheyli et al., 2012). The unplanned sprawl of the Lahore city is often attributed to the gaps in building control, rooted in the challenges faced by the development authorities (Ahmad et al., 2013b). Moreover, the practice of designating residential areas as commercial zones, often without adequate infrastructure, poses a significant challenge to urban sprawl in Lahore (Qureshi, 2022). This issue emphasized the need for improvement in current building control policies and the enforcement thereof.

While on one hand, the multiplex building control in Lahore appears to be beneficial in addressing specific needs and contexts of different urban settings, the overlapping and conflicts of control across the jurisdictions pose challenges to the effectiveness and enforcement of the policies. Researchers have pointed out that LDA's increasing authority weakened local governance by limiting MCL's control over planning and development, creating a parallel structure with overlapping responsibilities. MCL remains responsible for municipal services, particularly in older built-up areas and traditional neighborhoods, but lacks authority over housing schemes and commercialization outside these areas. Furthermore, LDA's exclusion of cantonment and DHA zones adds another layer of jurisdictional complexity. Such convolutions make the system difficult to understand by the public, builders, developers and building owners, further raising the risk of violations of building by-laws (Abbas & Wakil, 2023) In addition to the institutional challenges, the regulatory framework i.e., building regulations and by-laws, as well as their enforcement mechanism also need to be considered while discussing the effectiveness of building control in Lahore. Existing building by-laws and regulations of each authority need to be strengthened in light of international best practices. While various studies (Aziz, 2018), (Sherwani et al., 2024) and (Asim et al., 2017) have been conducted on the implementation of building control regulations in

residential or mixed (residential cum commercial areas) of Lahore, limited literature has been found on the commercial areas of the city. Most of the studies have conducted qualitative research through population surveys to analyze the people's perception of the effectiveness of building control in the district.

3. Research Methodology

This section delineates the research methodology employed to achieve the study's objectives. the detailed research methodology is given below:

3.1. Research Design

A mixed-methods research design was adopted, employing both the quantitative and qualitative research methods (Figure 1). The quantitative component involved a physical survey of commercial buildings using quota sampling, while the qualitative component included semi-structured interviews with officials from all three authorities, developers, and visitors.

A mixed-methods approach was adopted as building control is both measurable and contextual, requiring objective compliance metrics alongside insight into enforcement realities. Quantitatively, a regulation-based on-site checklist was applied to commercial buildings across LDA, MCL, and LCB to produce comparable Total Compliance Scores (TCS) and identify high-impact categories such as Open Spaces and Right of Way. Qualitatively, semi-structured interviews with authority officials and developers, along with visitor feedback, captured procedural practices, resource constraints, and user perceptions that explain the observed patterns. This integration allowed numerical results to be interpreted in light of institutional processes, improving validity and producing balanced, actionable findings that a single-method approach could not achieve.

Figure 1

The Research Design (Source: Author)
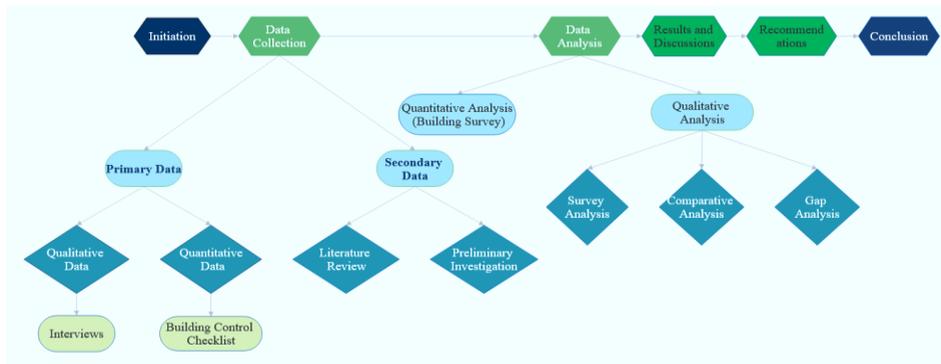
3.2. Data Collection Methods

3.2.1. Preliminary Investigation

Preliminary visits were conducted to the development authorities, where basic information on the functions, jurisdictions and building by-laws and regulations was gathered.

3.2.2. Sampling Technique

Quota sampling technique was selected for surveying commercial buildings, ensuring pre-determined representation from each of the three regions governed by the three authorities. Three exclusive regions pertaining to the respective authorities (strata) were selected **(Figure 2) for** building survey to meet a predefined quota. *Quota sampling* was deemed the most apt sampling technique for this purpose as it *segments* the study area in equal proportions, because the overall region dynamics (including size and density of commercial buildings) are unknown or difficult to ascertain. The sites selected for sampling are depicted by red dots in the cartographical representation below. These were selected in consultation with officials of the respective authorities during interviews keeping in view the objectives of the study and applicability of the latest building control regulations.

The study adopted Quota sampling because the total number and distribution of eligible commercial buildings in the jurisdictions were not fully known, making proportionate sampling impractical. This approach ensured balanced representation from each authority (LDA, MCL, and LCB) according to pre-defined quotas, allowing meaningful comparison of compliance levels. Cluster sampling, as depicted in Figure 3, is shown to illustrate the geographic grouping of surveyed buildings within each jurisdiction. While the field survey locations naturally formed clusters, the selection within these clusters followed the quota plan rather than a purely random cluster sampling design. This ensured that each authority's quota was met, while still reflecting the actual spatial distribution of commercial buildings across the study area.

Figure 2

Study areas of three authorities (Source: Author)

3.2.3. Sample Size Determination

As the total number, density and locations of commercial buildings in the city is unknown, the sample size was calculated using the sampling formula for unknown populations. This provided the researcher with statistical adequacy as it is aimed at producing statistically valid sample sizes suitable for making inferences about the population. The desired sample size (*n*) was determined using the formula:

$$n = \frac{Z^2 \times p \times (1 - p)}{e^2}$$

where:

- Z is the Z-score pertaining to the desired confidence interval,

- p is the estimated proportion of compliance (assumed as 50% (unknown)), and

- e is the target margin of error for the study.

Employing a confidence interval of 90% and a margin of error of 10%, the researcher got the sample size requirement, $n \approx 68$. The study did not employ 95% confidence level with a 5% margin of error due to the absence of a complete sampling frame and the practical limitations of fieldwork. The total population of eligible commercial buildings across the three jurisdictions was not fully documented, which meant that a statistically rigorous probability-based sample of the required size could not be drawn within the available time and resources. Instead, a non-probability quota sampling approach was used to ensure balanced coverage of each authority, producing results that are indicative of compliance patterns while remaining feasible for the scope of this study. Thus, a total sample of 68 commercial buildings was warranted in this case. To evenly distribute the sample among the three regions of jurisdiction, each region was allocated a subgroup sample size of $\bar{n} = \frac{68}{3} \approx 22.6$ commercial buildings for assessment for its concerned authority.

3.2.4. Data Collection

A standardized binary-response (compliant/non-compliant) checklist for on-site assessment of building control compliance was developed for each authority based on existing building control regulations, thereby ensuring consistency and reliability in data collection across all regions. Nine building control features, common to all three authority regulations, were selected for inclusion in the checklist. These included mandatory open spaces (V1), basement (V2), right of way (V3), energy, electricity, lighting and ventilation (collectively energy) (V4), water conservation (V5), waste management (V6), safety requirements (V7), accessibility and inclusion (V8), and parking compliance (V9). Data collected included specified building control criteria pertaining to structural compliance, utility provisioning, safety, accessibility and sustainability of commercial

buildings. The compliance checklist is reproduced in Appendix – A.

3.2.5. Data Preparation and Cleaning

The building control survey involved filling checklists on paper, which were later manually entered into Microsoft Excel. A consistency check ensured data accuracy, with typos and missing values corrected. This finalized digital dataset is referred to as the compliance dataset. The compliance dataset comprised of compliance-related data from 69 commercial buildings regulated by the three authorities, namely LDA, MCL and LCB, which is distributed as follows:

- LDA: 23 buildings

- MCL: 23 buildings

- LCB: 23 buildings

Each indicator category comprised one or more sub-indicators specific to each authority, outlining the required compliance features associated with that category. Once all the categories and sub-indicators were entered into the dataset, the compliance score for each indicator category was worked out for each authority. The compliance score for a category was rated as 10 if all the sub-indicator controls were fully compliant with the concerned authority's regulations for that particular category. If some of the sub-indicator controls were compliant and some weren't, a score of 5 was allotted to the category. If none of the underlying sub-indicator controls were compliant to stipulated regulations, the category fared a score of 0 in its overall evaluation.

The Compliance Score is the indicator variable name for TCS, representing the total compliance percentage. It was computed as follows, rounded to the nearest unit:

$$Compliance = \left[\left[\left(\frac{\sum Indicator\ Scores}{90}\right) \times 100\right]\right]$$

A validation check was conducted at the end to verify the computed compliance scores by recalculating them from the indicator terms. Once confirmed, the next step in the analysis was undertaken.

3.2.6. Interviews with Authority Officials

Semi-structured, face-to-face interviews were conducted with key officials of the authorities based upon purposive sampling. Purposive sampling was employed for selecting building control officials because the study required participants with direct regulatory authority and operational knowledge of the selected jurisdictions. Officials were identified through the organizational structure of LDA, MCL, and LCB, ensuring the research participants were

currently serving in posts responsible for the specific areas covered in the survey. Verification was made through official designations, departmental postings, and confirmation of their jurisdictional role before interviews were conducted, thereby ensuring that each respondent's experience and insights related directly to the geographic clusters under study. These interviews were conducted to seek detailed insights into the effectiveness of building by-laws adherence, challenges faced during enforcement thereof, and their perceptions of compliance levels.

3.2.7. Interviews with Commercial Building Developers

Snowball sampling strategy was employed to identify and interview commercial building developers operating within the city. Snowball sampling was used for developers and builders because there was no comprehensive or publicly available list of active professionals in the study areas. Initial contacts were identified through the authorities and industry networks, and these respondents then referred to other eligible participants. This approach was practical for reaching knowledgeable stakeholders who had direct experience with building control processes, ensuring that the responses were relevant and grounded in actual practice. Semi-structured interviews were conducted with building developers to seek their perspectives on building control policy and regulations, compliance processes, enforcement and monitoring practices and experiences, areas of concern, and suggestions for regulatory and procedural improvements.

3.2.8. Public Perception Surveys

Convenience sampling was adopted to recruit and gather public opinions from visitors in selected areas, who were readily available and willing to participate, to gauge external confirmation of study results. Visitors were approached in the surveying vicinities, with their consent, to seek their views on compliance levels of building control aspects in commercial buildings in the area, and gather their perception on areas of improvement.

3.3. Data Analysis

The study employed both quantitative and qualitative analytical techniques to process and interpret the collected data.

3.3.1. Quantitative Analysis – Building Survey

The quantitative component focused on analyzing numerical data collected from compliance surveys of commercial buildings. Data entry into spreadsheet-based statistical software packages including Microsoft Excel and SPSS was carried out to make it ready for analysis. An equally weighted scoring system was developed to quantify conformity to building control regulations for each commercial building surveyed. Each compliance criterion was assigned a weighted score as given in the compliance scoring guide

(Appendix – B).

3.3.2. Qualitative Analysis

The qualitative component involved analyzing interview data from authority officials, building developers and visitors. Responses were recorded using note-taking during the interview exercises. A Likert scale questionnaire was used to get feedback from the visitors (Appendix – C). A comparative analysis of building control in Lahore city with Mumbai (India), Kuala Lumpur (Malaysia) and New York City (NYC), USA was also carried out on the basis of the reports and documents published by India Smart Cities Mission, Kuala Lumpur City Hall and NYC Mayor's Office of Sustainability, respectively. Furthermore, a comprehensive gap analysis was also followed by the comparative analysis.

4. Results And Discussions

The results of the study have been derived from the following:

4.1. Quantitative Analysis: Building Survey

This section presents a detailed quantitative analysis of compliance surveys conducted on commercial buildings across the three government authorities: LDA, MCL and LCB. The objective was to assess compliance levels with promulgated building control regulations and determine through rigorous comparative analysis the key factors in their enforcement (shadow measure: compliance levels) by the three authorities. The analysis includes data preparation, descriptive statistics, comparative analyses and comprehensive interpretation of the findings.

4.2. Descriptive Statistics

Summary statistics of the overall compliance scores – including the mean, median, standard deviation, minimum, maximum and range – computed for each authority are presented in the table below: The scores in Table 1 were compared against the maximum possible compliance score derived from the regulation-based checklist used in the field survey. Each indicator was weighted equally, and the TCS was expressed as a proportion of this maximum possible value, providing a standardized basis for comparing compliance levels across LDA, MCL, and LCB.
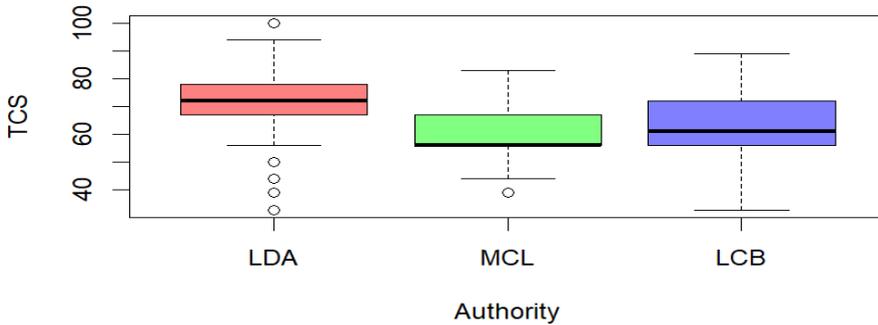
Table 1

Summary Statistics for Compliance Scores

Authority → Statistic ↓	LDA	MCL	LCB	Overall
Mean	70	58	64	65
Median	72	61	67	67
Standard Deviation	16	10	13	14
Minimum	33	39	33	33
Maximum	100	83	89	100
Range	67	44	56	67

Figure 3

Clustered Box-and-Whisker Plot of Compliance Levels

A visual depiction of the same is illustrated through the above clustered box-and-whisker plot of compliance levels for each authority (Figure 3).

In the aforementioned depiction of summary statistics, several data distribution trends can be observed. The data reveals that the surveyed commercial buildings located in LDA-operated regions reported relatively high average (mean and median) and maximum values, thereby indicating higher compliance levels than for other authorities. However, higher variability in terms of standard deviation and range was also observed therein which indicated a higher inconsistency in building control enforcement efficacy. This implies that LDA either has disproportionately strong and weak controls in different areas or that its regulatory implementation mechanism lacks uniform monitoring and evaluation front. Buildings located within MCL boundaries reported the lowest average values but with lesser variability amongst their compliance levels. This indicates uniformly lower compliance

levels and may suggest low regulatory control exercised by MCL in its jurisdiction. Infrastructure within LCB limits reported an intermediate mean and variability in compliance levels. These moderate compliance levels imply their regulatory control mechanism needs improvement (like others), though better performance than MCL but lower than that of LDA. This descriptive analysis shows that LDA has the best building control and implementation mechanism in comparison to the three authorities, in terms of building compliance levels in the areas surveyed. However, an average 70% compliance level is still not remarkable, given the criticality of the issue, and LDA needs to further improve its performance in this regard.

4.3. Inferential Statistics

Before proceeding further to draw statistical inferences from the collected data, it is essential to verify the normality of compliance scores as a precondition of any parametric tests that may be applied thereon. For the purpose of this exercise, both visual and numerical methods were used to assess the normality of data.

In the case of visual depiction thereof, the following set of clustered histograms highlight the data trends. This portrayal resonates with the findings of descriptive analyses noted earlier. It can be seen that the histogram is slightly left-skewed in the case of LDA, implying relatively higher levels of compliance. In the case of MCL, the histogram is more or less following the shape of a normal (bell) curve, thereby connoting an approximately normal distribution of data. Looking at the case of LCB, the histogram is slightly right-skewed which suggests slightly lower levels of compliance. The clustered histograms **(Figure 4)** depict a high degree of normality. The shape of the superimposed density plots strongly takes after the normal curves, thereby signifying normality.

Figure 4

Histogram of Compliance Scores
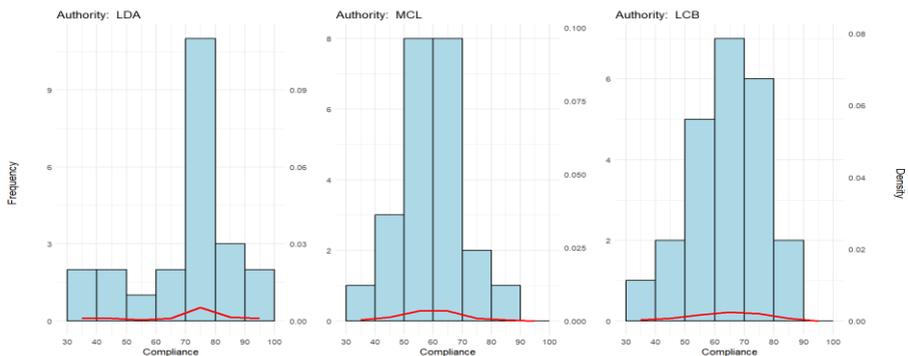
4.4. Comparative Analysis Between Indicator Categories

The purpose of comparative analysis is to examine indicator categories themselves and their relation with the overall compliance scores (TCS) (Figure 5). In this regard, correlation analysis is conducted to explore relationships between individual category indicators and the overall Compliance scores.

Figure 5

Correlation Analysis
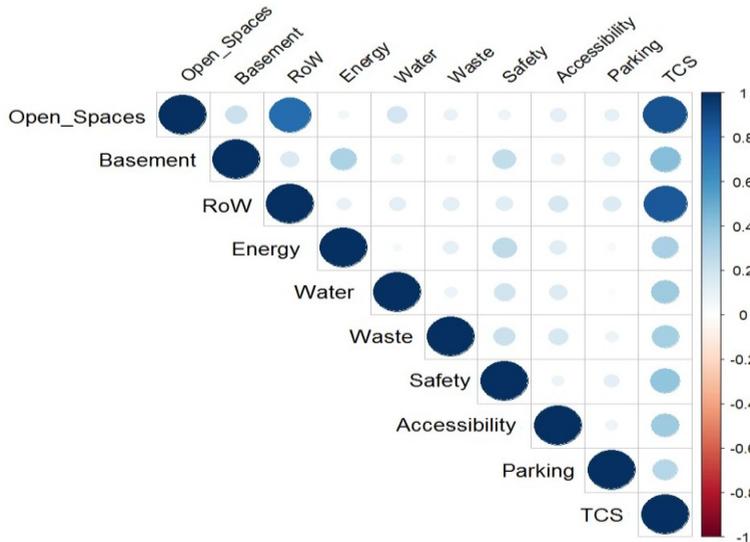
The data indicate that all indicator categories had *positive* correlations with the overall compliance scores. The Open Spaces and Right of Way categories had the *strongest* correlations (> 0.8) with compliance scores, implying that – on the basis of commercial buildings surveyed – these indicators heavily influence overall compliance. Thus, it can be deduced that these are among the elements regularly inspected, thereby resulting in high adherence. All other categories had a *moderate* effect therein.

Summing up the overall analysis, it can be concluded that LDA reported the *highest* building control compliance with an average score of 70. It significantly outperforms MCL, but fares only moderately above LCB. On the flip side, greater variability for LDA therein suggested inconsistencies in either enforcement mechanisms or developer practices. In terms of MCL, the *lowest* compliance was generally observed with an average score of 58. Although lower in compliance scores, buildings in MCL exhibited uniformity: lower variability indicated lower compliance levels and was consistently similar.

Concerted action is thus required therein to strengthen enforcement strategies. The case of LCB was a mixed bag, portraying moderate compliance with an average score of 64. No significant difference was observed during inter-authority comparisons, and it was deemed comparable to the other two authorities, falling between both of them. It reported moderate variability but indicated some inconsistency therein. Positive correlations were observed for all categories, as expected: enhancing any indicator improved overall compliance, with the policy implication that authorities should prioritize high-impact areas to boost compliance levels. This study gives a starting point in this regard.

Several stakeholder implications can be deduced from this analysis. The authorities should tailor enforcement strategies based on category impacts. Developers should focus on key compliance areas to meet regulations. Policymakers, on the other hand, need to re-evaluate regulations and enforcement mechanisms emphasizing critical indicators. However, all these inferences need to be taken with a grain of salt, as these findings are not generalizable (owing to non-probabilistic sampling and low sample sizes) and only relate to the areas where the surveys were conducted. Moreover, issues of data accuracy (accurate and unbiased data collection) and external factors (unaccounted variables like socioeconomic and cultural dynamics) may influence compliance and need to be catered for in future research studies.

All analyses were conducted as adhering to best practices relating to statistical analysis. This quantitative analysis revealed significant differences in compliance levels among the authorities, with LDA demonstrating more effective enforcement as compared to MCL and LCB. The correlation analysis underscored the importance of specific indicators, particularly Open Spaces and Right of Way, in overall compliance. These insights can guide authorities and developers in focusing efforts where they are most impactful, ultimately enhancing building control adherence across the city.

4.5. Responses from key officials:

The responses from key officials of LDA, MCL and LCB provided experience-based insights on the effectiveness of existing building by-laws in their jurisdictions and the challenges faced in their implementation and enforcement. As far as the effectiveness of the building by-laws is concerned, all the respondents provided positive feedback in this regard, commenting that the building by-laws are effective and in adherence to the Building Code of Pakistan 2021.

A review of the building by-laws, during preliminary investigation, indicated that the building regulations of LDA and MCL are quite similar and comparatively more stringent than those of LCB. However, it was noted down, as well as confirmed during the interviews with the key officials, that critical

sustainability elements like water conservation and energy efficiency are not categorized as non-compoundable offenses. In contrast, violations such as converting approved parking spaces, constructing additional floors, encroaching mandatory open spaces, insufficient car parking, and exceeding height or basement limits in commercial areas are treated as non-compoundable under existing regulations.

The enforcement mechanism was also discussed during the interviews, and the responses indicated that LDA conducts regular inspections of the commercial areas to check compliance of the rules and regulations, as well as the conditions contained in the building plan approval. However, the frequency of inspections by MCL and LCB was reported quite low. The reason was reported to be low human resource and transportation facilities.

While discussing the performance of authorities for processing the applications for building plan approvals or other ancillary matters, representatives from all of the three authorities informed that the applications are processed timely. Interestingly, the representatives of LDA and LCB informed that their clients are usually well aware of the building by-laws and regulations, however, MCL responded differently in this regard, stating that the level of awareness of clients about the building by-laws is very low.

The key challenges identified during the interviews are as follows:

- Political interferences in decision-making

- Intimidation and harassment from local mafias to overlook violations

- Inadequate resources and facilities

- Peoples' inclination towards misuse of available space, exceeding the intended capacities

The respondents were of the view that by limiting the political interference in decision making, awareness raising and capacity building of regulating authorities, implementation of the building by-laws may be improved.

4.6. Responses from the builders/developers

According to the builders/developers interviewed, the process of getting permits and licenses for commercial buildings is not easy. The participants informed that there is a long list of secondary NOCs from other departments including the Civil Defense, Water and Sanitation Agency (WASA) and Environment Protection Agency (EPA) and affidavits that are required to be attached with the applications, making the process very time-taking. Most of the participants further raised questions on the transparency in the process of obtaining approvals for construction projects. The respondents also provided negative responses regarding the support from building control authorities during construction in terms of regular inspection, guidance and timeliness of

approvals. Interestingly, the responses of developers/builders interviewed were quite different to the views of the officials from development authorities on building control regulations and enforcement mechanisms.

4.7. Responses from the visitors

The feedback collected from the survey participants is visually represented in Figures 6 – 8. Overall, the responses indicate a positive perception in several key areas. A significant proportion of respondents expressed satisfaction with the quality of commercial buildings, the accessibility of these spaces for individuals with disabilities, and the building control systems in place. However, the survey revealed concerns regarding the impact of commercial buildings on traffic congestion, where the responses were notably less favorable. In addition, respondents displayed a neutral stance on their trust in building control authorities to effectively address community concerns related to building regulations.

Notably, the survey results indicate a generally positive outlook on the impact of commercialization on community life, with most respondents perceiving it as beneficial.

The following gauge graphs depict the overall perception scores of visitors with regards to each indicator category. The survey participants were generally satisfied with the quality of commercial buildings in their areas, but expressed dissatisfaction regarding frequency of occurrence of incidents (e.g., fire) in commercial buildings.

Figure 6

Responses from visitors (Source: Author)
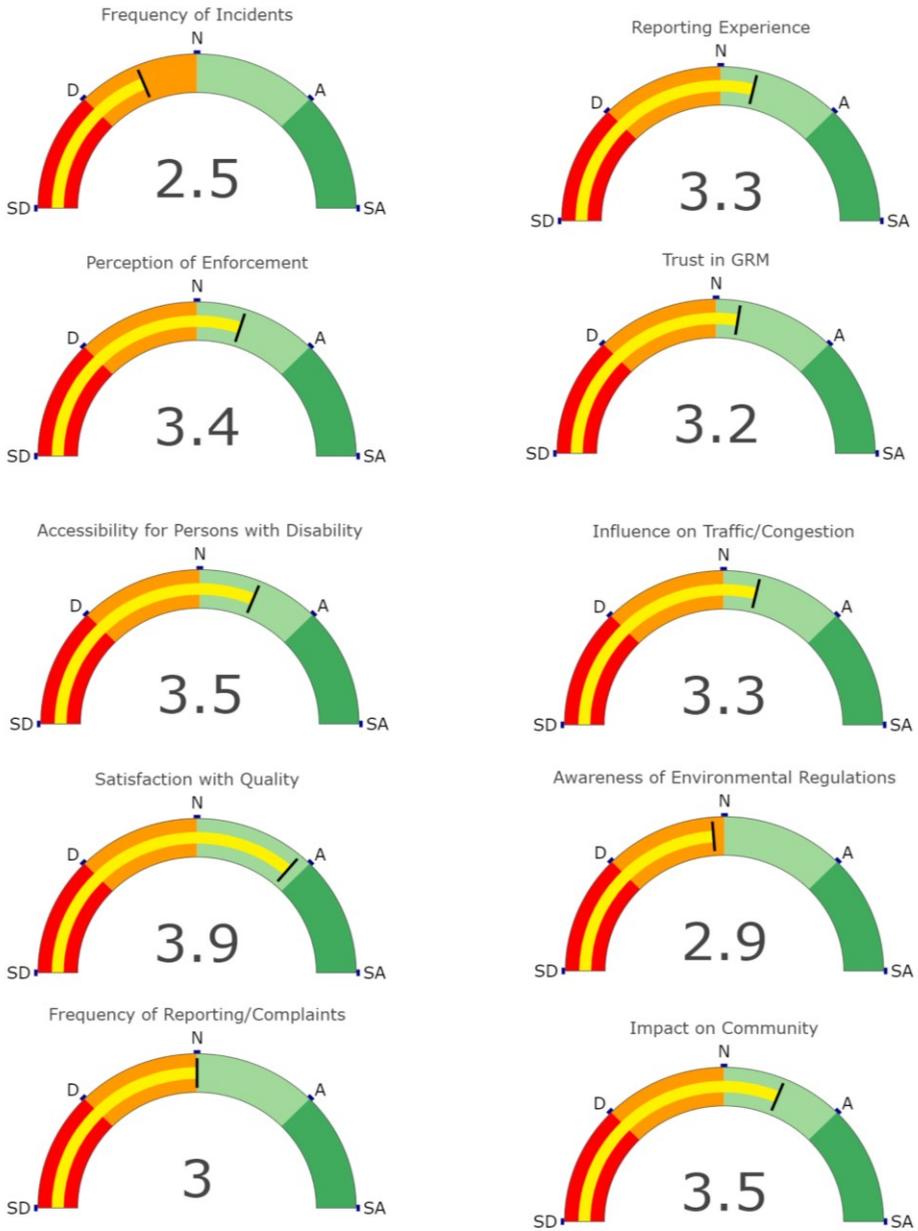
(SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree)

The following radar plot depicts the general perception of visitors regarding given indicator categories in the three authorities. In line with the physical assessment of commercial buildings, it was found that visitors had the highest opinion regarding LDA (in blue) whilst expressing the least regard for MCL (in red). The responses indicated a concern on part of the participants that commercial buildings within MCL jurisdictional areas got reported/complained the most regarding unsafe conditions or violations, however, LDA was deemed best at handling complaints. Perception performance of all indicator categories can be viewed in the graph below.

Figure 7

Radar Chart of Authority Wise Average Responses (Source: Author)

The visitors identified critical areas for improvement regarding compliance with building by-laws and the overall safety and sustainability of commercial buildings in Lahore. There was a consensus among respondents on the importance of enhanced and effective enforcement of building by-laws. Furthermore, the necessity for frequent and transparent inspections was highlighted as a significant requirement for improving adherence to these regulations.

In discussing the challenges encountered during visits to commercial buildings, the issue of parking availability emerged as the most prevalent concern. Respondents indicated that inadequate parking facilities contribute to accessibility problems.

Moreover, respondents highlighted the inefficiencies in electricity consumption prevailing in commercial plazas and shopping malls while

stressing the importance of designing and constructing energy-efficient buildings and implementing energy conservation practices within these structures.

Figure 8

Diverging Authority Wise Stacked Bar Chart of Survey Responses (Source: Author)
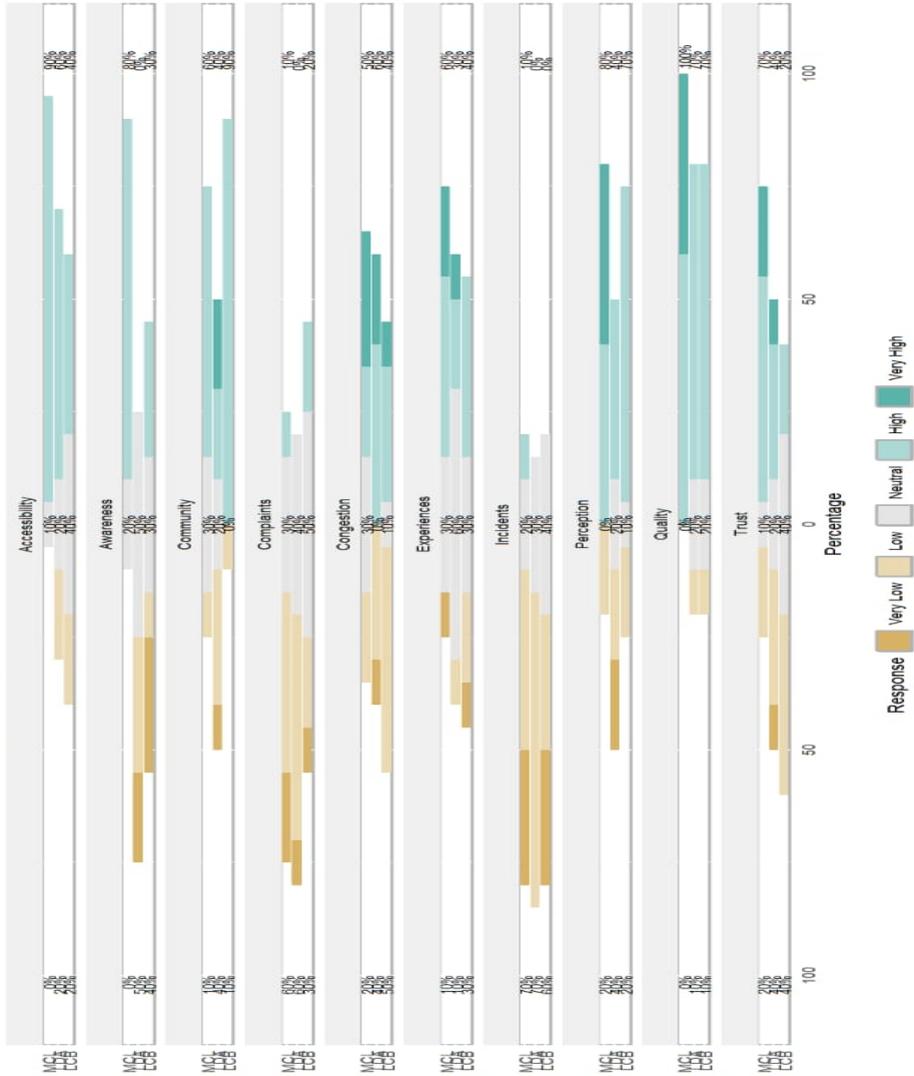
Finally, the need for improved fire safety facilities was a critical concern, as fire hazards are among the most frequently encountered risks in commercial buildings. Respondents advocated for the installation of robust fire safety

systems and regular training for staff to enhance preparedness for potential fire incidents. Collectively, these insights reflect a pressing need for regulatory authorities to address these issues comprehensively to enhance the compliance and safety of Lahore's commercial infrastructure.

4.8. Comparative analysis of building control across major global cities

This comparative analysis focuses on the building bylaws in Lahore, Pakistan, with comparative insights from New York City (USA), Kuala Lumpur (Malaysia), and Mumbai (India). This comparison across cities aims at identifying points of similarity and difference therein, garnering insights into best practices and challenges faced during the implementation of building control by-laws. It also focuses on comparability among the nine key indicator categories of the main study, listed underneath:

Table 2

Comparative Analysis of Building Bylaws in Lahore with global cities

Category	New York City, USA	Kuala Lumpur, Malaysia	Mumbai, India	Lahore, Pakistan
Regulatory Framework	Comprehensive, progressive codes by NYC Dept. of Buildings focusing on sustainability and safety	Governed by the Uniform Building By-Laws; enforced by City Hall with focus on accessibility	National Code and Development Control Regulations; moderate enforcement by MCGM	Pakistan Building Code, enforced by local authorities; requires modernization.
Implementation & Enforcement	Rigorous multi-agency enforcement; sustainability mandates are prioritized	Moderate enforcement, with compliance in visible projects; balancing development pressures	Limited enforcement due to socioeconomic factors; sustainability compliance is low	Weak enforcement capacity with high non-compliance rates due to limited resources.

Unclear jurisdictional control hampering |

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Category	New York City, USA	Kuala Lumpur, Malaysia	Mumbai, India	Lahore, Pakistan
				the effectual enforcement
Mandatory Open Spaces	Mandatory based on FAR; actively enforced	Open spaces required but inconsistently enforced	Open spaces mandated; often compromised in high-density areas	Open spaces mandated; inconsistently enforced due to high land pressures
Basements	Strict codes for safety, flood-proofing; strong enforcement	Safety codes for basements, moderate enforcement; unauthorized uses arise	Safety provisions weakly enforced; prevalent non-compliant uses	Safety considerations for basements; limited enforcement
Right of Way	Strictly regulated with fines	Right of Way enforcement moderate; older areas may have encroachments	Encroachment frequent due to limited capacity and economic pressures	Inconsistent enforcement; frequent unauthorized extensions
Energy Efficiency	Mandatory efficiency upgrades, fines for non-compliance	Voluntary Green Building Index gaining traction	Mandated for larger projects but low compliance	Minimal focus on energy efficiency; low awareness and enforcement
Water Conservation	Efficient fixtures required; stormwater	Encouraged, especially in high-end projects	Provisions exist but weak enforcemen	Limited to rainwater harvesting; rare

Category	New York City, USA	Kuala Lumpur, Malaysia	Mumbai, India	Lahore, Pakistan
	management enforced		t	implementation
Waste Management	Recycling required, high compliance	Waste plans required; moderate adherence	Weak enforcement; inadequate waste practices common	Limited requirements; improper disposal frequent
Challenges	High costs for compliance and retrofitting; achieving aggressive sustainability goals requires investment	Bureaucratic inefficiencies and urbanization pressures hinder enforcement; limited stakeholder awareness	Population density, land scarcity, and informal economy challenge enforcement	Weak enforcement, rapid urban growth, and outdated codes lead to non-compliance
Lessons Learned	Incentives and strict enforcement drive compliance; public-private collaboration improves implementation	Phased compliance and capacity building for agencies; incentives increase adoption	Integrating regulations with urban planning and engaging stakeholders improves compliance	Comprehensive, simplified regulations and stakeholder engagement needed for effectiveness
Way Forward	Investment in modernization, incentives for green technologies, and compliance	Strengthen enforcement, build capacity, align with national sustainabilit	Digitalize processes, simplify codes, reduce corruption opportuniti	Regulatory reform, enhance enforcement, build technical capacity,

Category	New York City, USA	Kuala Lumpur, Malaysia	Mumbai, India	Lahore, Pakistan
	support	y goals	es	improve sustainability compliance

The comparison of the Building Bylaws in Lahore with selected international cities, namely New York, Kuala Lumpur, and a representative Indian metropolitan city show that while Lahore's jurisdictions demonstrate strong performance in certain categories such as Open Spaces and Right of Way, their overall compliance scores remain lower than those of the global counterparts. New York's consistently high scores across all categories reflect rigorous enforcement and mature regulatory systems, whereas Kuala Lumpur shows strong compliance in design and safety-related indicators, and the Indian city exhibits comparatively balanced but moderate scores. The variation in Lahore's results, particularly in Parking and Building Height, suggests uneven enforcement and highlights areas where lessons can be drawn from the more uniform compliance patterns observed in these global cities.

In New York, strict zoning codes and regular post-construction inspections ensure sustained adherence to parking and height regulations. Kuala Lumpur employs integrated development control systems that link permit approval directly to verified compliance with parking and height standards. In Indian metropolitan contexts, the use of digitized approval platforms and public disclosure of sanctioned building plans has increased transparency and reduced non-compliance. Adopting similar practices such as systematic inspections, integrated approval systems, and greater public access to building regulation data could help Lahore's jurisdictions achieve more consistent compliance across these indicators.

4.9. Gap Analysis

A concerted gap analysis exercise was conducted to determine policy and implementation gaps in the building control governance framework in comparison with modern best practices, and designing targeted strategies to effectually achieve their fulfilment with a view towards practicability and sustainability. The analysis, as presented below, reveals significant discrepancies between Lahore's current building control regime and the desired state at par with international best practices. Addressing these gaps requires a multifaceted approach.

Table 3

Gap Analysis

Focus Area	Current State	Identified Gaps	Desired State	Recommendations
Regulatory Reform	Outdated regulations lacking modern standards; lack of oversight regarding modern sustainability aspects (Structural violations non-compoundable Sustainability elements overlooked)	Absence of comprehensive *modern* standards (e.g., energy & water efficiency, accessibility, inclusion); non-cognizance of modern sustainability aspects; Green standards are ensured but not considered as non-compoundable violations	Comprehensive building codes and regulations in-line with modern standards (international best practices); integration with modern sustainability aspects; Equal focus on sustainability, Non-compoundable **green** violations	Update and expand building codes, standards, and regulations; regulations in-line with modern best practices and sustainability aspects, upgrade list of non-compoundable violations by including green and sustainability elements in it
Enforcement Mechanisms	Weak enforcement mechanisms	Inadequate enforcement capacity;	Strong, resource-sufficient	Invest in capacity; active M&E and

Focus Area	Current State	Identified Gaps	Desired State	Recommendations
Implementation Approach	Inconsistent implementation of regulations, irregular inspections, limited follow-up.	Ineffective translation of regulations and standards into practice, lack of implementation framework in regulations	Consistent implementation, routine inspections, compliance monitoring	Strengthen frameworks, conduct real-time inspections, implement robust M&E tools
Technological Integration	Limited use of digital tools for approvals and monitoring	Low integration of digitalization; inefficient data management	Integrated usage of digital tools (review, approvals, etc.); GIS monitoring; use of AI	Implement digital management systems; integrated use of AI and GIS, especially in M&E
Stakeholder Engagement	Low public awareness; non-involvement of stakeholders in policymaking or action decisions	Lack of stakeholder awareness and involvement	High public awareness; involvement in policymaking and action plan decisions	Stakeholder consultations; public education campaigns; professional training
Socioeconomic Aspects	Resource limitations; high cost of compliance; cultural attitudes against compliance	Financial barriers to compliance; lack of incentives; cultural resistance	Financial support; incentives for compliance; community engagement	Financial benefits; tax breaks; recognition programs; enforce accessibility requirements

Bridging the gaps in Lahore's building control regime is essential for the city's

sustainable growth and the well-being of its residents. Learning from global cities and adapting best practices to the local context can significantly enhance the effectiveness of building regulations. Collaborative efforts among government agencies, industry professionals, and the community are crucial to achieving these objectives

5. Study Outcomes: Perspectives and Implications

Following are some of the key outcomes and perspectives gained from the study, based on which, a few implications for authorities, developers and policy-makers have also been given:

5.1. Perspective

5.1.1. Comparative Enforcement Efficacy

The quantitative analysis revealed significant differences in compliance levels among the three authorities. This indicates varying degrees of enforcement effectiveness, and suggests that different strategies and resource allocations may be influencing compliance outcomes.

5.1.2. Impact of Key Compliance Indicators

The relationship analysis identified Open Spaces and Right of Way as the most influential indicators affecting overall compliance. These areas showed strong positive correlations with TCS. The emphasis on these indicators highlights their critical role in ensuring building safety, accessibility, and urban planning efficiency.

5.1.3. Uniformity vs. Variability in Compliance

LDA exhibited higher variability in compliance scores, indicating inconsistency in enforcement or adherence among buildings within its jurisdiction. In contrast, MCL showed more uniform but lower compliance levels, suggesting consistent enforcement practices that may not be sufficiently stringent.

5.2. Implications

The study had several implications, for different stakeholder classes, to develop effective building control regimes, such as:

5.2.1. For Authorities

Authorities need to evaluate how resources are allocated towards enforcement activities, especially in key compliance areas identified as high-impact. The significant difference between LDA and MCL suggests that enforcement strategies directly influence compliance levels.

Variability in compliance within an authority's jurisdiction points to potential gaps in enforcement authority's/personnel's training and capabilities.

5.2.2. For Developers

Developers should prioritize and focus on critical compliance in areas that have the most significant impact on overall adherence, such as open spaces and right of way. Engaging proactively and collaborating with regulatory bodies can help developers understand requirements better, and facilitate smoother compliance processes.

5.2.3. For Policymakers

The findings suggest a need for policymakers to perform a regulatory review of extant legal instruments and revisit building control regulations to ensure they are effective, and practical, and address the most critical aspects of building safety and urban planning. Furthermore, implementing standardized enforcement protocols across authorities can reduce disparities in compliance levels.

5.2.4. For the General Public

Awareness and advocacy of the general public/visitors should be prioritized. Public perceptions influence and are influenced by building compliance. Increased awareness can lead to greater demand for adherence to building controls, indirectly pressuring authorities and developers to prioritize compliance.

6. Conclusion

This study evaluated the efficacy of the prevalent building control regime in commercial buildings of Lahore, focusing on the policies and practices within LDA, MCL and LCB jurisdictional areas. Following a mixed-methods research approach, the findings of the study revealed disparities in compliance levels among the three authorities: LDA areas reported the highest compliance rate at 70%, MCL the lowest at 58%, and LCB at a moderate 64%. At the same time, higher compliance variability within LDA's jurisdiction suggested inconsistencies in enforcement or adherence, while MCL's uniform but low compliance indicated consistent but insufficient enforcement practices; LCB fared midway therein.

The quantitative analysis highlighted "Open Spaces" and "Right of Way" as the most influential indicators affecting overall compliance, and deemed crucial for ensuring building safety, accessibility and efficient urban planning. Qualitative insights from authority officials pointed to institutional challenges hindering effective enforcement including resource limitations, political interference and public misuse of spaces. Building developers reported difficulties with the lengthy and cumbersome permit processes, and a lack of transparency and support from authorities. Visitors expressed satisfaction with building quality but raised concerns regarding parking shortages, energy inefficiencies and inadequate fire safety measures as key attention areas.

A concerted comparative analysis with international cities like New York City, Kuala Lumpur and Mumbai revealed that Lahore's building control regime lags in modernization, enforcement efficacy and sustainability integration. The gap analysis further emphasized significant discrepancies between Lahore's current practices and international best practices, necessitating regulatory reform, capacity building and enhanced stakeholder engagement therein.

7. Policy Recommendations

Based on the study's findings and lessons learned therein, the following policy recommendations are proposed for the building control authorities to implement to enhance compliance efficacy:

1. Digital technology solutions should be adopted for real-time monitoring and recordkeeping, utilizing tools like GIS/remote sensing, intelligent databases, imaging technologies, and AI.

2. A unified, city-wide standard regulatory framework should be established to ensure consistency in enforcement and compliance, with strong inter-authority collaboration to share best practices and resolve challenges.

3. Resources should be prioritized and allocated to key sectors and indicators with the greatest potential impact on compliance levels, along with the development of guidelines to assist building developers.

4. Regular consultations with stakeholders should be held to discuss regulatory updates, compliance challenges, and suggestions for improvement, supported by quick-response feedback mechanisms.

5. Public awareness campaigns should be launched to educate citizens on building controls, their significance, and how to report non-compliance through accessible channels like hotlines or online platforms.

6. Enforcement activities and compliance statistics should be publicized to build trust and demonstrate regulatory commitment.

7. Gender-sensitive provisions should be introduced in building bylaws, ensuring accessibility, separate ladies' washrooms, nursing rooms, and secure spaces in public and commercial buildings.

8. Regular compliance audits should be conducted to evaluate enforcement strategies, and key performance indicators (KPIs) and other metrics should be developed for assessing efficacy, with data analytics used to identify trends, predict compliance issues, and guide policy decisions. Few KPIs have been designed (Appendix – D), to illustrate the point.

9. Periodic reviews of building regulations should be conducted to ensure they remain relevant, clear, and aligned with urban development needs.

10. Compliance procedures should be streamlined, and incentives should be

introduced for developers with high compliance.

11. Increased budget allocations for enforcement, staff training, and technology should be advocated, and additional qualified personnel should be hired to manage workloads and reduce inspection backlogs.

12. Penalties for non-compliance should be enhanced, and legal departments should be strengthened for effective enforcement actions.

13. Environmental, climate, and sustainability considerations should be integrated into building controls, and safety regulations should be implemented to enhance buildings' resilience to natural disasters.

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