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Too Little, Too Late? An Investigation of Building Code Enforcement in Pakistan: A case of Quetta city Balochistan

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Abstract:
The capital city of Balochistan province, Quetta is surrounded by mountain ranges with many active seismic faults. Earthquakes remain among the deadliest natural hazards, causing massive human, financial and infrastructural losses in countries with poor compliance and implementation of building regulations. Even for those countries with de jure engineering requirements, enforcing them in nations like Pakistan remains a challenge. The aim of this paper is to investigate the status of and factors influencing the implementation of building codes in the Quetta city. We collected data through informant interviews from the key actors working in the fields of building constriction, building code implementation and disaster management. The results reveal that Quetta city does not have any independent building regularity authority and the existing codes have become obsolete despite high levels of seismic activity. The results further reveal that corruption, a highly bureaucratic governance system, lack of education/awareness, political interference and political will negatively affect the implementation and enforcement of building codes. The article suggests that Quetta and other earthquake prone cities establish a building regularity authority to help manage risks along with undertaking non-structural measures such as public awareness and preparedness for future earthquake events.

Key-Words: *Earthquake, Building Codes, Corruption, Balochistan*

1. Introduction

The enforcement of building-codes remains among the most effective tools in safeguarding lives and properties against earthquakes hazards (Aboulnaga & Mostafa 2019). (Ebrahim 2022) explains that natural hazards like earthquakes kill thousands of people in minutes but their repercussions extend over subsequent weeks and years. The risks and vulnerabilities posed by natural hazards are on rise (Kenny, 2009; Gaillard 2010; CRED 2023; Ahmed, 2018; Aldrich 2019) and affect physical, social, and economic sectors around the world (Bilham 2009; Cutter 2010). Major earthquake disasters over the last two decades such as Bam earthquake, 2004 Indian ocean tsunami, 2005 Kashmir earthquake, 2010, Haiti earthquake, Japan's 11 March, 2011 tsunami, and Turkish earthquake of 2023, have posed serious challenges for national and local governments in developing and developed countries (Fakunle et al. 2020; Aldrich 2010; Frazier 2012; Jones 2017). Developing countries receive high damages than those in developed world. The 8.0 magnitude Sichuan earthquake killed more than 70,000 people, for example, and the Marmara Turkey killed some 17,000. (Escaleras, Anbarci, & Register, 2007). The recent earthquake in Turkey and Syira took lives of more than 50,000 people. Earthquakes counts for most of the causalities worldwide and killed 60,000 people annually due to its unpredictable nature, and 90% of those deaths occurring in the developing world (OECD, 2008).

The data regarding building collapse shows that in Sichuan, Marmara turkey and Kashmir earthquakes, most of the collapsed buildings were of government offices, schools, and hospitals (Shaheen, 2008: World Bank 2005). These buildings fell down due to lack of adaption of and poor implementation of building regulations (Kenny, 2009). The contemporary literature on earthquakes indicates that developed and developing countries diverge in terms of impacts and death toll due to construction practices, building codes and poor land use practices (Kenny, 2009). For example, while the Armenia earthquake of 1988 took 25,000 lives and the Loma Prieta earthquake of 1989 near San Francisco, California, killed only 100. Similarly, the Paso Robles earthquake of 2003 in California released the same energy as the Bam earthquake in Iran but the death toll was 41,000 in Iran and 2 in California. Poor implementation of seismic codes with fragile construction practices increase people's vulnerability (Jones & Vasvani, 2017). Building code implementation is the most important tool in protecting human lives (Aigwi et al. 2019; Balikie 1994) and physical property (Adikari & Yoshitani, 2009; Ainuddin, Kumar Routray, et al., 2012).

Pakistan sits in a seismically active region and has suffered badly from earthquakes in the past (Maqsood & Schwarz, 2010). The region faced a 7.3 magnitude Mach earthquake (1931), 7.4 magnitude Quetta earthquake (1935), 8.0 magnitude Makran earthquake (1945), 6.0 magnitude Pattan earthquake (1974), 7.6 Kashmir earthquake (2005), and 6.4 Ziarat earthquake (2008), among others. The 2005 earthquake shocked the entire nation, causing huge properties losses (Jammu, 2007). Quetta experienced 1935 earthquake which was considered one of the major earthquakes in South Asia in the early 20th century. Administrators proposed the first building codes for Quetta after 1931, Mach earthquake during which all adobe structures collapsed. Following a detailed study by a local expert, he envisioned the first seismic macro-zoning map for the sub-continent (Kumar, 1933). After the 1935 earthquake and Kumar's work, the British government adopted new building codes in 1937, proposing eight types of building structures for the city. These codes applied only to the city of Quetta. Years later, the national government prepared Pakistan's first national-level building codes in 1986, dividing the country into 5 seismic zones, but implementation and enforcement lagged. After the 2005 earthquake, the 1986 codes were updated with a 2007 micro zoned map of the country. With a rapidly growing population and fragile buildings, earthquakes remain a lethal threat for man7 residents of Quetta. This paper investigates the factors influencing the implementation of building codes in Pakistan and specifically in Quetta, one of the most active seismic zones in Pakistan.

Along with the poor construction practices and weak implementations of building codes, developing countries often invest in post disaster relief activities (Sharma 2001; Gupta 2006; Masozera 2006; Halvorson 2007; Kulig 2008; Shaheen 2008; Farah 1984; Ahmad 2004) rather than preparedness and disaster risk mitigation strategies, increasing the vulnerability of the people and infrastructure (Birkmann 2006b: CRED 2011). The paradigm shift in the field, pushing emergency managers from relief to risk assessment, preparedness and early warning system, has not been universally adopted (Adger 2002; Ainuddin and Routray 2012; Dufty 2009). This shift and the Sendai framework seek to promote effective integration of disaster risk considerations into sustainable development policies and planning. Community awareness, preparedness and resilience to disasters are required for effective hazard mitigation, planning and recovery (Adam 2004; Walsh 2007; Norris 2008; Tobin 1999; Paton 2001; Bruneau 2003: Armas 2006). At the same time community capacity building and other decentralized institutional mechanisms serve as the prerequisites for disaster risk reduction (Davidson 1997; Adger 2006; Godschalk 1998; Birkmann 2006a; Cutter 2008, 2010, Armas, 2008: Paradise 2005).

2. History of Building Codes

The history of building codes dates back to Babylon period where, the ruler of that time Hammurabi had imposed a death sentence on builders whose buildings and structures crushed in disasters (Torgal & Jalali 2012). The available literature traces that the United Kingdom had fire resistance building codes during the rebuilding of London which was declared in 1666 "Rebuilding of London Act" (Usman et al. 2022), however American Insurance Association developed the first national level building condes which was the basis of the current building codes. The first ever international conference was held in 1922 which developed the first Uniform Building cedes in 1927. The American building codes of 1950 set a new era in construction industry for standardization and regulations regarding building. The international Code Council was formed in 1990s which has formulated the International Building Code in 1997 and continued developing various amendments and versions of the codes such as the Standard Building Code, National Building Code and Uniform Building Codes (Usman et al. 2022). Across the world, building codes are then developed by the government agencies/ bodies and are enforced over the areas of the countries and cities under their jurisdiction, however the approval, development and implementation of regulations varies from country to country (Ching & Winkel, 2019). There is a common consensus in the literature that building codes are either perspective or based on performance requirements, the former with more or less with fixed designs and the later with some flexibility, depending upon the elements (Usman et al. 2022; Cote & Grant 1988).

Pakistan lies in the Asia-Pacific region, South Asia, which has very low economic base and human development Consequently, remains highly vulnerable to natural disasters particularly earthquakes. In Pakistan, building codes are developed by Pakistan Engineering Council which is empowered though PEC Act of 1975 (Muhammad, 2022) while, the district councils, municipalities and Cantonments boards, Defense Housing Authorities issue the construction permits by the registered architects to the concerned municipality where the construction takes place. These agencies have their own set of planning bylaws for construction. Apart from issuing permit, they are also responsible for checking the construction of the buildings. Pakistan engineering council developed a number of codes including Seismic Provisions Codes of 2007 but after the provincial autonomy through 18th amendments in the national constitution, the legal status of these provisions remained ambiguous (Usman et al. 2022). The local governance such as provinces, district councils are yet to response and take some necessary steps. Additionally, there are other obstacles such as illegal and unsafe construction practices which increase the vulnerability of the people to earthquake hazards in the area (Ebrahim, 2022). Several studies on building codes and earthquake indicate that most of the buildings in the urban and rural areas of Pakistan are damaged in earthquakes are due to poor implementation of the building codes, causing wide speared damages to building, infrastructure and human lives (Rizwan (2021). After the earthquake of 2005 in Kashmir, most of the government buildings were damaged such as schools, hospitals etc, indicating the inadequacy of building codes, recognized by the experts (Maqsood et al. 2010; Haseeb et al., 2011). In additional to that, several donors suspected the poor enforcement of building codes and declined to fund the reconstruction projects in the affected areas after the Kocaeli earthquake in turkey (Spence et al., 2003). Therefore, this article tries to investigate that what are those influential factors affecting the building codes implementation in very highly seismic regions in Pakistan.

3. Materials and Methods

3.1 Selection of the study Area

Quetta, the provisional capital of Baluchistan, located at 29˚48, 30˚27 North (latitude) and 66˚14, 67̊18 East (longitude), sits in the north-western part of Balochistan. The area of the Quetta city is about 2653 square km. This fort-like city is surrounded by the Takatoo, Chiltan, Zarghoon and Murdar Mountains. The province lies in very active seismic zone; the city has faced many number of earthquakes in the recent past. The major source of seismic hazard of the area is based on the two fault belts, namely, the Chaman-Nushki and Chiltan trust fault belts which extends up to Afghanistan (Ainuddin, Kumar Routray, et al., 2014). The Chiltan trust fault belt started from Chiltan mountain and travels to the Kalat region. The Chaman Strike slip fault situated between the Indian-Eurasian tectonic plate moves north-ward alongside Chamman fault serves as the major source of earthquakes in Quetta. Faults include the Chukhau-Manda, Quetta Transver, Kohlu-Kingri faults, North Kirtar and Harnai-Khaliat belts (Tahir et al, 2009). National Engineering Services Pakistan (NESPAK) and Quetta Development Authority (QDA) divided Quetta into two seismic zones based on available seismic historical data of the region: Zone-A and Zone-B. Zone-A involves a very high risk seismic zone while Zone-B consists of a high seismic risk zone.

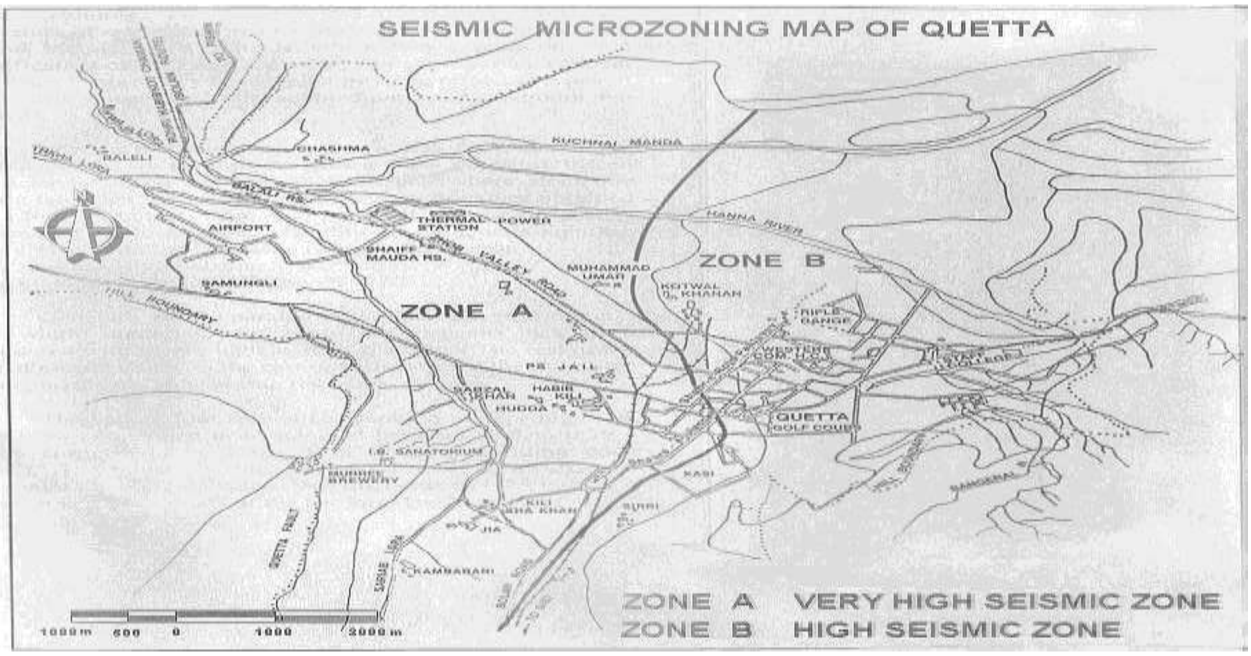

Figure 1: Seismic Micro-Zoning Map of Quetta

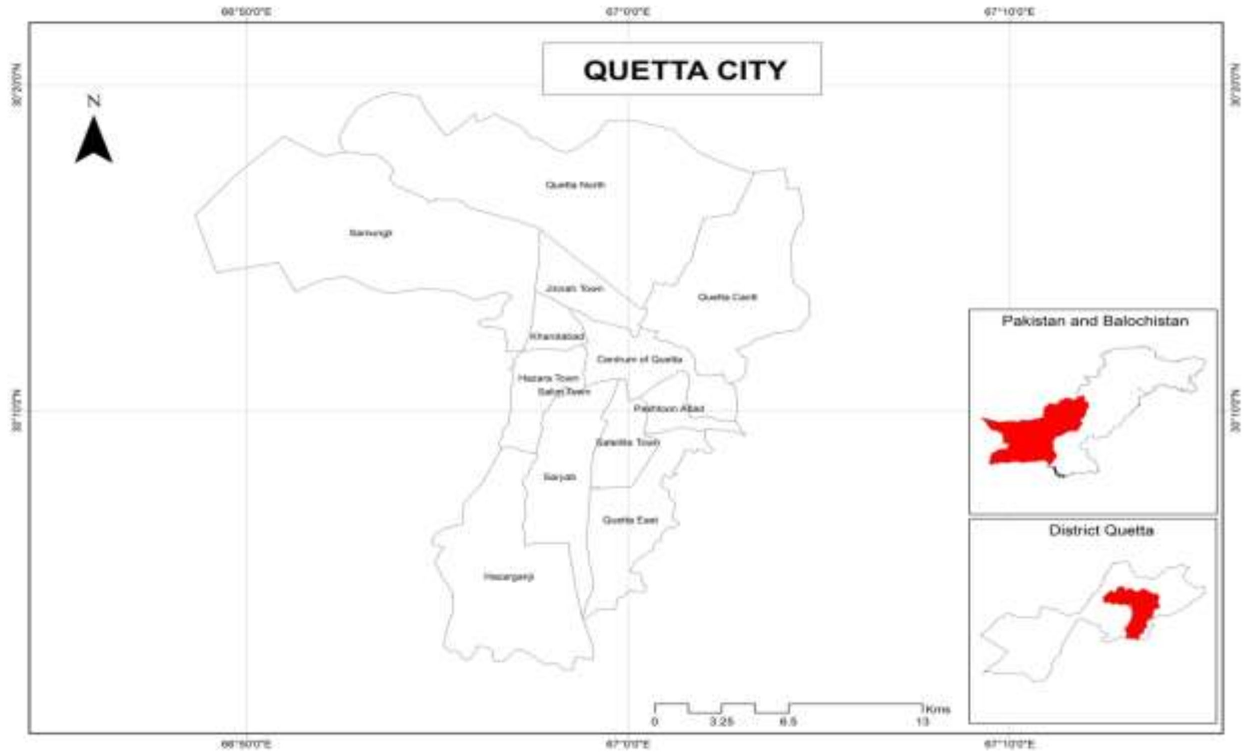

Figure 2. Location of Quetta City

3.2 Research Methodology

This paper utilizes both secondary and primary data sources and information. We gathered secondary data from published research articles, reports, and websites of the relevant departments and agencies including the National Disaster Management Authority (NDMA) and the Provisional Disaster Management Authority (PDMA) while primary data was collected through informant interviews. We conducted 24 in-depth, face to face interviews with the three key informant groups consisting of eight members in each group. These three groups include Local Authority Staff (Provincial Disaster Management Authority, Quetta Municipal Corporation, Quetta Cantonment Board and Quetta Development Authority), building practitioner (in the government and private sector) along with building owners. These serve as the key actors in the context of building construction practices, building codes implementation and disaster risk management. The target groups were selected being the major stakeholders and having relevancy to the topic under discussion. Two key informants were selected from each Quetta Development Authority, Quetta Cantonment Board, Provincial Disaster Management Authority and Quetta Municipal Corporation for Local Authority group. Four building practitioners from Government and private sector and eight owners were selected randomly to give their inputs, opinions and attitudes. Each interview took almost 20 to 30 minutes of time. Each interviewee received a consent form before the interviews were conducted.

We conducted key informant interviews in two parts. In the first part of the interview, we asked open ended questions about the status of building code implementation in the city. Questions included, “Why are building codes not well implemented in Quetta,” “Who is responsible for the implementations of such regulations,” “What is the public perception of building codes,” and “Who monitors the building regulation in Quetta?” Our team took notes during the interviews. In the second part of the interview, we provided a questionnaire listing 10 potential factors before each interviewee for ranking. We sought to understand the factors which could impact building code implementation using a five rating Likert scale. Factors listed for inclusion during the interview included: lack of awareness about building codes, corruption, interest of government, complexity of building codes, and connections in relevant departments as listed in Table 1. These factors were drawn from the earthquake hazard literature. The results of the first part of the interviews were analyzed based on content analysis and notes taken during the interview. The results of the second part of the interview were analyzed statistically using Relative Importance Index (RII) for ranking the factors affecting the building codes implementation in Quetta city. The RII indicated the influential factors affecting the implementation of building code regulations in Quetta city.

We calculated the RII as

$$RII = \frac{\sum W}{A \ X \ N}$$

Where;

RII = Relative Importance Index
W = 1 to 5 weights given to each factor by respondents
A = The highest weight =5
N = the total number of respondents.

4. Results of the case study

4.1 Results of key-informants on Status of Building Codes

Analysis of the informant interviews reveal that the population of the city has increased multifold since 1935 earthquake when roughly 40,000 people lived in the city; today the population is approximately3 million. Some seven decades after the initial event which prompted the creation of building regulations, these codes are still in practice for development projects as well as for housing construction. These projects are being implemented under the Quetta Development Authority (QDA) and the Quetta Cantonment Board (QCB) despite a lack of regulatory authority and without land use zoning. Furthermore, the government came up with the improved version of the previous codes without proper risk assessment procedure which typically apply in the construction of public and private projects in the city. Unfortunately, even these codes are not implemented or monitored within the city. The key informants underscored that QDA and QCB are the only departments which handle the construction projects in the city.

As our qualitative and quantitative data underscore, the social and economic hub of the province – Quetta - faces poor regulatory mechanisms. And it is alarming and unfortunate that in the 21st century, the government authorities have not established an independent and active working agency for building regulation and monitoring. Such an agency would be better positioned to control often unauthorized and unsafe construction projects. We also discovered that no risk assessment of the city has been carried out. The city government along with other relevant institutions have also not taken any serious steps to reduce earthquake vulnerability or to raise awareness and engage in preparedness planning. The Provincial Disaster Management Authority has developed contingency plans for other natural hazards – such as the monsoon - but has not prepared any kind of emergency plan for earthquake hazards in the province. The building owners argued that most of the time, most of the owners are unaware of technicalities of the building codes and these building regulations are not being explained well before they begin construction. The public lacks information about the importance of building regulation in ensuring resilience to seismic events. They also underscored that licensing of stone mason remains a major issue, as most are not formerly trained and lack certificates to work in construction.

4.2 Factors affection Building Codes Implementation

For residents of a highly earthquake prone region, many aspects of the institutions increase – not decrease – their risk of harm or fatality during future seismic events. We worked to identify the possible factors which can influence the implementation of the building codes in the city based on the earthquake and hazard literature. These factors were ranked by each individual interviewee through the 1 to 5 Likert scale, and the results calculated through relative important index (RII). These results and additional details are displayed below in Table 1.

Corruption

Among all factors, respondents ranked *corruption* highest. Local authority staff's responses provided it with an RII score of 0.925, building owners gave it an RII of 0.950, and building practitioners an RII of 0.875. These consistently high scores across actor groups indicate that at least in Quetta, corruption strongly constrains enforcement of building codes. Contractors often default to less expensive materials in construction, seeking to expedite building and, according to some, even move forward without inspection from authorities. Agencies grant project contracts without considering critical factors of experience, licensing, and training, but instead based on kickback or percentage cuts of construction projects. The results resonate with past research that has argued "corruption kills;" some 80% of all deaths from building collapses during earthquakes over the past 30 years occurred in those countries that are well known for their corruption (Nicholas and Bilham 2011).

Bureaucratic System

The second most highly ranked factor is the broader bureaucratic system. Building practitioners gave it a score of .90, building owners 0.925, and local authority and agencies an 0.850. Based on these results, it can be inferred that bureaucratic complications include file processing and approvals for permits taking an extended period. As a result, practitioners, owners and contractors use illegal ways to either gain or go around such approvals. This is a common practice in many developing countries (Bilham 2009). Further, across Baluchistan, we found no evidence of monitoring checks during the construction period itself.

Public Education and Awareness

In terms of nonstructural ways to reduce potential harm during shocks, public education and capacity building are important ways to mitigate disasters. The factor of public education about building codes was ranked as the third most important factor overall. Local authority staff gave it an RII of 0.90, building owners also gave it a RII 0.90, while building practitioners gave it an RII of 0.825 as shown in Table 1.

Political Interference

Political interference in giving permits and contracts is one of the biggest issues in the implementation of building codes. In interviews, respondents argued that builders and contractors are given projects based on their affiliation and attachment with ruling elites and government persons. Local authority staff ranked political interference as the third most factor affecting the implementation of building codes with an RII of 0.875. Building owners ranked it fourth with an RII of 0.875 and building practitioners had an RII of 0.775.

Lack of Government Capacity

Government capacity is considered as a main element in good governance (Aldrich 2019). Respondents identified a lack of government capacity in the implementation of building codes among the top five factors across key groups and respondents. Building practitioners ranked it third overall with an of RII

0.850. Local authority staff ranked it fifth with a RII score of 0.80 and building owners think ranking it seventh, with a RII score of 0.650. The local authority staff and building practitioners emphasized that government agencies should train their staff and hire relevant and qualified personnel to smoothly implement building codes.

Lack of Government Interest/ Commitment

Building owners ranked the issue of interest and commitment fifth with a RII score of 0.850. Based on our interviews, many respondents did not envision the government as prioritizing building codes. A lack of action on the issue despite regular past earthquakes convinced many in our respondent pool that the government would need to radically alter practices to show commitment towards adaptation and enforcement of seismic codes. The other two groups gave government commitment and RII of 0.725, with building practitioners ranking it sixth and local authority staff seventh.

Unavailability of Highly Qualified and Trained Persons

The lack of availability of highly qualified and trained people in concerned government departments and constructions companies was another matter of concern in adaptation and implementation of building codes. In this regard building owners and local authority staff ranked this factor sixth with RII scores of 0.725 and 0.775 respectively. Building practitioners ranked it eighth with a RII score of 0.650.

Lack of availability of Resources for the Implementers

As part of a developing nation, respondents argued that resource availability for safe building was an emerging issue. Building practitioners ranked it seventh with an RII score of 0.70, local authority staff ranked it eighth with (.625) and building owners nine with a RII score of 0.425.

Ambiguity of Building Codes

In Quetta, the building codes of 1937 remain in practice in 2024. Despite multiple earthquakes over the past decades, authorities have yet to move to properly update proper risk assessment procedures and regulations. Nevertheless, local authority staff and building practitioners ranked this factor ninth with a RII score of 0.60 and RII 0.50 respectively while the building owners ranked it eighth (RII of 0.525).

Accessibility of Building Codes Regulations

Respondents saw building codes as mostly accessible, with all three key groups ranking this issue 10th with RIIs of 0.474 (local authority staff), 0.40 (building practitioners) and 0.375 (building owners) respectively.

Table. 1. Factors Affecting Building Codes Implementation in Quetta.

Factors	Local Authority Staff		Practitioners		Building Owners	
	RII	Rank	RII	Rank	RII	Rank
Lack of public education and awareness on building codes	0.90	2	0.825	4	0.90	3
Bureaucratic System	0.850	4	0.90	1	0.925	2
Political interference	0.875	3	0.775	5	0.875	4
Corruption	0.925	1	0.875	2	0.950	1
Ambiguity of building codes	0.60	9	0.50	9	0.525	8
Lack of government capacity in enforcement of building codes	0.80	5	0.850	3	0.650	7
Lack of commitment by government authorities	0.725	7	0.725	6	0.850	5
Lack of accessibility on building codes regulations.	0.475	10	0.40	10	0.375	10
Unavailability of highly qualified/trained persons	0.775	6	0.650	8	0.725	6
Lack of availability of resources for the implementers	0.625	8	0.70	7	0.425	9

Source: Primary field data.

5. Discussion

This article has tried to investigate the current status of building code implementation in one of the highly risk areas in Pakistan through key informant's interviews involved in construction, monitoring of building regulations and disaster management activities at the local levels in Balochistan. Additionally, the article further explored the influential factors responsible for poor building regulation implementation in the province by using relative importance index. The index revealed that corruption, bureaucratic systems, lack of local government capacity and lack of public education and awareness on earthquake hazards are the most influential factors in the implementation of building codes. Non-compliance of building regulations and poor implementation are very pronounced in developing countries particularly those where economic and human development is at very slow pace (Edwards 2019). The results of this study are supported by the developing countries literature where implementation, compliance play very important role in the damages of infrastructure and human lives due to earthquake events. For example, Ahmed et al. (2019) argues that compliance of building code implementation in developing countries, particularly in Bangladesh and Nepal is always murky and unknown for reasons indicating poor governance system and it would be realized over a time in future by the local administrating. Similarly, Funke et al., (2020) notes that non-compliance of building codes in most of the developing countries is due to poor regulatory procedure and corrupt practice in the building construction and implementation. However, Ashtiany et al, (2017) explains, that to avoid corruption in compliance of building construction and codes enforcement, the administrative procedures need to be redefined and restructured so that it may not hinder the people's safety and construction. Moreover, our results also resonate with (Javier 2024) who emphasizes that failure to comply with the building cedes is due to political corruption and consistent government amenities for illegal construction which caused huge damage in the recent earthquake of turkey. In addition to that (Sengara 2019) recommends that Indonesian municipalities need to implement the building regulations in true sprit by avoiding misuse of power and political interferences in the implementation of the policy and construction. however, Japan may be considered the country which has the most resistant infrastructure and strict policy in the context of earthquake hazards. Japan implements policy of building regulations along with advanced technological innovations in building construction. For example; isolation of the buildings from the ground, specifications for beams, rubber pads and subsidy in retrofitting of existing building by giving less opportunity for any ignorance and corruption. (Zhang et al. 2021). Hence the article recommends that countries with same economic base and earthquake vulnerability may require advocacy, public awareness and accountability of the institution involved in building codes implementation to avoid future damages from the earthquakes.

6. Conclusion

In Baluchistan, the building codes of 1937 are still in practice and their enforcement is at best erratic with poor implementation and little capacity for rule enforcement. As the city has increased its population and buildings have become higher and more complex, neither laws nor zoning approaches have caught up. We also found little evidence that government departments or other potential actors – including construction firms themselves – set up preparedness practices which could mitigate harm in future shocks. We believe that capacity building and a stronger public and institutional awareness of relevant risk be given priority by authorities and civil society at all levels. The results of the relative importance index (RII) identified that corruption is seen as a main factor affecting the implementation of building codes in Quetta. Corruption creates hurdles for the smooth implementation of standard construction projects for seismic safety in the urban city. The other main factors including a highly bureaucratic system, political interference, a lack of public education and awareness about building codes, a lack of government capacity and commitment in adaption and enforcement of building codes. We see Quetta at serious risk of major, preventable damage from future seismic events. A systematic risk assessment is required to update the building codes of the city. The productive implementation of building codes requires institutional mechanism and the training and capacity building of practitioners and government agencies alike. The paper further recommends advocacy, awareness and programs be given priority by the government and other agencies working on disaster management (Bilham, 2013; Halverson 2010). Without investment and prioritization, Quetta may face another shock like the 1935 earthquake which killed nearly two-thirds of the population.

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Conflict of Interest of Authors:
The Authors do not have any conflicting Interest in this Research.

Ethical Statement
The research study is conducted under the guidelines of the Research Ethics Committee of the University which was approved under No. RUB/Esstt/T-08:598-05, dated on 15-05-2022. This research has nothing with the animals however the research is conducted with the participation of the people in the study area following the structural and behavioral laws of the social science.