

# Smart City Governance, Stakeholder's Satisfaction, And Crime Prevention: Moderating Impact of Institutional and Technological Innovation

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June 21, 2022

## Abstract

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Successful institutional and technological innovations are critical for smart city governance. The intrinsic complexity that characterizes institutional and technological innovations in smart cities is examined in this paper. A city's ability to innovate is heavily reliant on its technology and its ability to deploy it. This paper goes beyond the direct connections between smart city governance and stakeholder satisfaction and smart city governance and crime rate by proposing that institutional and technological innovation play a moderating role in these relationships. Multiple regression models were developed by surveying 214 Pakistani public and private citizens with a questionnaire. Using stakeholders and innovation theories, an analysis of the relationships between smart governance, stakeholder satisfaction, and city crime rates reveals a moderating role of institutional and technological innovation.

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**Keywords:** Smart City Governance, Institutional Innovation, Technological Innovation, Stakeholders' Satisfaction, Crime

## 1. Introduction

More than half of the global population lived in urban cities with an expectation of trend to increase to three quarters by 2050 (Bakıcı et al., 2013; Garau & Annunziata, 2019). Fast urbanization generates an insistence and imperative for cities to discover smarter ways to cope with the associated challenges such as security, stakeholder's satisfaction, air pollution, traffic congestion, wasteful energy consumption, and difficulty in waste management (Nam & Pardo, 2011a, 2011b). Furthermore, urban cities are progressively not only considered as the engines of economic growth and innovation but also the mechanism that may be used to solve wicked problems (Inayatullah, 2011; Myeong et al., 2021; Nijkamp & Kourtit, 2013). Local governments must generate adequate and advanced approaches to overcome various issues such as social inclusion, sustainable economic growth, crime control and prevention, and innovation (Benjamin, 2013; Landry, 2012).

Technological innovation can assist smart city governments in overcoming these governance challenges in urban areas and improving their overall environment (Lee et al., 2013). Crime monitoring, traffic control, energy production, etc., can be improved with the help of new technological development that enhances the intelligence of the urban systems and the city government may make the best use of available technologies to solve terrific glitches. *Smart city governance* can be defined as, "using new technologies to improve urban governance through better use of information and better communications" (Meijer, 2016). Currently, two distinct branches of technological innovation connect to different forms of smart city governance (Nijkamp & Kourtit, 2013), the two branches are technologies for concentrated intelligence and technologies for distributed intelligence.

Recently, Technological innovation in the public sector has attracted considerable attention in academic literature (Yarime, 2020). The public sector should adopt technological innovation practices to solve several composite and complex issues keeping in view their constraints and existing resources in response to stakeholders' expectations and satisfaction (Hartley et al., 2013). Diffusion and adoption of innovation may be utilized while evaluation of technologies (Rogers, 2010), smart city governance and planning literature culminates the important contribution to the quality of smart city environment, not only in term of the results but also the process of realizing such results. Most advanced technologies may not be used by smart cities and still be capable of providing successful and better outcomes (Myeong et al., 2021) in the shape of sustainability, economic growth, low crime rate, and better safety and for providing a better process in the form of better decision-making, implementation of policies, and depletion of the number of conflicts.

Institutional innovations are expected to be dynamic for realizing flexible smart city governance under stakeholders' satisfaction and crime rate (Silva et al., 2019; Yau & Lau, 2018). Institutional innovation, in this study, refers to deliberate variations in joint choice institutions that allow smart cities to be more effective and perform better to enhance stakeholders' satisfaction and reduce the crime rate. Scholars have begun exploring innovation in different domains extensively in current years, both within and larger scales (Hargrave & Van de Ven, 2006). Nonetheless, a substantial focus on analyzing the institutions that construct, and change because of, such innovative actions have been neglected. An institutional approach furnishes substantial new understandings of how smart city governance systems may or may not change cities' level of satisfaction and crime rate.

Despite previous literature revealed the positive relationship between smart city governance and stakeholders satisfaction (de Vries et al., 2018) and negative impact on crime rate (Berry, 2018), studying the impact of smart city governance is complex since the associations between smart city governance arrangements and stakeholders' satisfaction and crime rate are contextual. This study investigates how institutional and technological innovations moderates the relationship between smart city governance and stakeholders' satisfaction and the relationship between smart city governance and crime rate? This study assumed that relationships between smart city governance and stakeholders' satisfaction, and smart city governance and crime rate depend on contextual factors. The remainder of this study is arranged as follows: Section 2 introduces the literature review from previous research studies to develop hypotheses about smart city governance, stakeholders' satisfaction, crime rate, and institutional and technological innovations. Section 3 explains research methodology, data used for estimation, research model and analysis. Section 4 presents statistical results and finally, section 5 describes the discussion, conclusion, and future research.

## **2. Literature Review and Hypothesis**

### **2.1 Smart city governance and stakeholders' satisfaction**

Literature on public management has been grappling with knowing how to evaluate smart city governance. Some scholars argue that the performance of governance may be estimated with its effect on the environment, people, economy, mobility, and living standard of citizens (Winters, 2011). Other researchers have different opinions, and they claim that the main characteristics of

governance are the different goals and objectives that participating actors have. Different stakeholders of a city may like a project from the local government according to their demands to satisfy their needs. For instance, citizens would like to improve their natural environment, neighborhood, living standard, and basic health, water, and education facilities. At the same time housing societies may regard an environment to flourish their business activities to attract tenants, while security agencies may highlight the crime reduction (Meijer, 2016). For citizens, is one of the key stakeholders, effective governance requires the efficient and sustainable provision of housing, transportation, sanitation, employment, sewerage system, water, power, and additional facilities at an augmented pace. It also requires great attention on access to basic human growth indicators including security, healthcare, education, social justice, and civic engagement (Jabeen et al., 2017).

As per previous research, diversity in objectives means that the success of governance can only be analyzed in terms of stakeholders' satisfaction (Koppenjan et al., 2004). Uncertainty emerges when stakeholders are challenged with societal problems in their area, and they have no idea what will be impacts of their efforts to solve those problems. Hence, city government profoundly involves stakeholders including citizens, business associations, institutions, and other target groups in decision making and implementing its policies. They keep less prominence on autonomous legal instruments such as regulation and legislation but use the tools that can be more objective and have space for cooperation and consultation like awarding or gaining contracts, subsidies, and covenants as preferred between government and stakeholders (Le Roy & Czakon, 2016; Scholl & Scholl, 2014). It means that the priority of the city government is not in a position always to dictate but provide smart services without creating hassles to satisfy its stakeholders. For stakeholders, communication with the government is only one aspects to consider for their satisfaction. Besides communication, the involvement of stakeholders in public services, decision-making, and policy implementation is also an integral part of smart city governance. It is principally important that the process of engagement and involvement of key stakeholders in decision and policymaking must be fair and transparent (Albino et al., 2015).

According to Deng (2018), special attention must be devoted to stakeholder's general interests (property interest, business interest, political interest, general interest, and state interest) for their satisfaction in smart city and urban governance, not doing so, may have social, political, and institutional implications. Stakeholder theory (Freeman, 2010) is considered the most valuable and influential theory are supporting the business and stakeholders relationship. In this case of stakeholders' satisfaction, the importance is given to the relationship between smart city government and its governance system that may lead to better performance e.g., stakeholders' satisfaction, as government institutions that integrate societal actors with them considerations enhance satisfaction for their stakeholders. When city government will engage its stakeholders in policy and decision-making process (Bokhari & Myeong, 2022; Capra, 2016), enable them to approach basic necessities of life, and collaborate with them to create and utilize ICT- based to host e-government (Viale Pereira et al., 2017), the satisfaction of stakeholders will ultimately be enhanced positively. Hence, we hypothesize,

***Hypothesis 1:*** *Higher the city governance is smart, the higher the likelihood that stakeholders' satisfaction will be enhanced.*

## 2.2 Smart City Governance and Crime Rate

Cities have always been the epicenters of crime. Security has traditionally been considered the core of smart cities, with their walls serving as the primary emblem (Berry, 2018). However, a secure city is distinguished not only by the lack of hazard but also by the lack of dread. Consequently, while considering security, one must consider the real chance of becoming a crime victim and the impression of a violent and hazardous atmosphere influenced by various circumstances (Cardia & Bottigelli, 2011). A Smart City is characterized as the capacity to develop and implement solutions to challenges and opportunities of reshaping metropolises into more constructive and habitable places for their inhabitants (Alawadhi et al., 2012), by leveraging technological advances and the hyper-consumption of the Internet of Things (Zanella et al., 2014).

Because of its characteristics and functions, security management in smart cities has a significant position among its several domains (Colado et al., 2014). This may be seen in the digital economy, intelligent people, smart governance, the internet of vehicles, building automation, and smart lifestyle (Ibrahim et al., 2018). Smart governance relates to public security and utilizing data platforms such as open government data. Smart transportation includes the identification of driving offenses, the surveillance of traffic patterns, accident information, the prioritization of emergency vehicles. In a basic context, smart city security would entail the organization of chaotic urbanizations, the creation of safer cities through the adoption of highly connected sensor networks and security systems, and the management of accidents, malfunctions, or catastrophic circumstances. Through police, medical, and logistical coordination of rescue (among other players), network cybersecurity encryption for massive amounts of data (Lodato et al., 2021).

Though cyber security focuses on the safety of networks and data, smart city security must include human safety. Advanced and sophisticated technology based on information and communication technologies also assists in the increased safety of individuals in cities (Dey et al., 2012). Traditional equipment, such as smart street lighting, can also be improved to enhance safety for inhabitants (Jin et al., 2016). Scholars have increasingly begun to aggressively debate the notion of a safe city that guarantees the safety of its residents using these innovations. A secure city efficiently protects inhabitants from crime and terrorism while also allowing citizens to rapidly respond to health issues and calamities (Park & Lee, 2020). By following cybersecurity, smart economy, smart people, smart governance, and smart mobility strategies and manipulating the physical environment through urban design and planning, it is, therefore, possible to produce behavioral effects that will reduce the incidence and fear of crime (Berry, 2018). Hence, observing previous literature and theories, we will hypothesize as:

***Hypothesis 2:** Higher the city governance is smart, the higher the likelihood that the crime rate in the city will be reduced.*

## 2.3 Contextual Impact of Institutional Innovation

Institutions are human-created structures, values, and procedures that facilitate and regulate the behavior of social actors and make social life predictable and purposeful (Hodgson, 2006; March & Olsen, 2010). Understanding the institutional and legal bases of organizations benefits from the distinction between institutional actors and institutional arrangements. Within the confines of an institutional arrangement, an organization can only function as an individual entity with specific

rights and responsibilities (Hargrave & Van de Ven, 2006). An institutional arrangement can be extremely simple or extremely complex. While institutionalists generally define institutions as controlling action in organizational fields (Rao et al., 2003), institutional arrangements can refer to a specific institutional actor (a firm's internal policies), an industry or demography (technology standards), all inhabitants of a country (levies and land rights), or individuals from multiple countries (human rights regulations, trade agreements).

Institutional innovation is vital for the implementation of dynamic governance systems while keeping stakeholders in mind and avoiding security breaches (Eakin et al., 2017). Variations in legislation and programmatic frameworks that organize decision-making, changes in enforcement strategies, fluctuations in structures to achieve specific goals, and adjustments in collaboration mechanisms between various actors may all fall into this category. Scholars have conducted extensive research on innovation in public administration governance in recent decades, both within cities and worldwide (Kettl, 2015). This includes strategies such as policy innovation (Morgan, 2010), urban experimentation (Raven et al., 2019), urban security (Vivo-Delgado & Castro-Toledo, 2020), and urban laboratories cities (Gaubatz & Hanink, 2020), which involve a diverse range of stakeholders such as government, business, and civil society. Institutional innovation, in the wider context, is a political endeavor. Being ignorant, or neglecting the dynamics of authority and control, is a typical critique leveled against stakeholder engagement approaches (Pettit, 2010). To strengthen institutional innovation and adaptation procedures in cities, we must fundamentally redefine the concept of stakeholders' satisfaction through engagement and crime prevention by preventing security breaches. Self-reflection, ambiguity negotiation, constructive development, and strategic engagement are all required for institutional innovation (Woodhill, 2010).

Smart Governance is rapidly being positioned at the core of the ambition of developing the smart city as a holistic idea (Meijer, 2016), and scholars emphasize the relationship between smart governance and the need for integrated methods such as stakeholder and security (Castelnovo et al., 2016). Stakeholder engagement in decision-making is critical for Smart governance and is a prerequisite to becoming a smart city (Albino et al., 2015). City governors prefer to engage stakeholders in decision-making to deliver upgraded services that increase their satisfaction (Castelnovo et al., 2016), and take initiatives to deploy surveillance and other technologies in smart cities for crime prevention (Pali & Schuilenburg, 2020). Hence, we developed our hypotheses following the previous literature and theories:

*Hypothesis 3: Better the institutional innovation in smart city, higher the likelihood that stakeholders are happy and satisfied*

*Hypothesis 4: Smart cities with better institutional innovation are likely to have a lower crime rate*

*Hypothesis 5: Institutional innovation moderates and strengthens the relationship between smart city governance and stakeholders' satisfaction*

*Hypothesis 6: Institutional innovation moderates and weakens the relationship between smart city governance and crime rates*

## 2.4 Contextual Impact of Technological Innovation

Governance in smart cities is primarily responsible for managing information flows among stakeholders, as well as collecting/accumulating/managing data collected through innovative technologies related to value-added processes in smart cities (Silva et al., 2018). Moreover, GEs can certify data integrity and quality, collaborate with all stakeholders across value chains, and elevate internal and external awareness of smart city initiatives. Quintessential roles in city governance include project promotion, execution, structured finance, warranty, and certification and through technological innovation implementation. It is emphasized the importance of such bodies in promoting accountability, transparency, connectivity, and involvement among all stakeholders involved in their satisfaction (Joshi et al., 2016). Smart city governance is predicated on the technologically innovative use of ICT infrastructure to meet predetermined goals, providing all stakeholders with streamlined, one-stop expertise associated with service system implementation (Yu et al., 2019)

Many studies appear to undervalue the implementation of innovative technologies in the field of security for crime reduction. Nevertheless, we can see from Maslow's hierarchy of needs that security is a critical component of life quality in every city, hence, every smart city must be a safe city (Lacinák & Ristvej, 2017). Smart city governance in this domain is the goal of the Safer City program, which was initiated in 1996 by the institution UN-Habitat at the recommendation of African mayors. This initiative is distinguished by multiple segments in which the concept of Safer City was developed. The first stage focused on urban crime prevention approaches such as institutional crime and violence prevention, as well as social crime prevention. In the second stage, the perspective on city security and safety broadened to include two new fields: tenure security and forced evictions, and natural disaster relief. The third stage emphasizes the use of organizing, strategic planning, and management while emphasizing that these three components should not be separated. The last two stages are about integrating local governments and their proactive approach to security and safety (Habitat, 2013).

Innovative technologies serve many purposes, and those used in the field of security and safety contribute to the development of a crime-prevention system. The viewpoint of (Lacinák & Ristvej, 2017) has influenced our general description of a smart safe city. It will be parallel to the depiction of governance of the smart city, which enhances the effectiveness of mechanisms in the field of security and safety through the convergence of innovative technology and global ecosystems, to reduce crime and terror threats, to allow its stakeholders to live in a healthy environment, and to provide simple access to better services (Ristvej et al., 2020). Though some prior literature concedes that urban development poses challenges for traditional city safety and security infrastructure and that these are crucial issues for contemporaneous embedded urban developments (Benkő & Germán, 2016), this is only seldom discussed accordingly.

The safe city concept is one approach that aims to consolidate issues of crime prevention with new smart city developments (Lacinák & Ristvej, 2017). While it was originally envisioned as a framework for natural calamities protection, it rapidly expanded to encompass all components of city safety. The concept intends to consolidate urban growth with the need for security and safety by utilizing a variety of innovative technological functions and optimizing the distribution of security resources (Ristvej et al., 2020). Moreover, a safe city is defined as the integration of

innovative technology and the natural environment that improves the efficiency of the operations of dealing with the threat of crime and terror and enables for the accessibility of a peaceful ecosystem for stakeholders (Lacinák & Ristvej, 2017). They include issues such as stakeholder satisfaction and whether the technological innovation has benefited those who have been subjected to the intervention and those who have not. This is critical because stakeholders are, at the end of the day, at the heart of any urban safety intervention and vital to providing a safe space. Thereby, measuring stakeholders' perceptions of urban security is an important aspect of smart city governance because it ensures that cities not only prevent or react to potential dangers and security risks but also persist as an appealing place to live for stakeholders (Joshi et al., 2016). Hence, the following hypotheses are developed following the previous literature:

*Hypothesis 7: Better the technological innovation in smart city, higher the likelihood that stakeholders are happy and satisfied*

*Hypothesis 8: Smart cities with better technological innovation are likely to have a lower crime rate*

*Hypothesis 9: Technological innovation moderates and strengthens the relationship between smart city governance and stakeholders' satisfaction*

*Hypothesis 10: Technological innovation moderates and weakens the relationship between smart city governance and crime rates*

### **3. Research Methodology**

#### **3.1 Participants and Procedure**

The data was collected from participants working in the public and private sector, business individuals, graduate students, and other stakeholders belonging to various parts of Pakistan. The initial questionnaire was structured in English and then translated into Urdu before being returned to English by two bilingual specialists to ensure correctness and acceptability (Santos et al., 2010). The questionnaires were disseminated, and each respondent was given adequate time to complete the questionnaire survey and submit it. They answered the questions about their perception of smart city governance, institutional innovation, technological innovation, stakeholders' satisfaction, crime rate, and other demographics. Answers to the questionnaires collected were coded to ensure that the replies could be compared with each other. Participants were guaranteed that their opinions and perception would remain anonymous and would only be used for research purposes. A total of 214 completed surveys questionnaire were submitted, with an 85% validity rate, and they were utilized to analyze data statistically to satisfy the requirement of minimum sample size for multiple regression modeling. In this survey, 62 % of respondents were male, and 72% were between the ages of 18 and 40.

#### **3.2 Data Analysis**

SPSS 21.0 software was utilized to investigate the sample for this research, and multiple regression was employed to substantiate our hypothesis. Recent research in social science has revealed a substantial reliance on the bootstrap technique as one of the finest conventional approaches for examining moderating factors in social scientific domains (Albright & Marinova, 2015). Additionally, owing to various new advancements such as confirmatory analysis, non-



linear impacts, and mediating and moderating influences, multiple regression is recognized as one of the greatest novel alternatives to prior standard analytic methods (Rosopa & Stone-Romero, 2008). Though numerous scholars employed structural equation modeling (SEM) to examine the interaction effect between IVs and DVs, we believed that multiple regression would be the appropriate method for this study to examine our outcomes (Bokhari & Myeong, 2022).

A convergent validity test was used to develop a measurement model of the complete self-scales using confirmatory factor analysis (CFA). Afterward, the modification index is utilized to choose items from the variables. The component with the highest modification index value was eliminated first, followed by the next component, and so on until the required goodness of fits was attained. Most of the goodness of fit indicators exceeded the stipulated necessary level. The factor loadings of all components of observed variables are confirmed to be larger than the critical point of 0.5 (Gill et al., 2018). The absolute model fit index was identified using the goodness-of-fit test, which determined whether a dataset matched the connecting path map of a broader context.

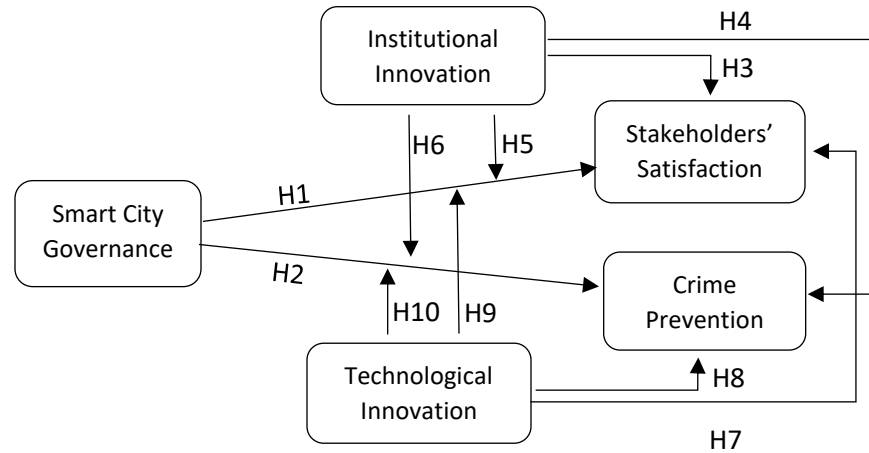


Figure 1: Theoretical Model

Figure 1 depicts our research framework, which represents smart city governance as independent, dependent on stakeholder satisfaction and crime rate, and institutional and technical innovation as moderating variables. Our empirical figure illustrates that smart city governance has a direct influence on stakeholder satisfaction and crime rate, but when institutional and technical innovation are included in the model, the direct linear correlation becomes a moderating relationship.

#### 4. Results

Table 1 describes the outcomes of KMO for all five variables (SGC as independent, institutional innovation and technological innovation as moderating, and stakeholders' satisfaction and crime rate as dependent variables) is 0.561, which is greater than 0.001 suggesting that the data sample size utilized for this research was adequate. Further, the Chi-square result is 902.463 with a substantial significance level of 0.000, satisfactory again.

\*\*\*\*\* INSERT TABLE 1 HERE \*\*\*\*\*

Table 2 explains the reliability and validity analysis. The impact of smart city governance as a predictor construct, stakeholders' satisfaction and crime rate as outcome variables, and institutional innovation and technological innovation as moderating factors were determined using reliability analysis for 20 items. The following are the answers to the twenty questions: Four items were assigned to smart city governance, four objects were assigned to stakeholder satisfaction, four factors were assigned to the crime rate, four items were assigned to institutional innovation, and four components were assigned to technological innovation. The overall Cronbach Alpha of a total of 20 items with a sample size of 214 was 0.934, indicating that the questions used to test all five components were reliable for this study. Furthermore, the factor loadings for each component exceeded 0.9. Factor loading greater than 0.6 for each component indicates that all questions posed to participants and utilized to quantify factors were reliable and valid for this study.

\*\*\*\*\* INSERT TABLE 2 HERE \*\*\*\*\*

The descriptive statistics, internal consistency reliabilities, and correlations among variables are shown in Table 3. All correlations were in the predicted direction, providing support for further testing of hypotheses such as smart city governance being positively related to stakeholder satisfaction ( $r = 0.801$ ,  $p 0.01$ ), institutional innovation ( $r = 0.642$ ,  $p 0.01$ ), technological innovation ( $r = 0.559$ ,  $p 0.01$ ), and negatively related to crime rate ( $r = -0.027$ ,  $p 0.01$ ). Multiple regression analysis was conducted to evaluate our moderated model, following the instructions stated by (Muller et al., 2005).

\*\*\*\*\* INSERT TABLE 3 HERE \*\*\*\*\*

We used SPSS 21.0 to examine the moderating hypotheses. As shown in Table 4 (Models 1 and 2), after we controlled for respondents' sex, age, and education, SCG was positively and significantly related to stakeholders' satisfaction ( $b = 0.026$ ,  $p < 0.01$ ), thus supporting H1. Hypothesis 2 forecasts that smart city governance has a negative connection with the crime rate, implying that improved smart city governance would result in a reduced crime rate. In Model 6 of Table 4, the findings demonstrate that smart city governance was negatively correlated to crime rate ( $b = -1.064$ ,  $p < 0.01$ ), thus H2 is substantially supported as projected. Hypothesis 3 predicts that institutional innovation has a positive and substantial influence on stakeholder satisfaction, whereas hypothesis 4 assumes that institutional innovation has a negative correlation with the crime rate. In Table 4, the results revealed statistically that institutional innovation was positively

associated with stakeholder satisfaction ( $b = 0.463$ ,  $p = 0.01$ ) and inversely related to crime rate ( $b = -0.437$ ,  $p = 0.01$ ), indicating that H3 and H4 are strongly supported. Further, Hypothesis 7 anticipates that technological innovation has a significant and positive impact on stakeholder satisfaction, however, Hypothesis 8 forecasts that technological innovation has a negative association with the crime rate. According to the findings in Model 3 and Model 7 of Table 4, technological innovation is significantly correlated to stakeholder satisfaction ( $b = 0.646$ ,  $p < 0.01$ ) and negatively associated with crime rate ( $b = -0.831$ ,  $p = 0.01$ ), suggesting that H7 and H8 are significantly substantiated.

To test the proposed moderating hypotheses 5, 6, 9, and 10, we estimated a moderation model (Model 4 and Model 8) that included the moderation effect of institutional and technological innovation on the relationship between smart city governance and its impact on stakeholder satisfaction and crime rate. Table 4 shows unstandardized empirical results for Model 4 and Model 8. In Table 4, Model 4, the interaction term between smart city governance and institutional innovation was positively associated with stakeholder satisfaction ( $b = 0.521$ ,  $p < 0.01$ ), as was the interaction term between smart city governance and technical innovation ( $b = 0.710$ ,  $p < 0.01$ ), indicating that Hypotheses 5 and 9 are supported significantly. Further, the moderating impact between smart city governance and institutional innovation was negatively associated to crime rate ( $b = -0.245$ ,  $p < 0.01$ ), as was the interaction term between smart city governance and technical innovation ( $b = -0.679$ ,  $p < 0.01$ ), demonstrating strong support for Hypotheses 6 and 10.

\*\*\*\*\* INSERT TABLE 4 HERE \*\*\*\*\*

## 5. Discussions, Conclusion, and Limitations

Continuous learning about institutional and technological innovations must be taken seriously considering the fast-paced changes in technology and the necessity of innovation to survive in such a dynamic environment. With this critical issue in thought and applying to the context of Pakistan, the main objective of this study was to explore how smart city governance affects stakeholder satisfaction and crime rate through the moderating role of institutional and technological innovation. The findings of this study revealed that governance in smart cities enhances stakeholder satisfaction and contributes significantly to a lower crime rate in the city by implementing institutional and technological innovation. Previous research in the smart city literature has found that smart city governance has a positive impact on stakeholder satisfaction (de Vries et al., 2018) while harming the city's crime rate (Berry, 2018). This study extends the literature by demonstrating the positive and significant impact of smart city governance on four key dimensions of stakeholder satisfaction, notably, true information of personal interest and confidence in doing the right thing, as well as the negative impact of smart city governance on four dimensions of crime rate, namely, traffic violation, robbery, corruption, and smuggling. These findings imply that smart city governance and the integration of traditional and prospective innovations through technology enhances stakeholder satisfaction and decreases crime rates.

This is a mixed-methods study that evaluated the effect of institutional and technological innovation on the relationship between smart city governance, stakeholder satisfaction, and crime rates. A theoretically derived research model was validated using a deductive approach. The data were collected using web-based survey questions with 214 respondents from Pakistan's public and private sectors. The impact of smart city governance on stakeholder satisfaction and the crime rate was investigated, as well as the moderating effect of institutional and technological innovation on this relationship.

Now that the research questions have been highlighted, they can be addressed. We found a significant positive relationship between smart city governance and stakeholder satisfaction in the first question, and a negative relationship between smart city governance and crime rate in the second. The results showed statistically significant support at the 95 percent confidence level, supporting Hypotheses 1 and 2. Hypothesis 3 is supported, in which governors' implementation of institutional innovation in smart cities is positively related to stakeholder satisfaction. Hypothesis 4 is supported because the use of institutional innovation in smart cities is also linked to a reduction in crime rates. Furthermore, the addition and implementation of technological innovation in smart cities increase stakeholder satisfaction and reduce crime in the city, as anticipated; thus, Hypotheses 7 and 8 are strongly supported.

We observed both moderating factors acting as a moderator for Hypotheses 5 and 6, institutional innovation as a moderator, and Hypotheses 9 and 10, technological innovation as a moderator on the relationship between smart city governance and stakeholders' satisfaction and smart city governance and crime rate because institutional and technological innovations are also directly associated with stakeholders' satisfaction and crime rate. The findings revealed that institutional and technological innovations have strengthened the relationship between smart city governance and stakeholder satisfaction while weakening the correlation between smart city governance and crime rate. Consequently, Hypotheses 5 and 6, as well as 9 and 10, are significantly supported, as predicted.

While the limitations of this study do not diminish the importance of the findings, they do call our attention to the generalization of the findings. The first limitation is in our sample, which was constructed using a simple random sampling method and thus cannot be guaranteed to be representative. The second limitation of our study is that we forecast our framework with a specific subset at a single point in time. To strengthen the significance of our observations, we would need to reconstruct them at different points in time to identify possible changes in stakeholders' satisfaction and crime with the implementation of institutional and technological innovation in smart cities. We would be able to examine the impact of various critical indicators in a more dynamic manner. Another limitation is that our study was conducted in Pakistan, which does not promise that the obtained results with the same framework in another context will be as significant as those reported in this research. Lastly, we could have investigated the interaction of other predictors such as service quality (Yu et al., 2019) for stakeholders' satisfaction and income equality (de Vries et al., 2018) for crime rate with institutional and technological innovations, and how it may circumstance the social relationship that inhabitants may establish with their smart cities.

This paper enables us to identify numerous future research directions. One research direction could be to investigate how smart city better service delivery (Yu et al., 2019) affects residents'

satisfaction and crime rate. We could also broaden the investigation by obtaining the determinants of other types of innovation, such as social innovation (Bokhari & Myeong, 2022), and investigating how such inclusion affects stakeholder satisfaction and crime rates in smart cities.

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Table 1: Bartlett Sphericity Test and KMO of Self Rating Items

Factors	No of Items	Component	N	KMO	Bartlett Test	
					Chi-square	Sig
Smart City Governance	4	0.960	214	0.561	902.463	0.000
Stakeholders' Satisfaction	4	0.821	214			
Crime Rate	4	0.931	214			
Institutional Innovation	4	0.807	214			
Technological Innovation	4	0.877	214			

Table 2: Reliability and Validity test

Variables	Items	Factor Loadings	KMO @ Bartlett's Test
Cronbach Alpha = 0.934			
Smart City Governance	Education and health facilities in my city provided by the city government are excellent	0.934	0.737
	City Government always involve the community in decision/policy making	0.926	
	Performance of city government in different departments is excellent	0.935	
	I am satisfied with the city government's organizational structure to provide better services	0.939	
Institutional Innovation	Innovations made in Government institutions are useful	0.929	0.727
	Innovations made in Government institutions are Legitimate	0.928	
	Innovations made in Government institutions are novel/new	0.929	
	Innovation made in Government institutions are acceptable for society	0.930	
Technological Innovation	Innovations in technology from the city government have improved services	0.928	0.778
	Innovations in technology from the city government have Improved working conditions on health and safety	0.929	
	Innovations in technology from the city government have reduced environmental impacts	0.929	
	Innovations in technology from the city government improved performance	0.931	
Stakeholder's Satisfaction	I have full confidence in the city government	0.928	0.727
	My city Government takes care of my interests	0.929	
	I believe that the city government provides information true and trustworthy	0.928	
	I believe that the city government do the right things for public	0.927	
Crime Rate	Innovations by the city government in institutions and technology resulted in a reduction in traffic rules violations	0.932	0.673
	Innovations by the city government in institutions and technology resulted in a reduction in Robbery/theft	0.939	
	Innovations by the city government in institutions and technology resulted in a reduction in bribery/corruption	0.932	
	Innovations by the city government in institutions and technology resulted in a reduction in smuggling/drugs	0.931	



**Table 3. Mean, Standard Deviations, and Correlations**

Variable s	Mean	SD	SCG	InstI	TI	SS	CR	Gen	Age	Edu
SCG	2.887	0.937	1							
InstI	3.499	0.922	0.642**	1						
TI	3.812	0.829	0.559**	0.808**	1					
SS	3.278	1.242	0.801**	0.574**	0.687**	1				
CR	3.623	0.906	-0.027**	0.560**	0.636**	0.345**	1			
Gen	0.650	0.478	0.060	0.116	0.168*	0.137*	0.176**	1		
Age	1.472	0.500	0.057	0.047	0.003	-0.025	-0.083	-0.071	1	
Edu	1.322	0.469	0.094	0.006	-0.100	0.003	-0.117	-0.185**	0.369**	1

**Table 4: Effect of Smart City Governance on Stakeholders' Satisfaction and Crime Rate**

Variables	Dependent Variable: Stakeholders' Satisfaction				Dependent Variable: Crime Rate			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
(Constant)	3.278***	3.664**	1.286***	1.408**	3.007***	0.402**	0.969***	3.563***
Gender	.304**	.300**	.115*	.131*	0.370**	0.202**	0.104**	0.154**
Age	-0.083	0.084	-.148*	.170**	0.074	0.126**	1.410*	0.161**
Education	.136*	.141	.074	.054*	0.106	0.106**	0.060*	0.083**
SCG		.026**	.588***	.260**		-1.064**	-0.924***	-0.885***
InstI			.463***	1.092**			-0.437***	-0.564***
TI			.646***	2.825***			-0.831***	-1.269**
Interaction Effect:								
SCG x InstI				.521***				-0.245**
SCG x TI				.710***				-0.679***

Note: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01