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Building Participative E-Governance in Smart Cities: Moderating Role of Institutional and Technological Innovation

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Abstract: The successful implementation of institutional and technological innovation is critical for the effective execution of e-governance in smart cities. This study examines the inherent complexity associated with institutional and technological innovation in the context of smart cities. The capability of a municipality to cultivate innovation is significantly dependent on the implementation of its technological infrastructure and institutional competence. This study aims to contribute to the existing literature on the relationship between e-governance in smart cities and stakeholder satisfaction. It highlights that institutional and technological innovation could mediate these interactions. Data were collected by administering a questionnaire to a sample of 589 individuals from the Republic of Korea and Pakistan to develop multiple regression models. This study employs stakeholder and innovation theories to investigate the relationship between e-governance and stakeholder satisfaction, emphasizing the moderating effects of institutional and technological innovation. The linear multiple regression analysis findings indicate that e-governance, institutional innovation, and technological factors statistically influence stakeholder satisfaction. It was also discovered that the presence of institutional and technological innovation moderates the association between e-governance and stakeholder satisfaction.

Keywords: e-governance; institutional innovation; technological innovation; stakeholders' satisfaction; smart cities

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1. Introduction

More than half of the global populace resides in urban areas, and this proportion is anticipated to be 75% by the year 2050 [1,2]. Rapid urbanization necessitates cities to actively seek more smart approaches to address the various challenges that arise, including but not limited to security, stakeholder satisfaction, air pollution, traffic congestion, inefficient energy usage, and waste management [3,4]. Urbanization is an inevitable extension of worldwide social and economic advancement and industrialization. Urbanization continues to get more prominent in society, coupled with more obvious urban challenges [5]. The challenge of urbanization in the context of information technology has given rise to a novel concept known as the "smart city". This concept entails the use of appropriate artificial intelligence (AI) information and communication technology (ICT) and the Internet of Things (IoT) for promoting urban development [6]. Smart cities strive to enhance government services, citizen well-being and satisfaction, and overall operational efficacy through AI, ICT, and IoT [7–9]. Applying AI, ICT, and IoT frameworks is instrumental in addressing various problems arising from urbanization, comprising economic, social, and environmental dimensions. Moreover, the application of this technology extends not only to traffic monitoring and parking remotely, but also to the management of common public services electronically, e.g., e-governance [10].

Governance is a comprehensive and multifaceted concept encompassing complex mechanisms and networks involved in governing. It entails the activities of ruling, collaboration, and management [11,12]. Governance plays a vital role in urbanization due to the significance of relationships and networks across numerous stakeholders to combat smart cities' "wicked problems" [13]. Smart cities provide a unique approach to urban governance, wherein ICT and IoT are employed to facilitate improved cooperation and networking among various stakeholders [14,15]. Internet use and open data policy implementation improve information accessibility, thus promoting citizen engagement in public decision-making [16] to foster their satisfaction. A smart city is an ecosystem that facilitates the public and private sectors' collaboration with citizens to develop innovative solutions for urban issues [17]. In addition, a believed feature of smart cities is facilitating good governance. Good governance comprises decision-making processes driven by transparency, democracy, and inclusivity, with various stakeholders engaged [18,19]. Previous research on smart city governance emphasizes two fundamental elements. One key aspect is prioritizing various stakeholders' involvement [4,20,21], specifically focusing on citizen engagement and inclusive decision-making [22]. The second critical attribute involves using ICT and IoT in governance, facilitating stakeholders' engagement, cooperation, and transparent decision-making [23]. Smart city governance, which evolved from e-governance, strives to enhance administrative effectiveness, citizen-centricity, and collaboration between government and other stakeholders [24]. E-governance in smart cities emphasizes stakeholder collaboration supported by digital technologies [20,23].

Technological innovation in the public sector has recently attracted considerable attention in the academic literature [25]. The public sector should adopt technological innovation practices to solve several composite and complex issues, considering their constraints and existing resources in response to stakeholders' expectations and satisfaction [26,27]. The diffusion and adoption of innovation may be utilized. At the same time, the evaluation of technologies [28], smart city governance, and planning the literature culminate in the important contribution to the quality of the smart city environment, not only in terms of the results, but also in the process of realizing such results. Smart cities may not use the most advanced technologies, and still, they may be capable of providing successful and better outcomes [29] in the shape of sustainability, economic growth, and better safety and of providing a better process in the form of better decision-making, the implementation of policies, and the depletion of the number of conflicts. Institutional innovation is expected to be dynamic for realizing flexible smart city governance to stakeholders' satisfaction [30,31]. In this study, institutional innovation refers to deliberate variations in joint choice institutions that allow smart cities to be more effective and perform better to enhance stakeholders' satisfaction. Scholars have begun exploring innovation in different domains extensively in current years, both within and on larger scales [32–34]. Nonetheless, a substantial focus must be analyzing the institutions that construct and change because of such innovative actions. An institutional approach furnishes significant new understandings of how smart city governance systems may or may not change cities' level of satisfaction.

The existing body of literature has demonstrated a positive correlation between e-governance in smart cities and the satisfaction of stakeholders [35–38]. However, investigating the influence of e-governance in smart cities is challenging due to the contextual nature of the relationship between smart city governance arrangements and stakeholders' satisfaction. Although previous studies in the literature displayed the influence of e-governance on citizen satisfaction [39], innovation and e-governance on smart city performance [40], rural population satisfaction on the service quality of common service centers of e-governance [41], e-governance as a mediating variable, stakeholders' involvement as a moderating variable between AI applications and cybersecurity [42], e-government services on village-level entrepreneur satisfaction [43], and stakeholder participation in e-governance projects implemented in public sector institutions [44], innovation has widely been neglected, especially between the relationship of e-governance and the satisfaction of

stakeholders who use online government services. This study constructed the subsequent research questions to address the existing gap in the literature:

- How does e-governance in smart cities influence stakeholders' satisfaction?
- How does institutional innovation by city government influence stakeholders' satisfaction?
- How does technological innovation by the city government influence stakeholders' satisfaction?
- Do institutional innovation and technological innovation play a moderating role in the relationship between e-governance in smart cities and stakeholders' satisfaction?

This study aims to empirically resolve the main research questions, assuming that the examined interactions are contingent upon the context. We analyzed these interactions empirically, employing sample data of 589 participants from the Republic of Korea and Pakistan and applying a multiple regression analysis in SPSS 21.0. This study contributed to the existing knowledge base of e-governance by directly examining the influence of e-governance in smart cities on stakeholders' satisfaction and the moderating role of technological and institutional innovation in this relationship.

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, and institutional and technological innovation. Section 3 explains the research methodology, data used for estimation, research model, and analysis. Section 4 presents statistical results, and Section 5 describes the discussion, conclusion, and future research.

2. Literature Review and Hypotheses Development

2.1. E-Governance in Smart Cities

E-governance, as defined by Dawes (2008, p. 36) [45], "E-governance comprises the use of information and communication technologies (ICTs) to support public services, government administration, democratic processes, and relationships among citizens, civil society, the private sector, and the state." E-governance in smart cities defines a model of governance that attempts to maximize the application of ICT and strengthen the quality of public services provided to citizens. This approach also endeavors to stimulate citizen engagement in decision-making processes and developing policies. This initiative may enhance governance and facilitate the government's digital transformation [46]. The concept of a smart city in Korea advocates for an integrative approach to urban development at the local level. Smart cities are becoming prominent globally, increasing at a rapid pace.

Consequently, providing suitable convenience services for urban residents has become challenging [13]. In the specific context of Korea, the significance and rationality of self-governance are highly pronounced. While e-governance promotes a concept focused on providing services to the people, the development of smart cities at the local level also prioritizes the needs and interests of the people [47]. E-governance improves the government's ability to deliver services to citizens, collaborate with organizations, and facilitate communication promptly and transparently. The primary goal of e-governance is to simplify and streamline administrative procedures. Some of the advantages of e-governance include an eventual decline in corruption due to the digital recording of transactions in the Republic of Korea [48], an improvement in communication obstacles, an improvement in the quality of governance [49], a decrease in overall costs, and increased citizen engagement in governing systems [42]. Similarly, India has successfully implemented e-governance practices to facilitate efficient local and national elections using electronic voting machines, which not only enhance the overall process, but also offer benefits, such as time and cost savings alongside mitigating the risk of vote tampering [50].

A smart city is an urban region that uses various technologies, sensors, and digital media to collect particular data methodically. Smart cities maximize the use of systems by applying AI, ICT, and IoT. Like e-governance, smart cities also offer several advantages: the ability to save time for citizens, a diminished environmental impact, the enhanced efficiency of transportation systems, and the provision of remote security using surveillance

cameras [6]. The existing studies on smart city governance emphasize two fundamental characteristics. The first important component focuses attention on the engagement of several stakeholders [20]. The consensus-building procedure has great significance in smart city governance for achieving an understanding among various stakeholders [51]. Interaction between stakeholders may encourage innovative and persistent urban growth [4]. Citizen involvement and community-driven decision-making have been emphasized in particular [22]. Vital citizen engagement in policy formulation can assist in determining citizens' needs and facilitate the development of better services to foster improved living standards. A smart city can encourage citizen engagement through a communication framework based on ICT.

The second key component involves using ICT in governance, facilitating active engagement, collaborative efforts, and transparent decision-making [23]. Smart cities implement ICT to stimulate economic growth, create avenues for transformative change, and promote inclusiveness [47]. Smart city governance is a concept that has emerged from the broader field of e-governance. Its primary objective is to enhance the performance of public administration, promote community-centric approaches, and facilitate effective networking between public agencies and other stakeholders [24]. The strategy described facilitates information sharing, resulting in a streamlined process that enhances service delivery to citizens, optimizes execution, and encourages accurate and inclusive decision-making [52]. The use of digital interactive tools has been discovered to motivate citizen engagement in the decision-making process [19], thus serving to enhance equality [53] and inclusiveness [54].

E-governance in smart cities stresses developing cooperation and building agreement among stakeholders, bolstered by modern digital technologies [20,23]. To use modern digital technologies, installing ICT systems is essential, which implies the development of extensive urban infrastructure. Hence, political backing and dedication are crucial components in the effective development of smart cities [55,56]. The government supposes an important place in the development of smart cities by providing a vision, strategies, and a welcoming atmosphere for stakeholder engagement and cooperation [3]. Thus, several smart city initiatives adopt a top-down process, which opposes the principles of smart city governance. For instance, multinational ICT vendors undertake smart city initiatives, such as Songdo, to integrate ICT infrastructure in urban environments to offer a comprehensive urban management solution. Nonetheless, the city faced criticism because of its market-driven approach and perceived oversight of routine urban life through surveillance [57,58].

2.2. Innovation in Smart Cities

Smart cities have emerged as catalysts for innovation, creating development in processes, products, and services. The key technical obstruction for smart cities is to build up an adequate infrastructure that facilitates an optimal environment for information exchange, cooperation, and connectivity among citizens throughout the city [33]. Nam and Pardo (2011: pp. 286–287) [3] emphasize that mobile, remote, and prevalent technologies are not only critical features of smart cities but that *"Those technologies offer benefits to city dwellers in mobile lifestyle. Smart city applications evolve from smart places to networked inhabitants. While the wireless infrastructure is a key element of digital city infrastructure, it is only a first step. A set of technological requisites for a smart city comprises network equipment (fiber optic channels and Wi-Fi networks), public access points (wireless hotspots, kiosks), and service-oriented information systems. Ubiquitous/pervasive computing infrastructure is a key technological component in building a digital city".*

Innovation can be conceptualized as a collection of innovative strategies executed in smart cities to optimize these environments. According to Glaeser (2011, p. 98) [59], the term "self-protecting innovations" refers to the ability of municipalities to develop internal strategies for managing various challenges, such as security, air pollution, traffic congestion, poverty, and other related issues. This notion can be referred to as a unique version of

collaborative innovation [60,61], public innovation [62], or social innovation [63,64] with an emphasis on confronting urban challenges and finding urban solutions.

Institutional Innovation: The proliferation of the "smart city" concept, which envisions the "city of tomorrow", has ignited a significant discussion on innovation. This discussion includes both technological innovation and social and institutional innovation. This integration is considered a crucial element in the redevelopment of smart cities. The concept of institutional innovation introduces an innovative perspective on defining a city's intelligence. In this context, the technological resources, networks, and intangible systems comprising cloud computing and electronic devices should be seen as tools whose value originates from their contribution to realizing smart, sustainable, and inclusive city objectives [10]. From this viewpoint, a smart city is fundamentally interlinked with institutional innovation. The existing body of literature on "institutional innovation" includes various definitions, highlighting the difficulties of defining the analytical parameters of a phenomenon that primarily manifests itself through practical applications [61].

Institutions refer to the constructed frameworks, norms, and rules that facilitate and restrict people's actions in society, thus creating predictability and significance in social interactions [65,66]. In adherence to Hurwicz's (2007) [67] framework, an analogy is made between institutional players or organisms and institutional structures, with the term "institution" referring in particular to the latter. The difference is advantageous for understanding the institutional and legal foundations of organizations. The ability of an organization to assume the role of an individual with clearly given rights and responsibilities depends on the existence of an institutional framework.

Our main emphasis is examining institutional innovation's impact instead of focusing on institutional theory. This study defines institutional innovation as "creating a new and more effective system to encourage people's behavior and the realization of socially sustainable development and innovation under the existing production and living environment" [68]. Institutional innovation has major significance for democratic societies and must be duly acknowledged. The existing body of literature discusses the concept of institutional innovation in the government sector and gives examples from the Seoul Metropolitan Government as case studies. In their research, O'Byrne et al., (2014) evaluated models of institutional innovation in the Seoul Metropolitan Government. The authors described that the government's collaborative techniques with civil society organizations and private sector institutions can enhance institutional innovation by strengthening creativity, leadership, and sustainability [69]. They concluded the positive impacts of institutional innovation on the governance system, citizens, and networks associated with the Seoul Metropolitan Government. Using innovation as a governance instrument in Seoul resulted in stronger competitiveness for the city, leading to its position as the seventh-largest trading nation to the United States and its position as the 15th biggest economy globally.

Technological Innovation: According to Hollands (2015), the use of technology for improving smart city governance is primarily an effort to build a modern depiction of the smart city, largely influenced by modernistic beliefs [70]. This approach has yet to emphasize the priorities of the local community. Bellini et al. (2022) [71] argued that the widespread adoption of technologies shows a natural bias towards growing cities, as the technologies used for promoting urban growth lack appropriate urbanization processes. If a solution to this challenge remains elusive, the technology can experience a transformation and become "censored", thereby exerting control and control over urban stakeholders. Meijer and Bolívar (2016) [15] suggest a strong scientific understanding of the interaction between technological innovation in smart cities and governance mechanisms to combat this challenge. Janowski (2015) [72] contended that the use of technology in cities needs to be approached with careful consideration of regional characteristics and specific environments. It is because the success of technology is conditioned upon its context in a given environment. Hence, the functionality to enhance smart city governance adheres closely to the real needs of various stakeholders in the city and its current governance strategies. This perspective assists in a shift in our perceptions from a specific focus on

technology-driven methods to a greater comprehension of technological innovation as a socio-technical process. The definition of technological innovation proposed by Mario Coccia (2021) [73] was adopted in this study. According to Coccia, technological innovation refers to "a complex system composed of more than one entity or subsystem of technologies and a relationship that holds between each entity and at least one other entity in the system for achieving specific goals".

This paper analyses the link between technological innovation and social perspectives, particularly emphasizing the interrelated emergence of technology and social conditions in smart city contexts. The aim is to understand how these factors mutually influence each other to ensure the stakeholders' satisfaction. The governance in smart cities entails the adoption and use of cutting-edge technologies and also "changes in routines, collaborations, and roles of actors" in the smart cities' governance [74]. This view states that the understanding of technology goes beyond its objective nature, contrary to common belief. However, it is highly connected with its social environment and shaped by a social contract. The factors influencing the adoption or denial of a technology may be closely linked to the social context. It is essential to examine the guidelines used to determine the superiority of technology and the various actors, including citizens, groups, and stakeholders, who participate in granting significance to technological developments. Therefore, there is a critical need to establish a link between the importance and substance of technology and its broader social setting. It is crucial because the social context clarifies the basis for the technological goals, impacts the layout and development of technical abilities, and examines the efficacy or failure of innovative technological adoption [75].

2.3. E-Governance and Stakeholders' Satisfaction

E-governance refers to a transformative system that city governments adopt to use artificial intelligence (AI), information and communication technology (ICT), and the Internet of Things (IoT) to establish interconnectedness among public entities and the private sector. To optimize e-government services and enhance security measures for the general public and other relevant parties, various governments have tried to adopt e-governance strategies [42]. However, according to a 2014 UN e-government survey [76], most citizens express concerns regarding their privacy and security when using e-government services. The academic literature about public management has been engaged in the ongoing endeavor of understanding the methods employed to assess the effectiveness of e-governance within smart cities. Certain academics posit that the evaluation of governance can be determined by its impact on various aspects, such as the environment, people, economy, mobility, and the overall quality of life experienced by the populace [77]. Other researchers have different opinions, and they claim that the main characteristics of governance are the various goals and objectives of participating actors. Different city stakeholders may like a project from the local government according to their demands that 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 want an environment that will flourish their business activities to attract tenants while security agencies may highlight crime reduction [14]. For citizens, as 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 to access basic human growth indicators, including security, healthcare, education, social justice, and civic engagement [78].

As per previous research, diversity in objectives means that the success of e-governance can only be analyzed in terms of stakeholders' participation and satisfaction [79]. Uncertainty emerges when stakeholders are challenged with societal problems in their area and have yet to learn the impacts of their efforts to solve them. For example, Lee and Porumbescu concluded in a study from South Korea that individuals who were regarded as elderly or possessed a disability display notably lowered levels of e-government use when

compared to the general populace [54]. Hence, the governments launched information and communication technology training programs for all stakeholders, with a particular focus on vulnerable stakeholders, such as elders and individuals with disabilities, and drew standardized content to educate citizens on computer literacy, enabling them to use the Internet and online services [80] effectively. Likewise, the city government involved stakeholders in decision-making and implementing its policies, including citizens, business associations, institutions, and other target groups. 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, such as awarding or gaining contracts, subsidies, and covenants as preferred between government and stakeholders [81,82]. It means that the priority of the city government is to refrain from dictating but to provide smart services without creating hassles to satisfy its stakeholders. For stakeholders, communication with the government is only one aspect 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 e-governance. It is principally important that the process of engagement and involvement of key stakeholders in decision- and policy-making must be fair and transparent [20].

Prior scholars claimed that special attention must be devoted to a stakeholder's general interests (property interest, business interest, political interest, public interest, and state interest) for their satisfaction in smart city and urban governance; not doing so may have social, political, and institutional implications [51]. Stakeholder theory [83] is the most valuable and influential theory supporting the business' and stakeholders' relationship. In this case of stakeholders' satisfaction, 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 their considerations enhance the satisfaction for their stakeholders. When the city government engages its stakeholders in policy and decision-making [63,84], enabling them to approach the necessities of life and collaborate with them to create and utilize ICT-based strategies to host e-government [23], stakeholders' satisfaction will be enhanced positively. Hence, we hypothesize:

Hypothesis 1. *Higher e-governance in smart cities enhances the stakeholders' satisfaction.*

2.4. 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 [85,86]; understanding the institutional and legal bases of organizations has benefits in the distinction between institutional actors and arrangements. Within the confines of an institutional arrangement, an organization can only function as an individual entity with specific rights and responsibilities [32]. An institutional arrangement can be extremely simple or extremely complex. While institutionalists generally define institutions as controlling action in organizational fields [87], 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 implementing dynamic governance systems while keeping stakeholders in mind and avoiding security breaches [55]. 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 [88]. It includes strategies such as policy innovation [89], urban experimentation [90], urban security [91], and urban laboratory cities [92], which involve a diverse range of stakeholders, such as government, business,

and civil society. Institutional innovation, in the wider context, is a political endeavor. Ignoring or neglecting the dynamics of authority and control is a typical critique against stakeholder engagement approaches [93]. To strengthen institutional innovation and adaptation procedures in cities, we must fundamentally redefine the concept of stakeholders' satisfaction through their engagement. Self-reflection, ambiguity negotiation, constructive development, and strategic engagement are all required for institutional innovation [94].

E-governance is rapidly being positioned at the core of the ambition of developing the smart city as a holistic idea [14], and scholars emphasize the relationship between smart governance and the need for integrated methods, such as stakeholders [95]. Stakeholder engagement in decision-making is critical for smart governance and is a prerequisite to becoming a smart city [20]. City governors prefer to engage stakeholders in decision-making to deliver upgraded smart services using ICT that increase their satisfaction [95]. Hence, we developed our hypotheses following the previous literature and theories:

Hypothesis 2. *Institutional innovation in the smart city enhances the stakeholders' satisfaction.*

Hypothesis 3. *Institutional innovation moderates and strengthens the relationship between e-governance in smart cities and stakeholders' satisfaction.*

2.5. Contextual Impact of Technological Innovation

Governance in smart cities is primarily responsible for managing information flows among stakeholders and collecting/accumulating/managing data collected through innovative technologies related to value-added processes in smart cities [96]. Moreover, generic enablers (factors that provide reclaimable key components for creating applications for prospective technologies) 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, warrantying, and certification through technological innovation implementation. It emphasizes the importance of such bodies in promoting accountability, transparency, connectivity, and involvement among all stakeholders involved in their satisfaction [17]. E-governance in smart cities 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 [97].

Innovative technologies serve many purposes, and those used in the field of aging in place [98], technology applications in the care of community-living older adults with dementia [99], usage of electronic means to interact with stakeholders by firms [100], and implementation of easy-to-use technologies for stakeholders for better health at a reduced cost [101] contribute to the satisfaction of stakeholders involved in technology utilization. The viewpoint of [102] has influenced our general description of a smart city. It will be parallel to the depiction of e-governance in a smart city, which enhances the effectiveness of mechanisms in the field of health, education, disaster management, e-services, and safety through the convergence of innovative technology and global ecosystems to allow its stakeholders to live in a healthy environment and to provide simple access to better services [103]. Though some prior literature concedes that urban development poses challenges for traditional governance approaches to provide services to stakeholders and that these are crucial issues for contemporaneously embedded urban development [104], this needs to be discussed.

The e-governance concept is one approach that aims to consolidate issues of stakeholders' engagement with smart city developments [102,105]. While originally envisioned as a framework for e-service provision, it rapidly expanded to encompass all city components, including safety, health, and education. The concept intends to consolidate urban growth with the need for electronic services with ICT applications and by utilizing a variety of other innovative technological functions and optimizing the distribution of security resources [103]. Moreover, a smart city is defined as the integration of innovative technology

and the natural environment that improves the efficiency of dealing with the utilities and enables the accessibility of a peaceful ecosystem for stakeholders [102]. They include issues such as stakeholder satisfaction and whether technological innovation has benefited those subjected to the intervention and those not. It is critical because stakeholders are at the heart of any urban safety intervention and vital to providing better services through ICT [105]. Measuring stakeholders' perceptions of urban security is an important aspect of e-governance in smart cities because it ensures that cities not only react to the demands of inhabitants and potential security risks, but also persist as an appealing place to live for stakeholders [17]. Hence, the following hypotheses are developed following the previous literature:

Hypothesis 4. *Technological innovation in smart cities enhances the stakeholders' satisfaction.*

Hypothesis 5. *Technological innovation moderates and strengthens the relationship between e-governance and stakeholders' satisfaction.*

Figure 1 demonstrates our conceptual framework where e-governance in smart cities depicts independence, dependence on stakeholders' satisfaction, and institutional and technological innovation as moderating variables. Our framework indicates a direct effect of e-governance, institutional innovation, and technological innovation on stakeholders' satisfaction. Still, with the insertion of institutional innovation and technological innovation in the third model, the direct linear relationship turned into a moderating relationship. Three basic techniques are used for statistical moderation analysis: (1) causal stages, (2) a coefficient difference, and (3) a coefficient product. The following statistical questions were developed to test our hypotheses:

$$SS = \beta_{10} + \beta_{11}Control + \in_1 \quad (1)$$

$$SS = \beta_{20} + \beta_{21}EG + \beta_{22}Control + \in_2 \quad (2)$$

$$SS = \beta_{30} + \beta_{31}EG + \beta_{32}II + \beta_{33}TI + \beta_{34}Control + \in_3 \quad (3)$$

$$SS = \beta_{40} + \beta_{41}EG + \beta_{42}II + \beta_{43}TI + \beta_{44}EGxSI + \beta_{45}EGxTI + \beta_{46}Control + \in_4 \quad (4)$$

where β_{10} and B_{11} are intercepts, SS (stakeholders' satisfaction) indicates the dependent variable; EG (E-Governance) describes the independent variable; II (institutional innovation) and TI (technological innovation) are the mediators; β_{31}, β_{32}, and β_{33} are the coefficients relating the independent variable and the dependent variable; β_{44} and β_{45} are the coefficients concerning the moderator to the dependent variable adjusted for the independent variable; and $\in_1$, $\in_2$, $\in_3$, and $\in_4$ represent error terms in variables. B_{11}, β_{22}, β_{34}, and β_{46} with control refer to control variables, such as gender, age, and education.

Table 1 provides a comprehensive overview of the variables used in this study, including their corresponding definitions, measurement items, and sources.

Table 1. Variables Definitions and Measurement.

Variable	Definition	Measurement	Source
E-Governance in Smart Cities (*Independent Variable*)	"E-governance comprises the use of information and communication technologies (ICTs) to support public services, government administration, democratic processes, and relationships among citizens, civil society, the private sector, and the state".	1. Online public service facilities provided by the city government are excellent. 2. My government interacts with citizens using digital media to provide news and information. 3. My government prioritizes increasing the number of mandatory online services for citizens. 4. City Government always involves the community in the policy-making process.	[45]
Institutional Innovation (*Moderating Variable*)	"Institutional change is a difference in form, quality, or state over time in an institution. Change in an institutional arrangement can be determined . . .. If the change is a novel or unprecedented departure from the past, it represents an institutional innovation".	1. Innovation made in government institutions are useful. 2. Innovation made in government institutions are legitimate. 3. Innovation made in government institutions are novel/new. 4. Innovation made in government institutions are acceptable to society.	[32]
Technological Innovation (*Moderating Variable*)	"Those technologies benefit city dwellers in mobile lifestyle. Smart city applications evolve from smart places to networked inhabitants. While the wireless infrastructure is a key element of digital city infrastructure . . .. build out of a digital city".	1. Innovation in technology from the city government have improved services 2. Innovation in technology have Improved working conditions on health and safety. 3. Innovation in technology from the city government have reduced environmental impacts. 4. Innovation in technology from the city government improved performance.	[3]
Stakeholders' Satisfaction (*Dependent Variable*)	Stakeholder satisfaction is the extent to which stakeholders believe their expectations regarding a particular product or service have been fulfilled.	1. I am confident and satisfied with using online public services. 2. I believe that the city government's information online is true and trustworthy. 3. My city government takes care of my interests. 4. I believe that the city government does the right thing for the public.	[21]

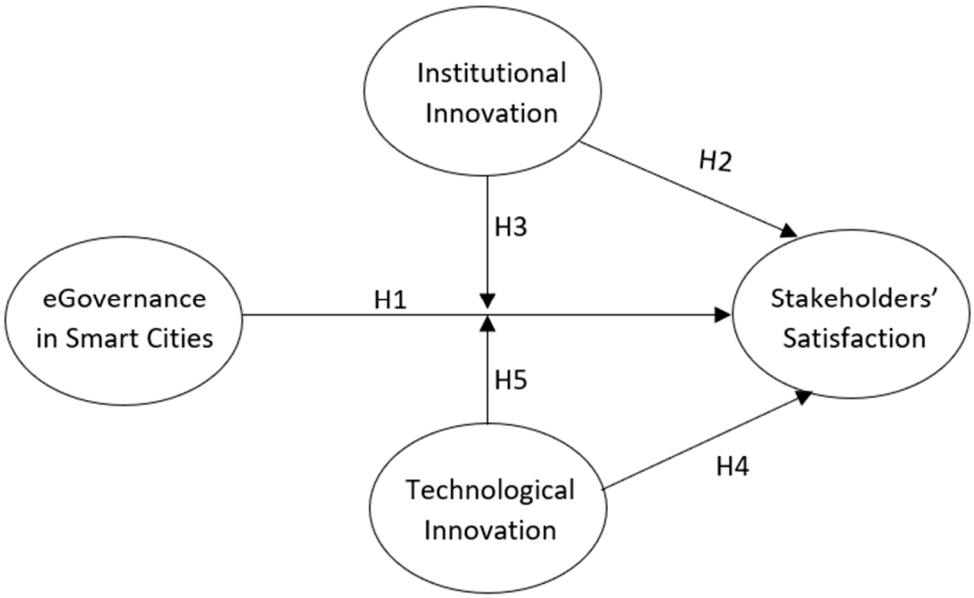

Figure 1. Conceptual Framework.

3. Research Methods

3.1. Participants and Procedure

The data were collected using convenience or purposive sampling techniques from participants working in the public and private sectors, business individuals, graduate students, and other stakeholders from the Republic of Korea and 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 [106]. 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 e-governance in smart cities, institutional innovation, technological innovation, stakeholders' satisfaction, and other demographics. Answers to the questionnaires collected were coded to ensure that the replies could be compared. Participants were guaranteed that their opinions and perceptions would remain anonymous and only be used for research. A total of 589 completed survey questionnaires were submitted, with an 85% validity rate, and they were utilized to analyze data statistically to satisfy the minimum sample size requirement for multiple regression modeling. Previous research has indicated that a larger sample size is necessary when addressing a smaller r-squared value and when a larger number of independent variables must be controlled for within the framework. Through the application of the software, a quantitative analysis determined that the minimum sample size necessary for testing a single independent variable alongside a maximum of ten controlled variables is below 100 [107]. Among the participants surveyed, it was found that 32.43% represented Korean males, 27.16% represented Pakistani males, 24.79% represented Korean females, and 15.62% represented females from Pakistan.

Additionally, it was observed that 46.69% of the participants were 18 to 35 years old, while 37.17% were aged between 36 and 50 years old. Furthermore, 15.12% of the participants were found to be between 51 and 65 years old, and a small proportion of 1.01% consisted of respondents who were over the age of 65. Finally, among the respondents, 12.22% possessed a high school certificate, 59.08% had completed university education, 27.34% held a master's degree, and 1.36% had attained a PhD degree. Table 2 provides a comprehensive breakdown of the demographic characteristics of the respondents.

Table 2. Demographic Profile of the Respondents.

Characteristics	Classifications	Frequency	Percentage
Countries			
	Republic of Korea	337	57.22
	Pakistan	252	42.78
Gender			
	Male (Republic of Korea)	191	32.43
	Male (Pakistan)	160	27.16
	Female (Republic of Korea)	146	24.79
	Female (Pakistan)	92	15.62
Age			
	18 to 35 years	275	46.69
	36 to 50 years	219	37.18
	51 to 65 years	89	15.12
	More than 65 years	6	1.01
Education			
	High School	72	12.22
	College/University	348	59.08
	Master's Degree	161	27.34
	Ph. D.	8	1.36

Several academics have focused on conducting comparative analyses between developed and developing countries on various issues. For instance, Wunder et al. [108] conducted a study comparing payments for environmental services while Pandya [109] explored the role of small- and medium-sized enterprises (SMEs) in economic development. In addition, Pandya [109] performed a comparative analysis to assess the influence of capital flows and the stock market on the economic progress of various nations. Subsequently, Joblin and Jamasb [110] executed a comparative analysis to investigate the effects of price volatility on the demand for oil in both developed and developing nations. Most prior research on the comparative analysis between advanced and emerging countries relied on available real-time data [111]. The rationale for selecting South Korea and Pakistan as the focus of our study stems from a scarcity of prior studies that have simultaneously examined the public's perception of the effect of artificial intelligence (AI) on decision-making in both developed and developing nations [63]. South Korea is located in East Asia on the southern portion of the Korean Peninsula, sharing borders with North Korea, and Pakistan is situated in South Asia, sharing its borders with India, Iran, Afghanistan, and China. The main justification for selecting two countries as the topic of our study originates from the opposing contexts they furnish. As a developed country, South Korea exhibits a significant presence of public managers who successfully implemented AI-based public service delivery. Conversely, Pakistan, a developing country, demonstrates an insufficient or inadequate implementation of online services. Therefore, the present study examined the general public's perception in the aforementioned countries.

3.2. Variable Measurement

Table 3 displays the components used to evaluate the variables in this study. The independent variable, e-governance, was measured by four items adapted from Potnis [112]. Furthermore, the dependent variable, stakeholders' satisfaction (four items), was adapted from Deng [51]; the moderating variable, technological innovation (four items), was adapted [113]; and institutional innovation (four items) was adapted from Eakin et al. [55].

Table 3. Measurement Items Used for Data Collection.

Variables	Items
E-governance in Smart City	Online services provided by the city government are excellent Governments' online interaction for news and information Governments' mandatory online services for citizens Government's involvement of the community in policy-making
Institutional Innovation	Innovation made in government institutions is useful Innovation made in government institutions is legitimate Innovation made in government institutions is novel/new Innovations made in Government institutions are acceptable to society
Technological Innovation	Innovation in technology from the city government has improved services Innovation in technology from the city government has improved working conditions on health and safety Innovation in technology has reduced environmental impacts Innovation in technology from the city government improved performance
Stakeholders' Satisfaction	I have full confidence in the city government My city government takes care of my interests I believe that the city government provides information that is true and trustworthy I believe that the city government does the right thing for the public

E-governance: We employed an adapted version of a four-item scale developed by Dawes [45] to assess the concept of e-governance. A five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was adopted to evaluate this construct. The items included in the scale encompassed various aspects, such as the excellence of online public service facilities, the government's interactions with citizens using digital media to provide news and information, the government's priority to increase the number of mandatory online services for citizens, and community involvement in decision/policy making by the government. The Cronbach's alpha coefficient for this particular construct was determined to be 0.890. Cronbach's alpha is widely recognized as a measure of internal consistency, which assesses the extent to which a set of items within a cluster are strongly interrelated.

Institutional Innovation: The construct of institutional innovation was adapted using a four-item scale developed by Hargrave and Van de Ven [32]. The items included in the scale contained various attributes, such as the usefulness of innovation in government institutions, legitimacy of innovation in government institutions, novelty of innovation in government institutions, and acceptability of innovation in government institutions. The Cronbach's alpha coefficient for this particular construct was determined to be 0.912, which measured the extent to which a set of items within a cluster are strongly interrelated.

Technological Innovation: We evaluated technological innovation through an adapted four-item scale (Nam and Pardo, [3]). The items included in the scale had several elements, such as innovation in technology from the city government that improved services, innovation in technology from the city government that improved working conditions on health and safety, innovation in technology from the city government that reduced environmental impacts, and innovation in technology from the city government that improved performance. The Cronbach's alpha coefficient for this particular construct was determined to be 0.892.

Stakeholders' Satisfaction: We used a four-item scale adapted from Robertson and Choi [21] to measure stakeholders' satisfaction. The items included in the scale were confidence and satisfaction in using online public services, confidence in the provision of online news and information by the city government, the city government, the city government taking care of stakeholders' interests, the city government providing true and

trustworthy information, and the city government doing the right things for the public. The Cronbach's alpha coefficient for this particular construct was determined to be 0.918.

Control Variables: This study incorporated gender, age, and education as control variables. The existing literature presents multiple perspectives on the impact of gender, age, and education on the usage of technology applications and the perception of user satisfaction [114,115]. The key variables were controlled throughout the testing process.

3.3. Data Analysis

SPSS 21.0 software was utilized to investigate the sample for this study, 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 [116]. Additionally, owing to various new advancements, such as confirmatory analysis, nonlinear impacts, and mediating and moderating influences, multiple regression is recognized as one of the greatest novel alternatives to prior standard analytic methods [117]. Though various 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 [63,118].

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 was utilized to choose items from the variables. The component with the highest modification index value was eliminated first, followed by the next component until the required goodness of fit 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 [119]. 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 depicts our research framework, representing smart city governance as independent, smart city governance as dependent on stakeholder satisfaction, and institutional and technical innovation as moderating variables. Our empirical figure illustrates that smart city governance directly influences stakeholder satisfaction. Still, when institutional and technical innovation were included in the model, the direct linear correlation became a moderating relationship. As per our conceptual framework, institutional and technological innovation moderated the relationship between e-governance in smart cities, strengthening the relationship between exogenous and endogenous variables.

4. Results

Table 4 describes the outcomes of Kaiser–Meyer–Olkin (KMO) for all five variables (SGC as the independent, institutional innovation and technological innovation as the moderating, and stakeholders' satisfaction as the dependent variable) is 0.761, which is greater than 0.001, suggesting that the data sample size utilized for this study was adequate. Further, the Chi-square result is 902.463 with a significance level 0.000, which is satisfactory again.

Table 4. Bartlett Sphericity Test and KMO of Self-Rating Items.

Factors	Number of Items	Component	N	KMO	Chi-Square	Sig.
E-governance in Smart City	4	0.960	589	0.761	902.463	0.000
Stakeholders' Satisfaction	4	0.821	589			
Institutional Innovation	4	0.807	589			
Technological Innovation	4	0.877	589			

Table 5 explains the reliability and validity analysis. The impact of smart city governance, stakeholders' satisfaction, institutional innovation, and technological innovation were determined using a reliability analysis for 16 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 items were assigned to institutional innovation, and four components were assigned to technological innovation. The overall Cronbach's alpha of 16 items with a sample size of 589 was 0.934, indicating that the questions used to test all five components were reliable for this study. Furthermore, the factor loadings for most components 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 [120].

Table 5. Reliability and Validity test.

Variable	Items	FL.	α	CR	AVE.	KMO
E-governance in Smart City	Online services provided by the city government are excellent	0.934	0.890	0.913	0.621	0.737
	Governments' online interaction for news and information	0.926				
	Governments' mandatory online services for citizens	0.835				
	Government's involvement of the community in policy-making	0.939				
Institutional Innovation	Innovation made in government institutions is useful	0.929	0.912	0.906	0.648	0.727
	Innovation made in government institutions is legitimate	0.918				
	Innovation made in government institutions is novel/new	0.829				
	Innovations made in Government institutions are acceptable to society	0.930				
Technological Innovation	Innovation in technology from the city government has improved services	0.928	0.892	0.934	0.713	0.778
	Innovation in technology from the city government has improved working conditions for health and safety	0.829				
	Innovation in technology has reduced environmental impacts	0.919				
	Innovation in technology from the city government improved performance	0.931				
Stakeholders' Satisfaction	I have full confidence in the city government	0.928	0.918	0.921	0.672	0.727
	My city government takes care of my interests	0.929				
	I believe that the city government provides information that is true and trustworthy	0.825				
	I believe that the city government does the right thing for the public	0.927				

Note: FL = Factor Loadings; α = Cronbach's Alpha; CR = Composite Reliability; AVE. = Average Variance Extracted.

The descriptive statistics, internal consistency reliability, and correlations among variables are shown in Table 6. 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, $p < 0.01$), and technological innovation (r = 0.559, $p < 0.01$). A multiple regression analysis was conducted to evaluate our moderated model, following the instructions stated by [121].

To test proposed moderating Hypotheses 3 and 5, we estimated a moderation model (Model 4) that included the moderation effect of institutional and technological innovation on the relationship between smart city governance and its impact on stakeholder satisfaction. Table 7 shows unstandardized empirical results for Model 4. In Table 7, 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 technological innovation (b = 0.710, $p < 0.01$), indicating that Hypotheses 3 and 5 are supported significantly.

Table 6. Mean, Standard Deviations, and Correlations.

Variables	Mean	SD	N	EGSC	InstI	TI	SS	Gen	Age
EGSC	2.887	0.937	589	1					
InstI	3.499	0.922	589	0.642 **	1				
TI	3.812	0.829	589	0.559 **	0.808 **	1			
SS	3.278	1.242	589	0.801 **	0.574 **	0.687 **	1		
Gen	0.650	0.478	589	0.060	0.116	0.168 *	0.137 *	1	
Age	1.472	0.500	589	0.057	0.047	0.003	−0.025	−0.071	1
Edu	1.322	0.469	589	0.094	0.006	−0.100	0.003	−0185 **	0.369 **

Note: EGSC = E-governance in Smart Cities; InstI = Institutional Innovation; TI = Technological Innovation; SS = Stakeholders' Satisfaction; Gen = Gender; Edu = Education. * $p < 0.1$, ** $p < 0.05$.

Table 7. Effect of Smart City Governance on Stakeholders' Satisfaction.

Variables	Dependent Variable: Stakeholders' Satisfaction			
	Model 1	Model 2	Model 3	Model 4
(Constant)	3.007 *** (0.348)	3.664 ** (0.246)	0.969 *** (0.261)	3.563 *** (0.881)
Gender	0.370 ** (0.181)	0.202 * (0.108)	0.104 (0.091)	0.154 * (0.086)
Age	−0.074 (0.182)	−0.126 (0.109)	−0.141 (0.091)	−0.161 * (0.086)
Education	0.106 * (0.198)	−0.106 (0.118)	0.060 (0.101)	0.083 (0.094)
E-governance		1.064 *** (0.054)	0.924 *** (0.060)	0.260 ** (0.317)
Institutional Innovation			0.437 *** (0.085)	1.092 ** (0.498)
Technological Innovation			0.831 *** (0.089)	2.825 ** 0.648)
Interaction Effect:				
E-governance x Institutional Innovation				0.521 *** (0.174)
E-governance x Technological Innovation				0.710 *** (0.210)
R	0.143	0.809	0.872	0.891
R^2	0.020	0.655	0.760	0.795
Adjusted R^2	0.006	0.648	0.753	0.787
Standard Error	1.238	0.737	0.617	0.574
F Model	1.456	9.003	10.425	9.180
Durbin-Watson	2.165	2.215	1.921	2.219

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5. Discussion

The literature on stakeholder theory and innovation is progressing. This study provides a pertinent and up-to-date contribution to the established theoretical framework [3,15,65,69,80] and the empirical literature [23,60,81,92]. This study provides empirical evidence supporting the significance of e-governance in smart cities in determining stakeholders' satisfaction [35,38]. Additionally, it establishes the relationship between e-governance and innovation, specifically institutional innovation [30] and technological innovation [67]. The findings of this study further validate the impact of both institutional innovation and technological innovation on the level of satisfaction experienced by stakeholders [17,92,102]. The study confirms that e-governance in smart cities positively favors the development of satisfaction. Similarly, this study validates the idea that institutional and technological innovation positively influence stakeholders' satisfaction. The findings stated in this study correspond with the outcomes established by previous research [34,35,38,65,67,81].

Continuous learning about institutional and technological innovation must be taken seriously considering the fast-paced technological changes 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 and the Republic of Korea, the main objective of this study was to explore how e-governance in smart cities affects stakeholder satisfaction through the moderating role of institutional and technological innovation. The findings of this study revealed that the association between e-governance in smart cities and stakeholder satis-

faction is strengthened by implementing institutional and technological innovation. That means that residents in smart cities use various innovative technologies to communicate with the government, and they receive numerous services at their doorsteps rather than visiting different governmental offices and waiting in long queues.

Previous research in the smart city literature has found that smart city governance positively impacts stakeholder satisfaction [35]. This study extends the literature by demonstrating the positive and significant impact of e-governance in smart cities on four key dimensions of stakeholder satisfaction, notably true information of personal interest and confidence in doing the right thing. These findings imply that smart city governance and integrating traditional and prospective innovation through technology enhances stakeholder satisfaction. It is a survey-based quantitative study that evaluated the effect of institutional and technological innovation on the relationship between e-governance in smart cities and stakeholder satisfaction. A theoretically derived research model was validated using a deductive approach. The data were collected using survey questions with 589 respondents from Pakistan and Korea's public and private sectors. The impact of smart city governance on stakeholder satisfaction and the moderating effect of institutional and technological innovation on this relationship was investigated.

Now that the research questions have been highlighted, they can be addressed. Table 7 demonstrates an interesting variety of outcomes. The study's findings suggest a clear positive correlation between e-governance, institutional innovation, technological innovation, and stakeholder satisfaction. According to the results presented in Table 7, no significant correlation is observed between multiple discrete e-governance features and various outcome parameters. Additionally, not only is e-governance an element influencing stakeholders' satisfaction, but other elements, including institutional and technological innovation, may also significantly affect stakeholders. When a city's administration involves its stakeholders in formulating policies and decision-making processes, facilitating them to address essential needs and fostering collaboration in developing and using ICT for online government services, it culminates in improving stakeholders' satisfaction levels. The outcome in Model 2 in Table 7 ($\beta = 1.064$, SE = 0.054 $p > 0.01$) substantially complements our projected H1. These findings are consistent with previous studies [35,38].

Similarly, The implementation of dynamic governance systems with due consideration for stakeholders and the prevention of security breaches necessitates the existence of institutional innovation. In Hypothesis 2, it was predicted that city governors' implementation of institutional innovation in smart cities positively impacts stakeholders' satisfaction. The findings obtained from Model 2 in Table 7 demonstrate that institutional innovation strongly influences stakeholders' satisfaction ($\beta = 0.437$, SE = 0.085, $p > 0.01$), which significantly supports our proposed H2. These outcomes follow previous research findings [17,30]. Likewise, innovative technologies have numerous kinds of applications, particularly in the city government implementing user-friendly technologies for stakeholders, resulting in better health at a lower cost, which contributes to the overall satisfaction of stakeholders involved in using such technologies. Hypothesis 4 contends that there is a relationship between the use of technological innovation in smart cities and the enhancement of stakeholder satisfaction. Specifically, the integration and implementation of technological innovation in smart cities results in an improvement in stakeholder satisfaction. The findings obtained from Model 3 in Table 7 depicted that stakeholders' satisfaction is significantly affected by technological innovation ($\beta = 0.831$, SE = 0.089, $p > 0.01$) as anticipated; thus, Hypothesis 4 is supported substantially. The findings of Hypothesis 4 were aligned with prior research [67,92].

The study examined the impact of two moderating components, institutional innovation and technological innovation, on the relationship between e-governance in smart cities and stakeholders' satisfaction. Hypotheses 3 and 5 were fted to investigate the moderating effects of institutional innovation and technological innovation, respectively. It was performed because institutional and technological innovation directly affect stakeholders' satisfaction. Hypothesis 3 proposes that the existence of institutional innovation

acts as a moderator, enhancing the association between e-governance and stakeholders' satisfaction. Similarly, Hypothesis 5 was developed to state that the emergence of technological innovation moderates the relationship between e-governance and stakeholders' satisfaction, strengthening this relationship. The findings revealed that institutional innovation ($\beta = 0.521$, SE = 0.174, $p > 0.01$) and technological innovation ($\beta = 0.710$, SE = 0.210, $p > 0.01$) have strengthened the relationship between e-governance in smart cities and stakeholder satisfaction. Thus, Hypotheses 3 and 5 are significantly supported, as predicted. Additionally, the practical and theoretical implications are summarized below for better understanding.

5.1. Practical Implications

Considering smart city governance is among the most critical factors of national strategy in developing countries, the outcomes from this study are anticipated to create a protocol for policymakers in developing efficient and productive approaches to enhance e-governance performance in smart cities. It will identify the areas whereby the administration should emphasize innovation tools, which will contribute to greater stakeholder satisfaction [122], resolve the shortage of infrastructures, and enhance the quality-of-service outcomes in the context of public service rendered to stakeholders [123]. It further advances the e-government paradigm by investigating and expanding it in the context of public services in the Republic of Korea and Pakistan, especially to improve performance by adopting e-services for stakeholders.

5.2. Theoretical Implications

This study makes an important contribution to theoretical modeling by revising the innovation diffusion and stakeholder models' proven best theories about a specific application domain that may provide new perspectives into the theory. The study's findings may be utilized as a framework for policymakers to encourage the allocation of innovation that facilitated the prominent function of unity and the potential of technological innovation to overcome several challenges that countries face, such as cybersecurity, and thereby promote and motivate the implementation of the country's national strategy.

5.3. Limitations

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 convenience or purposive sampling techniques 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 need to reconstruct them at different times to identify possible changes in stakeholders' satisfaction with implementing institutional and technological innovation in smart cities. We can examine the impact of various critical indicators more dynamically. Another limitation is that our study was conducted in the Republic of Korea and 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 study. Lastly, we could have investigated the interaction of other predictors, such as service quality [97], for stakeholders' satisfaction and income equality [35] for crime rate with institutional and technological innovation and how it may circumstance the social relationship that inhabitants may establish with their smart cities.

6. Conclusions

This study presents significant empirical findings that establish an association between e-governance in smart cities and the intensity of satisfaction among stakeholders. The results of the study revealed a substantial relationship between e-governance and stakeholders' satisfaction, presumably because the proactive approach of the city government in engaging stakeholders in policy formulation and decision-making processes

empowers them to address their essential needs and collaborate with the government in the development and use of ICT-based services, which enhances stakeholders' satisfaction. By adopting the stakeholder theory, it was further discovered that institutional and technological innovation positively impacted stakeholders' satisfaction. Consistent with the findings of de Vries et al. (2018) [35] and Wong et al. (2007) [36], this study further demonstrated a positive correlation between e-governance and stakeholders' satisfaction via its interaction with innovation. By augmenting institutional innovation, e-governance can strengthen stakeholders' satisfaction and instill confidence among city inhabitants in their local government, consistent with AlMalki and Durugbo (2023) [68]. Moreover, this study reveals a positive correlation between e-governance and technological innovation in predicting stakeholders' satisfaction, following the findings of Hollands (2015) [70]. It suggests that when institutions demonstrate robust innovation and embrace technological advancements, implementing e-governance can greatly impact the satisfaction levels of stakeholders. The findings indicate that institutional and technological innovation strengthens the relationship between e-governance and stakeholders' satisfaction.

Future Research Directions

This paper enables us to identify numerous future research directions. One research direction could be investigating how a smart city's better service delivery [97] affects residents' satisfaction. We could also broaden the investigation by obtaining the determinants of other types of innovation, such as social innovation [63], and investigating how such inclusion affects stakeholder satisfaction in smart cities.

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