



**How to cite this article:**

Jahanbakhsh, K. (2027). Digitalization of Urban and Rural Planning and Its Impact on Strategic Spatial Management and Territorial Governance. *Journal of Historical Research, Law and Policy*, 5(4), 1-21. <https://doi.org/10.61838/jhrp.336>



Article history:  
Original Research

**Dates:**

Submission Date: 15 April 2026

Revision Date: 04 July 2026

Acceptance Date: 12 July 2026

First Publication Date: 13 July 2026

Final Publication Date: 01 July 2027

# Digitalization of Urban and Rural Planning and Its Impact on Strategic Spatial Management and Territorial Governance

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## ABSTRACT

Digitalization, as one of the principal drivers of transformation in planning systems, has increasingly reshaped the structures, processes, and instruments of urban and rural planning. This article aims to elucidate the role and impacts of digitalization on spatial planning by examining how modern information and communication technologies, big data, geographic information systems, and smart platforms influence the enhancement of strategic spatial management and the strengthening of territorial governance. The research adopts a descriptive-analytical method and investigates the various dimensions of this transformation through documentary studies and conceptual analysis. The findings indicate that digitalization, while increasing accuracy, transparency, and efficiency in spatial decision-making, also enables broader stakeholder participation and improves coordination among different levels of governance. Furthermore, this process contributes to the reinforcement of future-oriented and data-driven approaches in strategic spatial management and provides the foundations for integrated and intelligent territorial governance. Nevertheless, challenges such as the digital divide, institutional issues, and infrastructural limitations may hinder the full utilization of existing capacities. Ultimately, the article emphasizes the necessity of redefining policy-making frameworks, developing digital infrastructures, and enhancing technological literacy in order to achieve intelligent spatial planning.

**Keywords:** *Digitalization, Urban and Rural Planning, Strategic Spatial Management, Territorial Governance, Smart Governance, Big Data, Geographic Information Systems.*

## Introduction

Technological transformations in recent decades, especially in the field of information and communication technologies, have been recognized as one of the most important driving forces in redefining the structures and functions of urban and rural planning systems. The expansion of digital technologies, including big data, the Internet of Things, artificial intelligence, and geographic information systems, has not only transformed analytical and decision-making tools but has also led to changes in dominant planning paradigms. Within this framework, spatial planning is moving from a traditional, static approach based on limited data toward a dynamic, data-driven, and future-oriented approach. This transformation has made it possible to understand spatial complexities, forecast development trends, and manage resources optimally across different scales, while also paving the way for the emergence of new models such as smart cities and digital villages (1, 2).



In this context, digitalization functions not merely as a technological tool but as a transformative paradigm that plays a decisive role in redefining the relationships among space, power, and governance. With the penetration of digital technologies into planning processes, the methods of producing, processing, and applying spatial information have undergone fundamental changes, making evidence-based decision-making possible on the basis of more accurate data. This contributes to improving the quality of spatial policy-making, increasing the efficiency of resource allocation, and enhancing coordination among different institutions. Moreover, by providing interactive and participatory platforms, digitalization enables more active participation by citizens and stakeholders in planning processes and contributes to strengthening social capital and the legitimacy of public decisions (3, 4).

Despite these capacities, the full realization of the benefits of digitalization in spatial planning faces numerous challenges. One of the most important of these challenges is the digital divide among different regions, especially between urban and rural areas, which may intensify spatial inequalities. In addition, weak technological infrastructures, limited access to up-to-date and reliable data, and the absence of appropriate institutional frameworks for data management and application are among the other obstacles to digitalization. Furthermore, in many planning systems, bureaucratic and centralized structures lack the flexibility required to adapt to digital transformations, and this makes the transition to smart planning difficult (5, 6).

On the other hand, strategic spatial management, as one of the main pillars of spatial planning, requires the use of new tools and approaches capable of properly understanding and analyzing environmental complexities and dynamics. In this regard, digitalization, by enabling the analysis of big data, the simulation of different scenarios, and the continuous monitoring of spatial changes, can contribute to improving the effectiveness of strategic management. This allows decision-makers to design and implement development policies and programs with a more comprehensive and data-based perspective. In addition, the use of digital technologies can improve coordination among different levels of governance, from the local to the national level, and increase coherence in spatial policy-making (2, 4).

In the same vein, territorial governance, as a framework for exercising power and managing resources within a specific territory, has been strongly affected by digital transformations. By creating transparency in information, facilitating access to data, and increasing the capacity for monitoring and evaluation, digitalization can help strengthen the accountability and efficiency of governance institutions. Moreover, digital technologies enable interaction and cooperation among different actors, including the state, the private sector, and civil society, and have led to the formation of new models of participatory and networked governance. These transformations can improve the quality of territorial governance and contribute to sustainable development, provided that the necessary infrastructures and institutional requirements are established (7, 8).

Nevertheless, it should be noted that digitalization does not by itself guarantee improvement in spatial planning and territorial governance; rather, the way it is applied and the degree of institutional and social readiness to accept these transformations play a decisive role in its success. In many cases, the absence of comprehensive digital strategies, weaknesses in training and human-resource empowerment, and resistance to change are among the factors that may prevent the effective use of digital technologies. Therefore, it is necessary to adopt a comprehensive and integrated approach to managing digital transformation in spatial planning, in which technical, institutional, social, and cultural dimensions are considered simultaneously (9, 10).

Within this framework, the central problem of the present study is to examine how digitalization affects strategic spatial management and territorial governance in the context of urban and rural planning. In other words, this study

seeks to clarify how digital technologies can contribute to improving spatial decision-making processes, increasing the efficiency and effectiveness of programs, and strengthening coordination among different levels of governance. Identifying the existing challenges and barriers to the realization of this transformation is also one of the objectives of this study, so that solutions can be proposed to improve the current situation (5, 6).

Finally, the significance of this study lies in the fact that, by focusing on the relationship among digitalization, strategic spatial management, and territorial governance, it can contribute to enriching the theoretical literature in this field and provide the basis for developing applied frameworks for spatial policy-making and planning in the digital age. Given global trends and the necessity of keeping pace with technological transformations, addressing this subject can play an important role in improving the quality of urban and rural planning and achieving balanced, sustainable, and intelligent development.

## Theoretical Foundations

### *Digitalization*

Digitalization, as one of the most important transformative trends of the contemporary era, refers to a process through which human activities, structures, and interactions are redefined and reorganized through digital technologies. This concept goes beyond the mere “digitization” of data, meaning the conversion of analog information into digital form, and refers to the deep integration of new technologies into decision-making, management, and governance processes. In fact, digitalization changes the logic according to which systems operate and makes it possible to create new forms of value through data, connectivity, and intelligentization. In spatial planning, this transformation means a transition from traditional models based on static and limited data toward dynamic, real-time, and data-driven systems capable of analyzing spatial complexities across different scales (1, 9, 11).

In the scientific literature, digitalization is often examined in connection with concepts such as digital transformation, intelligentization, and data-driven governance. Digital transformation refers to fundamental changes created in structures and business or governance models as a result of the application of digital technologies, whereas digitalization focuses more on the process of integrating technology into existing activities. This conceptual distinction is especially important in urban and rural planning because it shows that the mere use of digital tools is not sufficient; rather, the logic of decision-making and policy-making must also be redefined in accordance with new capacities. From this perspective, digitalization is a multidimensional process that includes technological, institutional, social, and spatial dimensions, each of which plays an important role in shaping its outcomes (3, 9).

One of the key characteristics of digitalization is the production and use of massive volumes of data known as “big data.” These data, generated from diverse sources such as sensors, social networks, transportation systems, and urban platforms, make it possible to analyze behavioral, spatial, and economic patterns more accurately. As a result, urban planners and managers can make more effective decisions based on real and up-to-date data. In addition, technologies such as the Internet of Things, artificial intelligence, and machine learning play an important role in improving the quality of decision-making by enabling advanced analysis and trend prediction. These transformations have paved the way for the emergence of “smart planning,” in which data are regarded as one of the most important strategic resources (2, 12, 13).

In the spatial domain, digitalization has had profound effects on how space is understood, analyzed, and managed. Geographic information systems, remote sensing, and spatial modeling are among the tools that enable more accurate analysis of land-use patterns, environmental changes, and resource distribution. By combining spatial and non-spatial data, these tools help planners better understand complex relationships among different factors and evaluate various development scenarios. Moreover, digital platforms and participatory systems have increased interaction between citizens and planning institutions and have contributed to strengthening participatory approaches in spatial planning. This is particularly important within the framework of smart governance (2, 14, 15).

However, digitalization is also accompanied by complex challenges and consequences that cannot be ignored. One of the most important of these challenges is the digital divide, which refers to inequality in access to technologies and digital skills among different groups and regions. This divide may reproduce or even intensify spatial inequalities. In addition, issues related to privacy, data security, and information ownership are among the major concerns of the digital age. From an institutional perspective, many organizations also face problems such as resistance to change, lack of required skills, and weak intersectoral coordination, all of which may hinder the process of digitalization (5, 8).

Overall, digitalization can be understood as a structural and multidimensional transformation with extensive consequences for urban and rural planning systems. While this process creates opportunities for enhancing efficiency, transparency, and participation, it also gives rise to institutional, social, and spatial challenges that require intelligent management and appropriate policy-making. A deep understanding of the various dimensions of digitalization and its consequences can help planners and policy-makers make effective use of the capacities of this transformation and move toward sustainable development and smart governance (2, 9, 13).

### *Urban and Rural Planning*

Urban and rural planning, as one of the fundamental pillars of spatial development management, is a systematic, purposeful, and multidimensional process aimed at the optimal organization of space, the equitable distribution of resources, and the guidance of growth and development in human settlements. This type of planning, by taking physical, social, economic, and environmental dimensions into account, seeks to establish balance and coordination among the different components of space and to provide the conditions for sustainable development. Within this framework, cities and villages are not considered as separate entities but as components of an integrated spatial system whose mutual interactions play a decisive role in regional and national dynamics. From this perspective, contemporary spatial planning seeks to establish effective links among different settlement levels and to reduce spatial inequalities (1, 16).

In its theoretical evolution, urban and rural planning has moved from traditional and physicalist approaches, which mainly focused on physical design and land-use control, toward comprehensive, strategic, and participatory approaches. In recent decades, concepts such as strategic planning, participatory planning, sustainable planning, and resilient planning have gained a prominent position in the literature of this field. This transformation reflects a shift in the understanding of space from a merely physical container to a complex socio-economic phenomenon that requires multidimensional analysis and integrated management. Especially under conditions of rapid urbanization, climate change, and increasing pressure on natural resources, the necessity of adopting new approaches to planning has become more evident than ever (3, 17, 18).

One of the key axes of urban and rural planning is attention to spatial justice and the reduction of regional inequalities. The unequal distribution of facilities, services, and economic opportunities among different regions, especially between cities and villages, is one of the major challenges in many countries. In this regard, spatial planning seeks to create balance in development, strengthen urban–rural linkages, improve quality of life in less privileged areas, and prevent excessive concentration of population and activities in metropolitan areas. This requires the adoption of policies capable of simultaneously contributing to economic development, environmental protection, and social cohesion (4, 8, 19).

In recent decades, with the expansion of digital technologies, urban and rural planning has entered a new stage of transformation in which data and emerging technologies play a central role in decision-making processes. The use of geographic information systems, remote sensing, big data, and smart platforms has made it possible to analyze spatial patterns more accurately, forecast development trends, and evaluate different scenarios. These transformations have led to the emergence of approaches such as smart and data-driven planning, in which decisions are made on the basis of objective evidence and advanced analyses. Within this framework, planning is regarded not only as a specialized activity but also as an interactive and participatory process among different stakeholders (2, 12, 13).

Nevertheless, the realization of the goals of urban and rural planning faces numerous challenges, some of which are rooted in institutional and managerial structures. Centralization in decision-making, weak coordination among different institutions, shortages of financial and human resources, and the absence of integrated information systems are among the obstacles that can reduce planning efficiency. In addition, in many cases, the real participation of citizens in planning processes is limited, and decisions are made in a top-down manner, which can reduce the legitimacy and effectiveness of programs. In rural areas, problems such as migration, population decline, and weak infrastructures add further complexity to the planning process (5, 16, 20).

On the other hand, urban and rural planning in the contemporary era must inevitably adapt to uncertainty and rapid environmental change. Crises such as climate change, pandemics, and global economic transformations have shown that traditional and rigid planning approaches are no longer adequate for today's needs. In this context, flexible and resilient approaches, which emphasize the ability of systems to adapt to change and recover after crises, have become increasingly important. Resilient planning, by emphasizing vulnerability reduction and adaptive capacity enhancement, can contribute to the long-term sustainability of settlements and play an important role in managing spatial risks (8, 21, 22).

Ultimately, urban and rural planning, as an interdisciplinary field, requires a comprehensive and integrated approach capable of simultaneously addressing the different dimensions of development. In this regard, the integration of digital technologies with new planning approaches provides an exceptional opportunity to improve the quality of decision-making, increase efficiency, and enhance spatial governance. However, the effective use of these opportunities requires institutional reform, strengthening human capacities, and developing the necessary infrastructures. Otherwise, there is a risk that inequalities and spatial divides will deepen. Therefore, rethinking the theoretical and practical foundations of urban and rural planning in light of digital transformations is an unavoidable necessity for achieving sustainable, balanced, and intelligent development (2, 8, 18).

### *Strategic Spatial Management*

Strategic spatial management, as one of the new approaches in spatial planning, emphasizes the purposeful, future-oriented, and integrated guidance of spatial transformations toward sustainable development. Unlike traditional approaches, which mainly focused on land-use control and physical regulations, this concept is based on macro-environmental analysis, identification of opportunities and threats, formulation of long-term objectives, and design of flexible strategies for spatial management. Within this framework, space is viewed not merely as a physical container but as a dynamic and complex system affected by economic, social, environmental, and institutional interactions. From this perspective, strategic spatial management seeks to create coordination among these dimensions and guide them toward balanced and efficient development (1, 17, 18).

In the planning literature, strategic spatial management is rooted in the strategic planning approach, which emerged in the final decades of the twentieth century as a response to the inefficiency of traditional comprehensive planning. This approach, by emphasizing flexibility, participation, and focus on key issues, attempts to transform planning from a static and prescriptive process into a dynamic and interactive one. Within this framework, instead of preparing comprehensive and unchangeable long-term plans, emphasis is placed on designing strategies capable of adapting to changing conditions. This feature is especially important in confronting uncertainties arising from economic, social, and technological transformations (3, 18, 23).

One of the key components of strategic spatial management is environmental analysis and the precise identification of spatial characteristics, capacities, and constraints. This analysis includes the examination of demographic, economic, environmental, and physical trends at different levels and helps decision-makers design appropriate strategies on the basis of real evidence and data. In this regard, tools such as SWOT analysis, scenario planning, and spatial modeling play an important role in identifying possible development pathways and evaluating their consequences. By providing a comprehensive view of the future, these tools enable more informed decision-making and reduce risks arising from uncertainty (2, 16, 24).

On the other hand, strategic spatial management is strongly dependent on multilevel governance and coordination among different institutions. Geographic spaces, especially at urban and regional scales, are affected by the decisions and policies of different institutions at local, regional, and national levels. As a result, the absence of coordination among these levels can lead to spatial conflicts, waste of resources, and reduced program efficiency. Within this framework, strategic spatial management, by emphasizing intersectoral cooperation, stakeholder participation, and the establishment of coordinating mechanisms, seeks to strengthen coherence and integration in spatial policy-making (4, 8, 17).

In recent decades, digitalization has emerged as a key factor in transforming strategic spatial management. Digital technologies, by making it possible to collect, process, and analyze massive volumes of spatial and non-spatial data, play an important role in improving the quality of decision-making. The use of geographic information systems, big data, artificial intelligence, and simulation models enables planners to examine different development scenarios more accurately and predict the consequences of each. This leads to improved efficiency, reduced uncertainty, and increased transparency in the process of spatial management (2, 12, 13).

However, the effective implementation of strategic spatial management faces numerous challenges. One of the most important of these challenges is weak institutional and managerial capacity, which may prevent the successful implementation of strategies. In addition, limited access to up-to-date and reliable data, shortages of financial and

human resources, and the absence of an appropriate organizational culture for accepting change are among the other barriers to this approach. In some cases, conflicts of interest among different stakeholders and the absence of appropriate mechanisms for resolving such conflicts can also make decision-making processes more complex and time-consuming (5, 19, 23).

Ultimately, strategic spatial management can be regarded as a modern and effective approach that plays an important role in guiding spatial development under today's complex and changing conditions. By emphasizing foresight, flexibility, participation, and the use of data and new technologies, this approach can contribute to improving the quality of decision-making and enhancing the efficiency of planning systems. However, the full realization of these capacities requires the creation of appropriate infrastructures, the strengthening of institutional and human capabilities, and the development of integrated policy-making frameworks. In this regard, attention to the relationship between strategic spatial management and digital transformations can open new horizons for achieving smart and sustainable spatial governance (2, 13, 18).

### *Territorial Sovereignty/Governance*

Territorial sovereignty or territorial governance, as one of the key concepts in the literature of spatial planning and geographical sciences, refers to a set of mechanisms, institutions, processes, and power relations through which space is managed, controlled, and guided at different geographical levels. This concept goes beyond the state as the only principal actor and emphasizes the role of a network of actors, including public institutions, the private sector, and civil society, in shaping spatial decisions. Within this framework, territory is not merely a physical area but a complex socio-political arena in which interactions among power, resources, and different interests shape spatial development patterns. From this perspective, territorial governance seeks to create coordination among different levels of decision-making and ensure the sustainable, equitable, and efficient use of spatial resources (1, 4).

In the theoretical literature, territorial governance is directly connected to the concept of multilevel governance. This approach argues that spatial decision-making does not take place in a simple and linear hierarchical system but is shaped within a complex network of local, regional, national, and even supranational levels. Under such conditions, coordination among these levels and the creation of mechanisms for cooperation and interaction play a fundamental role in the effectiveness of spatial policies. Moreover, changes caused by globalization, regionalism, and technological transformations have weakened the traditional boundaries of spatial governance and have led to the emergence of new patterns of networked and participatory governance. This transformation highlights the need to redefine the role of the state from a centralized decision-making institution to a facilitator and coordinator (3, 25, 26).

One of the important characteristics of contemporary territorial governance is its emphasis on participation and the involvement of different stakeholders in decision-making processes. In traditional approaches, decisions were mainly made in a top-down manner by governmental institutions, whereas in new models, citizens, local organizations, the private sector, and civil institutions play an active role in shaping spatial policies. This not only increases the legitimacy of decisions but also improves their quality through the use of local knowledge and diverse experiences. In this regard, territorial governance seeks to create participatory and interactive processes in which decision-making is collective and based on relative consensus (4, 16, 17).

On the other hand, territorial governance has been increasingly affected by digital transformations. Digitalization, by enabling faster and broader access to data, increasing transparency, and facilitating communication among different actors, has paved the way for new models of smart governance. In these models, decisions are made on the basis of real-time data and advanced analyses, and citizens participate in governance processes through digital platforms. This transformation, especially in the form of “smart urban and territorial governance,” has emerged as one of the new trends in spatial planning, aiming to increase the efficiency, transparency, and accountability of management systems (2, 12, 27).

However, territorial governance also faces complex challenges that may affect its efficiency. One of the most important of these challenges is inequality in power and resources among different actors, which may lead to the domination of some groups over decision-making processes. In addition, lack of coordination among different levels of governance, weakness in institutional mechanisms, and insufficient transparency in decision-making processes are other major obstacles to effective governance. In many cases, these problems reduce public trust in governance institutions and weaken citizens’ participation in planning processes (5, 8, 25).

Alongside these challenges, environmental changes and global crises such as climate change, rapid urbanization, and economic crises have made the need to rethink territorial governance models more evident than ever. These conditions require governance systems to move from static and reactive models toward dynamic, anticipatory, and resilient models. In this regard, resilience has been introduced as one of the key principles of modern territorial governance, emphasizing the ability of systems to adapt to changes and return to equilibrium after crises. This approach has become particularly important in confronting environmental and social uncertainties (8, 21, 22).

Ultimately, territorial governance, as both an analytical and practical framework, plays a fundamental role in guiding spatial development and achieving spatial justice. By emphasizing interaction among different actors, coordination among levels of governance, and the use of new technologies, this concept seeks to make spatial management systems more efficient, transparent, and participatory. In the digital age, the relationship between territorial governance and information technologies has opened new horizons for the formation of smart governance models that can improve quality of life, increase the efficiency of planning systems, and contribute to sustainable development. However, the success of this approach requires institutional reform, strengthening human capacities, and creating appropriate infrastructures for data and information management.

### *Smart Governance*

Smart governance, as one of the emerging concepts at the intersection of public governance, digital technologies, and spatial planning, refers to a mode of public administration in which policy decision-making, implementation, and evaluation are based on real-time data, new information technologies, and broad stakeholder participation. This approach has emerged in line with digital transformation in management systems and aims to increase efficiency, transparency, accountability, and flexibility in governance processes. In smart governance, data are regarded as a strategic resource, and technologies such as the Internet of Things, artificial intelligence, big data, and digital platforms play a central role in policy analysis, prediction, and guidance. As a result, governance moves from a hierarchical and bureaucratic structure toward a dynamic, data-driven, and participatory network (1, 15, 27).

In the theoretical literature, smart governance can be regarded as an advanced stage of e-governance and digital governance, in which the issue is not merely the provision of online services but the intelligent use of data to improve decision-making and create public value. In e-governance, the focus is more on the digitalization of government services; however, in smart governance, the emphasis is on data integration, advanced analysis, and the use of technology to predict and manage social and spatial complexities. This transformation reflects a shift in the role of the state from a service provider to a data-driven facilitator that interacts with other actors within a participatory governance ecosystem (3, 28).

One of the key characteristics of smart governance is data-driven and evidence-based decision-making. In this approach, data obtained from different sources such as urban sensors, geographic information systems, social networks, and management systems are analyzed in an integrated manner and used as the basis for policy-making. This makes it possible to identify hidden patterns, forecast future trends, and respond rapidly to environmental changes. Especially in the field of urban and rural planning, these capacities play an important role in traffic management, resource allocation, natural-hazard control, and improvement of public-service quality. As a result, smart governance can increase the efficiency of management systems and reduce decision-making costs (2, 12, 13).

On the other hand, citizen participation is one of the fundamental pillars of smart governance. Unlike traditional models in which decisions were mostly made centrally and from the top down, in smart governance citizens participate in decision-making and decision-shaping processes through digital platforms, applications, and social networks. This participation not only helps increase transparency and accountability but also improves the quality of decisions through the use of local knowledge and citizens' lived experiences. Within this framework, the concept of the "digital citizen" emerges as an active actor in the governance process, playing an important role in shaping public policies (4, 8, 16).

Smart governance is also directly related to institutional integration and multilevel governance. In this approach, coordination among different institutions at local, regional, and national levels is of special importance because data and decisions circulate within a complex network of institutional relations. Lack of coordination among these levels may lead to inefficiency, overlapping responsibilities, and reduced policy effectiveness. Therefore, smart governance seeks to facilitate effective interaction among different actors and increase institutional coherence by creating shared digital infrastructures and standardizing data (5, 15).

Despite its numerous advantages, the implementation of smart governance is accompanied by significant challenges. One of the most important of these challenges is the digital divide, which can lead to inequality in access to digital services and opportunities among different social groups and geographical regions. In addition, issues related to privacy, data security, and the possible misuse of information are among the major concerns in this field. Moreover, the absence of appropriate institutional capacities, lack of digital skills among government employees, and organizational resistance to change are major obstacles to the realization of smart governance (5, 6, 8).

Ultimately, smart governance, as a new model in public and spatial management, plays an important role in improving the quality of governance, increasing the efficiency of decision-making systems, and improving interaction between the state and citizens. By using the capacities of digital technologies and emphasizing data-driven and participatory approaches, this model provides the basis for the formation of flexible, transparent, and accountable governance systems. However, the full realization of the goals of smart governance requires the creation of appropriate infrastructures, development of human skills, reform of institutional structures, and

formulation of comprehensive data-driven policies. Under these conditions, smart governance can be expected to function as one of the main pillars of sustainable development in the digital age.

### *Related Theoretical Approaches*

The theoretical approaches related to the digitalization of spatial planning and territorial governance can be explained within three main currents: theories of modern spatial planning, the data-driven approach to planning, and theories of networked and digital governance. Each of these approaches, from a different but complementary perspective, redefines the relationship among space, technology, and governance and provides the foundation for new models of spatial management. Overall, these theoretical frameworks show that spatial planning is moving from a merely technical and physical activity toward a complex, multilevel, and data-driven process in which interaction among different actors and the use of new technologies play a central role (1).

Within the framework of modern spatial planning theories, the main emphasis is on the transition from comprehensive rationality and hierarchical planning toward participatory, strategic, and flexible approaches. These theories, which have been widely developed since the final decades of the twentieth century, are based on the principle that space is a dynamic and changing phenomenon and cannot be managed solely through fixed and predetermined plans. In this view, planning is defined as an interactive and learning-oriented process in which different stakeholders play a role in shaping spatial decisions. Approaches such as strategic planning, participatory planning, and communicative planning are among the most important branches of this theoretical current, emphasizing dialogue, collective agreement, and social learning (3, 17, 18).

Following this theoretical transformation, the data-driven approach to planning has emerged as one of the most important new paradigms. This approach emphasizes the systematic use of data and empirical evidence to guide spatial decisions. With the expansion of digital technologies, massive volumes of spatial and non-spatial data are generated from different sources such as urban sensors, geographic information systems, satellite images, and social networks. The analysis of these data through advanced methods such as machine learning, spatial analysis, and predictive modeling enables a deeper understanding of spatial patterns and development trends. Within this framework, planning has moved from being based on general assumptions toward decision-making based on real and real-time data (2, 12, 13).

The data-driven approach has also changed the role of the planner. In the past, the planner acted as the main and central decision-maker, but in new models, the planner increasingly functions as a data analyst and facilitator of the decision-making process. This role transformation reflects a transition from “prescriptive planning” to “smart and participatory planning,” in which data and digital technologies become the main tools of analysis and decision-shaping. In addition, the use of big and real-time data enables continuous monitoring of spatial changes and rapid responses to urban and rural problems, thereby increasing the flexibility of planning systems (5, 12, 14).

Alongside these two approaches, theories of networked and digital governance also play an important role in explaining contemporary transformations in spatial planning. Networked governance is based on the idea that public affairs are no longer managed solely by the state but through a network of governmental and non-governmental actors that interact continuously with one another. These networks include the central government, local institutions, the private sector, civil organizations, and even citizens, each of which participates in some way in decision-making and policy implementation. Within this framework, governance has shifted from a hierarchical structure to a more horizontal and interactive structure in which coordination and cooperation replace control and command (4, 7).

In line with networked governance, the concept of digital and smart governance has emerged, emphasizing the use of information technologies to improve governance processes. In this approach, digital technologies are not merely tools for facilitating public services but function as core infrastructures of governance. Digital platforms, data-driven systems, and advanced analytical tools enable more effective communication among different actors, increase transparency, and enhance accountability. As a result, digital governance, as an advanced form of networked governance, seeks to create an intelligent, flexible, and participatory system for managing space and society (2, 15, 27).

Overall, the combination of these three theoretical currents shows that spatial planning and territorial governance are moving toward an integrated and multidimensional paradigm in which data, technology, and participation play key roles. This theoretical transformation has paved the way for new models of spatial management, in which decisions are not only based on scientific and data-driven analyses but are also shaped through a network of interactions among different actors. Under such conditions, a deep understanding of these theoretical approaches appears necessary for designing effective policies in urban and rural planning and achieving smart territorial governance.

### *Background*

The research background on the digitalization of spatial planning, strategic spatial management, and territorial governance shows that this subject has increasingly attracted the attention of domestic and international researchers in recent years. However, the focus of studies and their levels of analysis differ, and this has created significant research gaps. In the following, this background is examined in two parts: domestic and international studies.

In domestic studies, a considerable part of the research has focused on the role of new information technologies in improving urban and rural planning systems. Many of these studies have examined the application of geographic information systems, remote sensing, and spatial information systems in spatial analyses and have highlighted their role in increasing the accuracy of urban and regional decision-making. For example, some studies have shown that the use of GIS in land-use analysis and urban growth management can improve planning efficiency and reduce spatial conflicts (2, 10).

Alongside these studies, other research has examined the concept of the smart city and its relationship with urban governance. These studies have mainly focused on the technological and infrastructural aspects of the smart city and have considered the role of big data, the Internet of Things, and digital systems in improving urban services. However, in many of these studies, the relationship between technology and governance structures has been analyzed less integratively, with greater emphasis placed on technical aspects (3, 6).

On the other hand, some domestic studies have addressed territorial governance and spatial management and have attempted to examine the role of different institutions in managing spatial development. These studies usually emphasize challenges such as centralization, weak institutional coordination, and spatial inequalities. Nevertheless, fewer studies have simultaneously addressed the relationship among digitalization, strategic spatial management, and territorial governance, which itself constitutes an important gap in the domestic literature (4, 5).

In international studies, the digitalization of spatial planning and smart governance has been examined with greater depth and breadth. A significant part of international studies focuses on the concepts of “data-driven planning” and “smart cities.” Scholars in this field have shown that the use of big data and digital technologies can

lead to a fundamental transformation in the way space is analyzed and managed and can transform planning from a static process into a dynamic and real-time system (13).

Alongside this approach, numerous studies have examined digital governance and smart governance. These studies show that digitalization has not only changed the tools of governance but has also transformed the structure of power and the way the state, citizens, and the private sector interact. Within this framework, networked and participatory governance has been introduced as one of the main axes of analysis, in which decisions are made in a multi-actor and data-based context (15).

Some international studies have also examined the relationship between spatial planning and urban resilience in the digital age. These studies emphasize that the use of digital technologies can increase the capacity of cities and regions to confront crises, climate change, and environmental uncertainties. In this view, real-time data and smart systems are introduced as key tools for increasing spatial resilience (8).

A review of domestic and international background shows that although numerous studies have been conducted on digitalization, spatial planning, and territorial governance, several important gaps remain identifiable in the existing literature. First, many studies have addressed the subject in a partial and sectoral manner, and fewer studies have been able to establish an integrated relationship among digitalization, strategic spatial management, and territorial governance.

Second, in domestic studies, the dominant focus has been on the technical and applied aspects of technologies, while theoretical, institutional, and governance dimensions have received less attention. In contrast, although international studies have offered more advanced theoretical approaches, many of them have been conducted in developed contexts, and their direct applicability to developing contexts, including Iran, requires reconsideration.

Third, another important gap is the absence of a comprehensive analytical framework for explaining how digitalization affects the rearrangement of power structures, decision-making, and spatial management at different levels. In other words, it has not yet been precisely clarified how digital technologies can simultaneously affect planning efficiency, governance quality, and spatial justice.

Therefore, the present study attempts to focus on these gaps and provide an integrated framework for analyzing the role of digitalization in strategic spatial management and territorial governance, thereby contributing to the enrichment of the theoretical and applied literature in this field.

## Method

In terms of nature and objective, this study falls within the category of descriptive–analytical research and, in terms of approach, within applied–developmental research. This means that it first describes and explains the concepts, approaches, and relationships among the main variables, including digitalization, strategic spatial management, and territorial governance, and then, by analyzing these relationships, seeks to present a conceptual framework for a better understanding of the role of digital technologies in spatial planning systems. This study is also exploratory in nature because it seeks to identify and explain underexamined relationships among technological, institutional, and spatial dimensions in the context of urban and rural planning (29, 30).

In terms of data-collection method, this study is based on documentary and library research. Accordingly, scientific sources, including books, domestic and international scholarly articles, reports by international organizations such as UN-Habitat and the OECD, and reputable scientific databases, were examined. The main focus in data collection was on recent studies in the fields of digitalization, smart governance, spatial planning, and

urban management. In addition, the analysis of credible scientific documents was used to extract key concepts, identify theoretical trends, and examine research gaps. This approach provides a deeper understanding of conceptual and theoretical transformations in the field under study (8, 16, 31, 32).

In the data-analysis section, the study employs a qualitative analysis approach and conceptual interpretation. In this method, the collected data were first systematically classified and then, through conceptual content analysis, the relationships among the main variables were extracted. This analysis focuses on identifying patterns, recurring concepts, and theoretical connections between digitalization and spatial governance structures. In addition, theoretical comparative analysis was used to better explain the relationships among concepts so that the differences and overlaps among different approaches in the domestic and international literature could be identified (29, 30).

Another important part of the methodology of this study is the development of a conceptual analytical framework. This framework was designed based on the integration of three main axes: digitalization, strategic spatial management, and territorial governance. In this conceptual model, digitalization is considered a driving and transformative variable that affects spatial planning structures and processes through new tools and technologies such as big data, GIS, artificial intelligence, and digital platforms. This effect can be analyzed at two main levels: first, the level of strategic spatial management, which includes improving decision-making, increasing efficiency, foresight, and information integration; and second, the level of territorial governance, which includes enhancing transparency, participation, institutional coordination, and networked governance.

Within this framework, it is assumed that digitalization, by increasing access to accurate and real-time data, enables the analysis of spatial complexities and consequently improves the quality of strategic decisions. This process also contributes to improving territorial governance by creating participatory platforms and strengthening communication among different actors. In contrast, contextual factors such as institutional capacity, technological infrastructure, and level of development are considered moderating variables in this conceptual model, as they can affect the intensity and manner of digitalization's impact.

## **The Impact of Digitalization on Strategic Spatial Management**

### *Improving Decision-Shaping and Decision-Making*

Digitalization, as one of the most important drivers of transformation in contemporary planning systems, has had profound effects on strategic spatial management. These effects can be explained through four main axes: improving decision-shaping and decision-making, developing spatial foresight and scenario planning, increasing the efficiency of resource allocation, and integrating information and spatial analysis. Overall, this process has caused spatial management to move from traditional approaches based on limited data and static analyses toward intelligent, data-driven, and dynamic systems capable of adapting to changing environmental conditions (1).

One of the most important effects of digitalization on strategic spatial management is the improvement of the quality of decision-shaping and decision-making. In traditional approaches, decisions were mainly made on the basis of limited data, individual experience, and static analyses; however, in the digital age, access to a broad volume of real-time and accurate data has made evidence-based decision-making possible. Technologies such as big data, artificial intelligence, and geographic information systems enable planners to analyze complex spatial patterns and predict the potential consequences of different decisions. This reduces uncertainty and increases accuracy in decision-making processes (2).

In addition, digitalization has changed the role of the planner from a mere decision-maker to a data analyst and facilitator. Under these conditions, decision-making becomes a participatory and multi-actor process in which data function as a common basis for analysis and dialogue among stakeholders. This transformation has created the conditions for increasing transparency, reducing individual biases, and improving the quality of spatial policy-making.

### *Spatial Foresight and Scenario Planning*

Digitalization plays an important role in strengthening foresight capacity in strategic spatial management. One of the most important tools in this field is spatial scenario planning, which enables planners to model different futures based on existing trends, historical data, and environmental variables. The use of simulation models, big-data analysis, and predictive algorithms makes it possible to evaluate different scenarios of urban and regional development.

Within this framework, spatial management shifts from a reactive mode to an anticipatory one; that is, instead of responding to problems after they occur, it seeks to analyze and manage the possible consequences of decisions in advance. This approach is especially important under conditions of economic, environmental, and social uncertainty and contributes to increasing the resilience of spatial systems (13, 16).

### *Increasing the Efficiency of Resource Allocation*

Another important effect of digitalization is the improvement of efficiency in the allocation of spatial and financial resources. In traditional planning systems, resource allocation was often carried out on the basis of incomplete information and non-transparent processes; however, in the digital approach, accurate and real-time data make optimal resource distribution possible. This is especially important in areas such as transportation, public services, urban infrastructures, and land management.

Digital technologies, by enabling demand analysis, needs forecasting, and continuous monitoring of system performance, help managers allocate limited resources more efficiently. As a result, not only does productivity increase, but waste of resources and spatial inequalities are also reduced. Within the framework of sustainable development, this issue plays a key role in creating balance among economic growth, social justice, and environmental protection (4).

### *Integration of Information and Spatial Analysis*

One of the fundamental transformations resulting from digitalization is the creation of integration in spatial data and information. In the past, data related to urban and rural planning were scattered, fragmented, and non-integrable across different institutions; however, with the emergence of digital technologies, the integration and integrated analysis of such data have become possible. Geographic information systems, spatial databases, and smart platforms play an important role in creating this integration.

This informational integration provides the basis for multilayered and multiscale analyses and allows planners to better understand complex relationships among economic, social, and environmental factors. In addition, shared access to data among different institutions increases institutional coordination and reduces duplication in planning processes. As a result, strategic spatial management moves toward an integrated, transparent, and coordinated system.

Overall, digitalization, by transforming decision-making, foresight, resource allocation, and information management processes, plays a decisive role in improving strategic spatial management. This transformation has paved the way for the formation of intelligent and data-driven planning systems in which efficiency, transparency, and flexibility are considered fundamental principles of spatial management.

### **The Impact of Digitalization on Territorial Governance**

In recent decades, digitalization has become one of the fundamental factors in redefining the structures and functions of territorial governance. This transformation has not only changed the tools used to administer space but has also affected the nature of power relations, the method of decision-making, and the mode of interaction among different actors. Within contemporary governance, territorial governance is no longer limited to the state as the central actor; rather, a network of public institutions, the private sector, civil organizations, and citizens plays a role in shaping spatial policies. In this context, digital technologies, as new governance infrastructures, have made it possible to rearrange these relationships (1, 7, 26).

#### *Strengthening Multilevel Governance*

One of the most important effects of digitalization on territorial governance is the strengthening of multilevel governance. In this approach, spatial decisions are not centralized at a single level but are shaped through interaction among local, regional, national, and even supranational levels. Digital technologies facilitate the flow of information among these levels and provide the conditions for better coordination and the reduction of institutional gaps.

Integrated information systems, data-driven platforms, and digital communication networks enable rapid information exchange and policy alignment among different institutions. This is especially important in managing complex spatial issues such as urban development, natural-resource management, and regional planning because uncoordinated decisions among different levels can lead to inefficiency and spatial conflicts (3, 8, 25).

#### *Increasing Transparency and Accountability*

Digitalization plays an important role in increasing transparency and accountability in territorial governance. Broad access to data, information, and decision-making processes through digital platforms has increased the possibility of public monitoring of governance institutions' performance. This transparency leads to the reduction of administrative corruption, the increase of public trust, and the improvement of decision quality.

In traditional governance, many decision-making processes took place at limited and non-transparent levels; however, in digital models, data are made openly and accessibly available to stakeholders. This not only increases the accountability of public institutions but also enables citizens to participate more actively in monitoring and decision-shaping processes (4, 28).

#### *Development of Smart Governance*

Another important consequence of digitalization is the development of smart governance in the territorial context. Smart governance refers to the systematic use of digital technologies, big data, and advanced analyses to improve

decision-making and public management processes. In this approach, data are regarded as a strategic resource that can significantly improve the quality of policy-making.

In smart governance, decisions are made based on real-time analyses and accurate predictions, which increases efficiency and reduces human error in spatial management. This approach also enables faster responses to crises and environmental changes and increases the resilience of territorial systems (2, 13, 27).

### *The Role of Digital Platforms in Spatial Policy-Making*

Digital platforms are among the most important tools of transformation in spatial policy-making. By creating interactive environments among the state, citizens, and other stakeholders, these platforms make broader participation in planning and decision-making processes possible. Through these tools, spatial data are collected, analyzed, and made available to policy-makers, thereby contributing to the improvement of decision quality.

In addition, digital platforms play an important role in integrating information and reducing data fragmentation. In many cases, information related to spatial development is stored separately in different institutions, but integrated platforms make it possible to aggregate and analyze these data. This increases institutional coordination and improves coherence in spatial policy-making (5, 12, 15).

Overall, digitalization has fundamentally transformed the structure of territorial governance by strengthening multilevel governance, increasing transparency and accountability, developing smart governance, and expanding the role of digital platforms. This transformation has paved the way for the formation of flexible, participatory, and data-driven governance systems that can contribute to improved spatial management and higher-quality territorial development.

### **Challenges and Barriers to Digitalization in Spatial Planning**

Despite the extensive capacities of digitalization for improving the quality of spatial planning and territorial governance, the full realization of this process is accompanied by a set of structural, institutional, and social challenges and barriers. These challenges cause the transition to digital planning to be slow, unequal, and inefficient in many cases. In general, the most important barriers can be classified as the digital divide, infrastructural limitations, institutional and bureaucratic issues, data shortages and weak data management, and cultural and skill-related challenges (5, 8).

### *The Digital Divide Between Urban and Rural Areas*

One of the most fundamental challenges of digitalization in spatial planning is the existence of a digital divide between urban and rural areas as well as among different social groups. This divide refers to differences in access to digital technologies, internet quality, level of digital literacy, and the ability to use new tools. In many rural and less developed areas, communication infrastructures are weaker, and this limits the use of digital capacities in planning processes.

This digital inequality may intensify existing spatial inequalities, in such a way that privileged areas benefit more quickly from smart planning, while deprived areas fall behind in this process. As a result, if not properly managed, digitalization may reproduce or even intensify inequality instead of reducing it (4, 8).

### *Infrastructural Limitations*

Another important barrier is the limitation of information and communication technology infrastructures. The implementation of smart planning systems requires strong infrastructures in high-speed internet, data centers, information-processing systems, and digital equipment. In many countries, especially in developing regions, these infrastructures have not yet reached a desirable level.

The absence of appropriate infrastructures disrupts the collection, processing, and analysis of spatial data and consequently reduces the efficiency of planning systems. In addition, dependence on foreign technologies and lack of technological autonomy may create new security and managerial challenges (2, 8, 12).

### *Institutional and Bureaucratic Issues*

Institutional and bureaucratic structures are also serious barriers to the digitalization of spatial planning. Many planning institutions still operate on the basis of traditional, hierarchical, and inflexible structures that are not compatible with the networked and data-driven logic of digital governance.

Organizational resistance to change, lack of coordination among different institutions, and weakness in process integration are among the factors that prevent the effective use of digital technologies. Under such conditions, even when appropriate technology exists, its efficiency in planning processes will not be fully realized (3, 7, 17).

### *Data Shortages and Weak Data Management*

Another important challenge is the shortage of accurate, up-to-date, and reliable data, as well as weakness in the data-management system. Digital spatial planning is strongly dependent on extensive and high-quality data; however, in many cases, data are either incomplete or scattered across different institutions.

The absence of common standards for data collection and exchange, weakness in information-integration infrastructures, and the lack of efficient systems for managing spatial data reduce the quality of analyses and decisions. This issue becomes especially important in areas such as urban management, regional planning, and crisis management (5, 13, 14).

### *Cultural and Skill-Related Challenges*

Alongside technical and institutional challenges, cultural and skill-related issues also play an important role in limiting digitalization. In many organizations and communities, the level of digital literacy and familiarity with new technologies is still insufficient, and this prevents the effective use of digital tools.

In addition, an organizational culture based on traditional decision-making methods and resistance to data-driven approaches is one of the important barriers to digital transformation. Under such conditions, even if technical infrastructures are available, the absence of specialized human resources and resistance to change can disrupt the digitalization process (5, 6).

### **Solutions and Recommendations**

Given the numerous challenges and barriers to the digitalization of spatial planning, it is necessary to provide practical and policy-oriented solutions for the effective use of the capacities of new technologies. These solutions should be designed in an integrated and multidimensional manner so that they can simultaneously cover

infrastructural, institutional, human, and governance dimensions. In this regard, the most important recommendations include developing digital infrastructures, reforming institutional structures, improving digital literacy, formulating integrated digital policies, and strengthening data-driven governance.

The first and most fundamental solution is the development and strengthening of digital infrastructures at different spatial levels. The realization of smart spatial planning requires stable access to high-speed internet, data-processing centers, integrated information systems, and advanced communication infrastructures. In this regard, public investment and private-sector participation play a key role in accelerating infrastructure development.

In addition, reducing spatial inequalities in access to digital infrastructures, especially in rural and less developed areas, should be considered a strategic priority. This measure not only provides the basis for equitable access to digital services but also prevents the intensification of the digital divide.

Reforming institutional and bureaucratic structures is another fundamental prerequisite for success in the digitalization of spatial planning. Traditional, hierarchical, and inflexible structures lack the capacity to respond to the requirements of digital governance. Therefore, movement toward networked, flexible, and participatory structures is necessary.

In this regard, creating coordination among different institutions, reducing duplication, and defining clear roles for different actors in the planning process can help increase the efficiency of the spatial governance system. The establishment of intersectoral cooperation mechanisms and the strengthening of multilevel governance are also among the other requirements of institutional reform.

One of the most important factors in the successful implementation of digital planning is improving digital literacy and the specialized capabilities of human resources. Without human resources familiar with new technologies, even the most advanced infrastructures will not have the required efficiency. Therefore, training and empowering planners, managers, and public-sector employees in the field of digital technologies should be prioritized.

These training programs should include skills such as spatial data analysis, working with geographic information systems, using artificial intelligence tools, and understanding the concepts of data-driven governance. In addition, improving organizational culture and creating a positive attitude toward digital transformation play an important role in the success of this process.

For the effective realization of digitalization in spatial planning, the formulation of integrated and comprehensive policies at national and regional levels is necessary. These policies should encompass all technological, institutional, economic, and social dimensions and prevent the fragmentation of actions. Lack of coordination in digital policy-making can lead to duplication, waste of resources, and reduced program effectiveness.

Integrated digital policies should be based on principles such as transparency, participation, spatial justice, and sustainability. In addition, the establishment of common standards for collecting, storing, and exchanging spatial data is among the necessary measures in this field (4).

One of the most important future orientations in spatial planning is movement toward data-driven governance. In this approach, data are considered the central basis of decision-making, and all planning processes are shaped on the basis of accurate and real-time analyses. This requires the establishment of appropriate infrastructures for data collection, processing, analysis, and sharing.

Strengthening data-driven governance also requires the creation of legal and institutional frameworks for data protection, information-security assurance, and ethical management of data use. Under such conditions, decisions will not only be more accurate and efficient but will also benefit from greater transparency and accountability (5).

Overall, the successful realization of digitalization in spatial planning requires a comprehensive and integrated approach that simultaneously addresses infrastructure development, institutional reform, human-capacity enhancement, coherent policy formulation, and data-driven governance. The implementation of these solutions can provide the basis for the formation of an efficient, intelligent, and sustainable system in spatial management and territorial governance.

## Conclusion

The present study was conducted with the aim of explaining the role and effects of digitalization on urban and rural planning, strategic spatial management, and territorial governance. Based on theoretical and analytical examinations, it can be concluded that digitalization is not merely a limited technological transformation but a structural and paradigmatic transformation in spatial planning systems, leading to the redefinition of decision-making methods, resource management, and the mode of interaction among spatial actors. Within this framework, digital technologies, by creating data-driven, smart, and participatory platforms, play a decisive role in improving the quality of spatial governance.

The findings of the study showed that digitalization affects spatial planning systems at several fundamental levels. First, at the level of strategic spatial management, it improves decision-shaping processes, increases accuracy in spatial analyses, strengthens foresight, and increases the efficiency of resource allocation. The use of real-time data and advanced analytical tools has significantly increased the possibility of understanding spatial complexities and designing development scenarios.

Second, at the level of territorial governance, digitalization has led to the strengthening of transparency, accountability, and participation and has created the conditions for multilevel and networked governance. In this regard, digital platforms and data-driven systems have played a key role in integrating information and improving interaction among different actors. Third, despite its advantages, this transformation is accompanied by challenges such as the digital divide, weak infrastructures, institutional limitations, and shortages of specialized skills, which can limit its effectiveness.

In response to the main research question—namely, how and to what extent digitalization can affect strategic spatial management and territorial governance—the results showed that this process has a direct and meaningful effect on improving the quality of decision-making and governance through increasing access to accurate data, enhancing spatial-analysis tools, and creating participatory platforms. By reducing uncertainty and increasing informational transparency, digitalization makes more efficient spatial management possible.

In response to the sub-questions, it was also found that this transformation can contribute to improving the efficiency of the spatial planning system by enhancing institutional coordination, strengthening multilevel governance, and developing data-driven approaches. However, the extent to which these effects are realized depends on contextual conditions such as the level of infrastructure development, institutional capacity, and cultural and human readiness. The findings of this study indicate that digital transformation, as an inevitable trend, will fundamentally affect the future of spatial planning. In the future, urban and rural planning will move increasingly toward intelligent, integrated, and data-driven systems in which decisions are made on the basis of real-time analyses and predictive models.

This transformation not only increases efficiency and accuracy in spatial management but also makes more transparent, participatory, and accountable governance possible. Under such conditions, spatial planning changes

from a merely technical process into a complex socio-technological system in which interaction among humans, data, and technology plays a central role.

To complete the existing literature, it is recommended that future studies conduct empirical and field investigations into the real effects of digitalization at different spatial levels. In particular, comparative analysis between urban and rural areas regarding the extent to which digital technologies are used can provide valuable findings.

In addition, the development of quantitative and mixed models for measuring the impact of digital governance on indicators of spatial planning efficiency is another important area for future research. Moreover, examining the role of cultural, social, and institutional factors in the success or failure of digital planning projects can further enrich the literature in this field.

### Acknowledgments

We would like to express our appreciation and gratitude to all those who helped us carrying out this study.

### Authors' Contributions

All authors equally contributed to this study.

### Declaration of Interest

The authors of this article declared no conflict of interest.

### Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

### Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

### Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

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