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Smart Land Governance: Towards a Conceptual Framework

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Abstract: Global environmental governance (GEG) is one of the world's major attempts to address climate change issues through mitigation and adaptation strategies. Despite a significant improvement in GEG's structural, human, and financial capital, the global commons are decaying at an unprecedented pace. Among the global commons, land has the largest share in GEG. Land use change, which is rooted in increasing populations and urbanization, has a significant role in greenhouse gas (GHG) emissions. As a response, land governance and, consequently, good land governance, have arisen as normative concepts emerging from a series of success factors (notably economic development, environmental conservation, and social justice) to achieve greater sustainability. However, global land governance has shown little success in helping GEG due to the lack of intellectual and flexible thinking over governing the land sector. Consequently, reforming land governance "in a smart way" is one of the most critical actions that could contribute to achieving GEG goals. Hence, we propose a smart land governance (SLG) system that will be well addressed, understood, and modeled in a systemic and dynamic way. A smart system may be smart enough to adapt to different contexts and intellectual responses in a timely fashion. Accordingly, SLG is able to promote shared growth and solve many land sector problems by considering all principles of good land governance. Therefore, in order to enhance adaptive land governance systems, efficient land administration and management are required. This study's outcomes will raise the comprehension of the problems of land management, providing an excellent framework to help land planners and policy-makers, as well as the development of strategic principles with respect to the principal multidimensional components of SLG.

Keywords: land reform; land tenure; land administration; environmental management; sustainable governance; land sustainability

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1. Introduction

One of the major attempts to mitigate and adapt to human-induced climate change has recently focused on global environmental governance (GEG) [1–4]. Governance is a cross-cutting practice that addresses all conventional systems of land management [5], which are important to accomplish political and social goals and to achieve sustainable growth [6]. GEG involves policy instruments [7,8], financing mechanisms [9], rules [10], protocols, and

guidelines that govern global processes for sustainable development [11,12]. GEG is a set of institutions, policy tools, funding mechanisms, laws, manners, and norms that govern the preservation processes of the environment at the global level [13]. In the early 1970s, environmental concerns entered the international agenda, and global environmental policy has evolved rapidly since then. Today, the environmental governance system reveals both successes and failures in addressing these concerns across the succeeding five decades [14].

Although GEG has grown in size and scope towards achieving its broader objectives of genuinely enhancing global sustainable growth, it has not been entirely effective. There are six broad factors restricting its effectiveness: (a) the proliferation and breakdown of multilateral environmental agreements; (b) a lack of regional cooperation; (c) a lack of regulation, compliance, and feasibility of GEGs; (d) the wasteful utilization of resources; (e) developments beyond the range of GEG; and (f) non-state players in a system that depends on the state [15–17].

In 1972, the first World Environment Conference was held in Stockholm, beginning a debate that has spanned five decades and initiating the ratification of a series of international environmental agreements. The Stockholm Conference established the United Nations (UN) Environment Program [18]. After twenty years, when the Earth Summit was convened in Rio de Janeiro, conventions on desertification, climate change, and biodiversity were introduced, and another UN political organization, the Sustainable Development Commission, was established. Small, low-budget administrations to tackle specific aspects of sustainable development were created in various locations, with several agreements concluded at meetings in different parts of the world [19]. Sustainable development was identified by the World Trade Organization and the World Bank as their main goal, while environmental concerns, including sustainable development, are perceived to be growing in international and regional institutions [20]. Numerous funding sources for international environmental measures are currently available, including the operating budgets of various organizations and specific funding mechanisms established as part of particular or general treaties [21]. The Global Environment Facility (GEF), a multi-lateral trust fund established in 1991, for example, has financed USD 4.8 billion in projects and USD 15.6 billion in joint financing [22].

Despite the substantial increase in institutional, human, and financial capital for GEG, the Earth's commons have continued to decay [17,23–26]. Among these commons, land has the largest share to contribute to GEG since land use change accounts for 35% of greenhouse gas emissions [27]. The per capita volume of arable land has steadily decreased, halving from 0.45 ha to 0.25 ha over the past 50 years [28]. Such a global decline in per capita arable land is rooted in the increasing growth of populations and urbanization [29–31], which has caused substantial land use changes due to the growing need for housing, industry, and services [32]. This raises issues of governance worldwide.

Land governance is the procedure of specifying, documenting, and sharing data about ownership, value, and land uses when enforcing policies of management. The sound sustainable management of land is essential for development in all sectors [33–36]. Climate change [37], food security [38], energy scarcity [39], urban growth [40], environmental degradation [41], and natural disasters [42] are all related to land governance and management [43–45]. Governments must seek to protect land, especially agricultural land, to meet the food needs of future generations [46].

The growing scarcity of land and landlessness in poor countries presents a serious threat to food security [47,48]. Formal and informal institutional arrangements of land are the most influential factors that affect land use change and food security [49,50]. As a result, the role of land policy is fundamental to developing a better understanding of food security [51], the administration of land [51,52], poverty reduction [53], economic growth [54], and environmental sustainability [55–57]. The key challenges to be addressed include the non-implementation of agreements on the implementation and effectiveness of existing GEG, and sustainable development legislation. However, there are two distinguishing features of land administration: strong reliance on soft law and a rich history

of civil community cooperation [58]. Accordingly, the need for action to deal with land tenure challenges should be seen as an opportunity by land beneficiaries (e.g., owners and/or tenants) to benefit from land tenure security, greater production, and improved food security [59,60]. This implies that land tenure security must be taken seriously [61]. The status of groups or individuals is related to property, which can be occupied and used under various conditions, including independent, rental, conditional, collective, and common conditions. Land security is considered part of property rights: the right to remain on land via ownership tenure, to use rights or occupations without title, and to use the land in a way that individuals or groups value, as long as it does not harm others [62]. The security of access to land helps stakeholders to establish rights of ownership and/or the use of land. This can help to establish a link between stakeholders and governments. The security of access to land can render land tenure more secure and permanent, which is important for agricultural development [63]. Terms such as "land governance" or "farm sector governance" and subsequently "effective (efficient) farm governance" have developed as foundational pillars that have a crucial role in attaining sustainable development [64,65]. However, global land governance (e.g., the rules governing land use, the certification of agricultural lands, and also food security [66]) has had little success in helping GEG due to the lack of intellectual and flexible thinking over governing the land sector [67,68]. Nonetheless, most land governance initiatives have concentrated primarily on one of the principles (including the rule of law for land management) of good (efficient) land governance, while not necessarily addressing all the human, technical, and institutional preconditions required to ensure inclusive governance [64,69,70].

GEG is a qualitative concept that is difficult to operationalize. Its desirable characteristics are as follows (adapted from FAO [71]): (1) sustainable and locally sensitive; (2) legal and reasonable; (3) efficient, productive, and competent; (4) open, responsible, and predictable; (5) providing protection and stability; and (6) committed to honesty [72,73]. The official SLG definition relating to land access and land use decisions is how these decisions are implemented and enforced and how competing interests are managed on the land. However, it is important to keep in mind that land governance is inherently connected to authority and the economic policies pertaining to land. In most areas, the more powerful (and richer) individuals are able to acquire stronger forms of tenure, whereas the most vulnerable and disadvantaged groups typically have weaker, more unpredictable tenure conditions [74]. According to Otsuki et al. [75], although we envision "a world with no one left behind", as outlined in the UN's Sustainable Development Goals, more than one billion people are still living in slums and informal settlements. While these people are trying to survive, they also have to deal, on a daily basis, with the fear of being evicted or resettled elsewhere. We urgently need a people-centered SLG approach as a central component of sustainable development. Reforming land governance "in a smart way" is one of the critical actions to contribute to achieving GEG goals. These goals include (1) improving leadership, (2) knowledge production, (3) cohesion and coordination, (4) improving environmental conditions, and (5) ultimately achieving sustainable development [76]. A smart and capable GEG needs new methods of planning policy. First, the problems of the environment are transnational in nature, and their impacts extend across spatial boundaries [77]. Second, because of the complex issues related to the environment, there are different views and interpretations regarding environmental understanding [78]. Third, human problems related to the environment are entwined with land use change in the world [79]. These challenges have sparked scholarly debates and have led to calls for the democratization of international management of the environment. Nevertheless, the complexity of environmental concerns has led hypotheses and practical studies to focus on various areas or characteristics of specific obstacles, such as the growing population, urbanization, and land use change, and there is no integration between the discussions [80,81]. Therefore, people and stakeholders should have a functional position in the generation or assessment of scientific knowledge [82]. Hence, our starting point is the theory of smart land governance

as a conceptual framework emphasizing that various system components can have various intelligent operations and, thus, should be evaluated at the system level.

The main novelty of this study is the introduction of an innovative framework to develop an analysis of "smart land governance" (SLG). Thus far, many studies have focused more on smart land management, and attention to SLG has been very limited. This situation is useful for understanding the problem of land governance, as it directly corresponds to different stages in SLG, and its implementation. It helps to understand strategic principles with respect to the core multidimensional components of SLG. Therefore, it is intelligent enough to adapt to different situations and timely responses. In this study, the land governance system will be outlined and "modeled" in a systemic and dynamic way.

Developing a Conceptual Framework

Land administration addresses policy decisions on land use, implements appropriate legislation, and organizes decision-making with citizens and official bodies across various institutional layers [83,84]. This administration is part of the state, an institution that has the responsibility to make the essential decisions in a geopolitical system determined by law. Governance is the way in which rules, norms, and actions are structured, sustained, regulated, and made accountable [85]; it encompasses all processes, including government, market, network, family, tribe, organization, formal or informal territory, laws, norms, and power or language [86]. Successful land governance enables the creation and implementation of regulations, laws, and processes that play a part in land resource management [84,87–90]. Governance includes the system by which an organization is established and functions, as well as the mechanisms by which it and its individuals are made accountable [91].

In short, environmental protection is not possible without proper land and soil management [92]. While there is considerable experience in land management and regulatory and technical law reform worldwide [93–95], not all of this experience has been positive. Political and economic issues in land management make it very difficult to reform laws at various scales, including the labor market, product, tax and budget policies, education, healthcare, and environmental policies. Moreover, focusing on one principle of GLG is insufficient to avoid possible losses caused by land investors and can result in establishing weak land governance that would marginalize vulnerable groups [96,97]. As a result, improving global governance around the world requires a more comprehensive, consistent, and long-term strategy to achieve sustainable goals [98–102].

Previous efforts such as the studies by Berge et al. [103], Chamberlain and Anseeuw [104], Duveiller et al. [105], Jombo et al. [106], Musakwa [107], Pasura [108], and Pritchard [109] show the value of blurring the distinction between the design of land use reform laws and the implementation of these laws to encourage policy-makers in the field of land use to use the new knowledge and understanding of this process. For example, Nuhu [110] showed that in Tanzania and other developing countries, peri-urban land governance is formed by the divergent or complementary positions of players arising from their jurisdiction, influence, and interest, which establish a dynamic relationship that affects the mechanism of land governance. Recognizing the role of different actors is therefore crucial not only in enhancing relations among actors to strengthen the administration of peri-urban land, but also in the introduction of appropriate legislative and administrative mechanisms to regularize both formal and informal actors. Stevens, Greif, and Bouma [36] argued that while global supply chains facilitate economic growth and poverty alleviation, they also exert adverse impacts, including accelerating tropical deforestation. Thus, in order to encourage positive outcomes from large-scale land acquisition NGOs, foreign institutions and stakeholders have encouraged businesses to willingly implement responsible policies towards land. Good governance is one of the management models in the public sector that facilitates decision-making and assists the government in performing its legal duties [111]. As a result, there is a need for a smart approach that purposefully includes land reform champions, gatekeepers, and challengers and applies continuous information and outreach

strategies to enable adaptation to different socio-economic, political, and environmental contexts. Accordingly, it is proposed that SLG is able to promote shared growth and solve many land sector problems by considering all principles of good land governance. Governance should be focused on the intelligent sharing of knowledge flows among its various subsystems. The sharing of knowledge is focused on a clever policy-making system structured for connecting users and data across multiple domains, as well as sharing information.

SLG, along with all stakeholders involved, develops pro-active, open-minded, and flexible land governance mechanisms while stressing the need for innovative decision-making processes and land implementation in accordance with these decisions. In order to affirm the rationality of governments by using more accurate, easily available, and usable information and the execution of key decisions, such decision-making should be further informed by the use of network technology. Accordingly, SLG can comprise smart technologies, intellectual dialogue, and active collaborations between knowledgeable stakeholders and effective institutions to face the challenges of multi-level land governance, thus integrating the macro (global), meso (national), and micro (local) levels. Hence, the following structural questions need to be answered:

- What is the distinction between and the status of SLG and GLG?
- What types of technologies can be called smart?
- What is the role of smart technology in the decision-making processes of land governance?
- How can SLG provide active collaborations among multi-level stakeholders?
- What opportunities and challenges will SLG offer by developing a multi-level land governance structure?

This study aims to analyze SLG by creating an innovative framework. The logic behind the above SLG definition is the need to develop capabilities, skills, and competencies at all levels, including individual, organizational, and societal levels. SLG recognizes limited capacities in land management and the related education and research as one of the priority land challenges facing developing countries at these different levels. SLG aims at widening the access to globally developed information and globally available opportunities for skills and competency development in such a manner that societal impacts are responsible and sustainable. In addition to journal articles, this analysis uses grey literature, such as conference papers, documents of governments, and technical studies and reports, in the synthesis process, but it is limited by the lack of extensive empirical research on SLG.

2. Materials and Methods

To achieve the main goal, the first step was the development of a conceptual framework involving the components of smart land governance (SLG), from which an SLG system was designed. This involved the following steps:

(1) Reviewing the historical context of GLG and SLG to better understand the issues and the context (to develop a conceptual framework): During this time, the latest framework provided with respect to climate adaptation was first reported. The role and situation of SLG were then addressed.

(2) Knowing and discussing when land governance is smart: In this step, the study addressed the issue of when land governance is smart. It can adapt to different contexts in order to develop strategic principles aligned with the main three multidimensional components.

(3) Modeling the findings using a systematic and dynamic approach: During this step, the findings were converted to the elements and the structure of the SLG system. As land governance is highly contextual, it was important to conduct the study in the field and make it comparative. This study examines Ethiopia and Iran. These two countries were chosen because agriculture there is essential to most people's livelihoods and contributes considerably to the GDP. Land has been a central theme throughout Ethiopian and Iranian history. Regardless of political and socio-economic upheavals, the governments have always maintained strong control over land use

and its allocation. In both countries, there is a great deal of autonomy over land use decisions and administration in accordance with federal legislation. Accordingly, policies and land-related programs are very different to the situation in other countries, leading to overlapping or competing for institutional responsibilities. Given such different contexts, the study benefited from a systemic design that used mixed methods [112,113], including both qualitative and quantitative techniques to contextually collect, analyze, and integrate data elicited from multi-stakeholders including local people. More precisely, the following specific approaches were utilized in the framework with four sub-steps (Figure 1). Despite comprehensive land certification schemes, land tenure security is relatively low, especially in the lowlands. Access to land has been limited for peasants, pastoralists, women, and the urban poor. Despite various proclamations, in practice, land may be expropriated for public use without compensation at any time. Given that the agricultural sector can promote growth and food security, the governments have successfully promoted large-scale agricultural investments and attracted domestic and international ventures. However, long-term agribusiness leases are problematic as they lead to the displacement of local populations, deforestation, ecological damage, and restricted access to pastures, forests, and water resources. Therefore, this study suggests that the model can be useful in both Ethiopia and Iran, especially for low-income farmers.

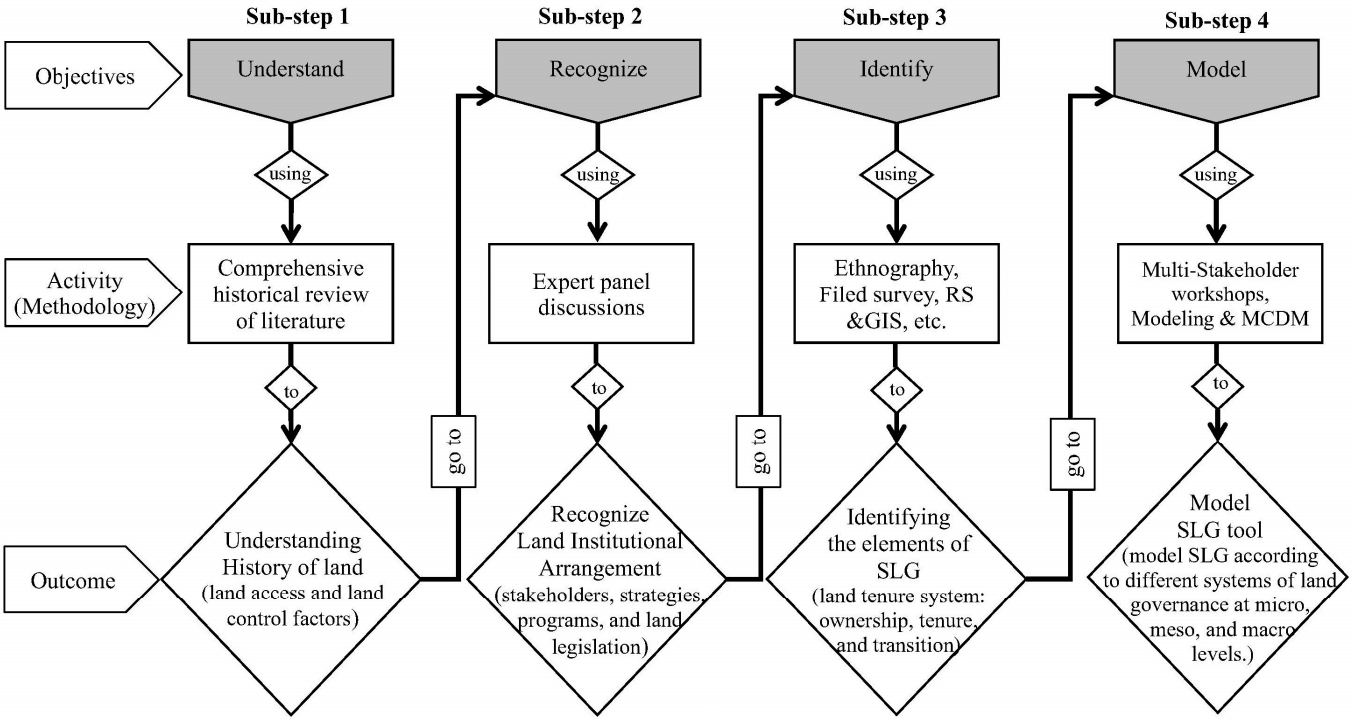

Figure 1. The proposed smart land governance (SLG) system.

Sub-Step 1: Understanding the historical background: At this stage, the main factors of land access and its control from the socio-economic dimension have been studied. This was achieved mainly through a comprehensive review of the literature on land governance studies for each of the selected countries (Ethiopia and Iran). The SLG framework has not been implemented in Iran and Ethiopia so far. Therefore, the current knowledge of land tenure and governance was critically reviewed in both countries. This review has a special focus on historical trajectories including substantive interdisciplinary findings, as well as theoretical and methodological contributions to the institutional arrangements for land

Sub-Step 2: Recognizing land-based administrative arrangements: The manner in which various institutional structures have been consolidated by governments or decentralized by indigenous people should be identified at this point. This clarifies the landowners'

contribution to land rights and the shared awareness and collective expectations of land users in society [30]. This method clarifies how such structures have been socially developed by the creation of a multi-stakeholder forum, for which the positions of stakeholders, strategies, programs, and land legislation have been examined.

Sub-Step 3: Identifying the main elements of SLG: This step explains how strong and weak governance could result in stable or insecure land tenure. It also tries to identify (in)efficient practices in the land sector. Accordingly, different elements of SLG are defined. Building up multi-dimensional land governance, the system impact of both safe and unstable land tenure on the development of fragile or sustainable land use is identified. Therefore, the system is defined in line with several factors of the three main dimensions of SLG, and new concepts for land governance are developed.

The ethnographic methods, including participant assessment, participatory rural appraisal (PRA), and participatory action research (PAR), which have already been used by Ghorbani et al. [114] in Iran and by Ghorbani, Eskandari-Damaneh, Cotton, Ghoochani, and Borji [114] in Ethiopia, seek to classify the key components of SLG primarily by integrating qualitative assessments that cannot be performed through survey studies. Local land users' opinions and insights on the basic syntax and components of SLG are gathered through field surveys. Considering that SLG contains a range of highly context-based components, it is important to gather some specific evidence from different case studies that will be selected in different developing countries according to the following criteria: (i) the existence of disputes over land, (ii) the rate of conversion, fragmentation, and change in agricultural land usage, and (iii) the inclusion of sound land management principles.

In addition, land users were selected through a multi-stage random sampling method based on the "land size" and "land organizations". To gather data on the current state of land use in the research areas, the geographical information systems (GIS) method was used because this technology can synchronize information from spatial databases with other attributed databases. This enables visualization of the information collected in an easy-to-understand format and provides all the details required by policy-makers. In fact, the actual potential of ethnography in policy-making is to assist in redefining a government's perception of its goals and how the world is changing and shaping them [115].

A recent trend is the use of extensive measurement technologies and computational techniques and models to measure and model environmental-related behaviors [116]. This concept is used in collective sensing, which involves the use of moving and stationary sensors in the user environment and can be used to quantify user behavior that is related to environmental influences. Collective sensing generates new possibilities to map human behavior on different scales, from individuals to communities. Such methods are applied in the evaluation of new means to decrease the environmental footprint [117]. To do this, an interdisciplinary computational environmental ethnography (CEE) methodology that combines methods from the fields of computer science and anthropology is introduced. This method performs assessments that not only minimize environmental impacts but also provide knowledge of the mechanisms behind the effect, such as human motives, based on quantitative and qualitative technical research. This method also makes it possible to assess qualified human values such as support and health [118]. Therefore, satellite image analysis is performed over the study sites (remote sensing techniques). To identify the status of areas under the influence of strong and weak governance, the appropriate models of land use and land cover change (LUCC) have been used to determine the current conditions of the study sites. The analysis was performed using the "Definiens Professional" and other supporting software. The pre-processing steps such as radiometric normalization and georeferencing were used for the first time. Then, a series of data processing steps were undertaken in order to achieve the goals required for the application of remote sensing and GIS technologies.

Sub-Step 4: Modeling SLG: The research groups held several panel meetings to share the findings of the SLG model with the multi-disciplinary experts, including specialists in legal and legislative land use and property, land planning and development, and managing

public lands. The SLG group then organized a roundtable discussion with the members from key ministries and other land-related entities. The purpose of this meeting was to discuss the findings and initiatives to address the problems identified by this research on the development of SLG. Once the main elements of SLG, according to different contexts, were identified, the final step was to provide the SLG model. To do so, different modeling and multi-criteria decision-making techniques (MCDM) were applied. The broad range of such techniques helped to deal with the complexity of SLG according to different systems of land governance at the micro, meso, and macro levels.

(4) Examining the validity of the model by reviewing some case studies and existing evidence and developing several case studies:

According to Doran et al. [119], due to increased vulnerability in Africa, environmental risks, business insecurity, poor governance, severe urbanization, and a lack of resources such as land, conducting academic research on land management can be very successful. According to Suhardiman et al. [120], the state's control over land has a significant role in the production of land ownership throughout the Global South. In Myanmar, the government's approach to the regional extension (i.e., when the government extends its sovereignty over most of the land) has led to a system of territorial sovereignty and, as a result, the widespread and systematic grabbing of land by foreign powers. In short, the study of SLG in Latin America, Asia, and Africa is essential in promoting sound land management.

3. Case Studies for Modeling SLG

Since SLG is a new concept, no studies have analyzed its implementation. However, in order to discuss similar studies, this study focuses on land governance, smart land use, and smart land management in two selected countries to highlight land-related facts in these countries. Therefore, by identifying the most important key problems, this study will present the framework of SLG as the best solution. The following are studies conducted on land governance in two selected cases, which highlight the importance of SLG. For this purpose, we have examined SLG in the land governance structure of Iran and Ethiopia. This is due to the creation of a new method of land governance in both of these countries as a result of the transition from the instrumental to participatory land management systems. An integrated SLG framework may thus be suggested as an appropriate and effective model based on the consensual (horizontal/vertical) integration of all players and the delegation of certain governmental authority to the lowest local level (subsidiarity), coupled with the development of capacity.

3.1. Land Governance in Ethiopia

In Ethiopia, a lack of access to land and ineffective or corrupt land management systems have negatively impacted the country's investment climate and general welfare. Land and its governing institutions have also had a significant impact on economic progress [121].

Hailu [122] reported that all land in Ethiopia is owned by the government or the state. Although land cannot be sold or exchanged in any other way, the government acknowledges usage rights. The primary authority in charge of playing a federal role in land governance and examining current legislation, which falls under the management of land administration and land use, is the Ministry of Agriculture and Natural Resources. Different pieces of legislation and practices support the land system. The diversity of laws and institutions pertaining to land is thus a characteristic trait. Gabrihet and Pillay [123] contend that the Ethiopian federal structure grants its regions a high degree of autonomy, which has resulted in the coexistence of various laws and institutions with ambiguous mandates at various levels, making it possible to compare the difficulties of land governance in Ethiopia with the international standards. According to Wabelo [121], there are a number of components in Ethiopia's present land governance system that might serve as possible entrance gates for corrupt activities. These include hazy policies, ill-defined institutions, a lack of transparency, minimal public involvement, and capacity issues. Both urban and rural areas are affected by these issues. The quantity and severity of tenure-related issues

in Ethiopia are also significantly influenced by the effectiveness of land governance. As a result, the effectiveness of land governance will also influence the results of changes intended to address similar issues. Weak land governance affects a society negatively through both formal statutory land governance and informal and customary tenure systems. Therefore, in accordance with the principles of sustainable development, Ethiopia must have an SLG policy that improves the transfer of land rights, increases respect for human rights, and protects the environment from pressing threats [121,124].

The Hailu [122] report on Ethiopian land governance showed that the development of a smart land framework would be an important tool for evaluating the leading land management systems in Ethiopia. It is assumed that where they are lacking, land use plans may be produced using the best local practices and including a contractual agreement with the landowners. These plans can be implemented according to the law, and, after land mapping, the plans of land use can be completed and connected to cadastral maps. On the one hand, trying to make decisions about construction activities with a lack of data from land use applications can lead to subjective and unfair decisions. On the other hand, in Ethiopia and other sub-Saharan countries, deep holes continue to appear due to public distrust of the government, and this distrust is deepening [125].

SLG is a method to assess the condition of national land sovereignty through a participative process that systematically makes use of available data and local knowledge. Land use in urban development and planning, public land management, processes of transferring public land to private use, the provision of land information in a public way (land management and information systems), land and tax assessment, the resolution of conflicts, and the review of organizational arrangements are some of the factors that can be improved by applying SLG in the context of land in Ethiopia. Therefore, the process of SLG can help to build a consensus on (i) gaps in the available documentation; (ii) a framework for institutional regulation or reform, the pilot deployment of novel methods, and initiatives to improve land governance on a larger scale (e.g., through strengthening land rights and their enforcement); and (iii) criteria to assess the effectiveness of these interventions in Ethiopia [122].

3.2. Smart Land Use in Iran

In the 1980s, the goal of promoting an environmental revolution led to the global popularity of the idea of sustainable growth and quality improvement in policies, planning methods, and urban architecture around the world. Iran has been no exception in terms of responding to this changing agenda. The urbanization priorities (e.g., housing, urban green space, and educational and health spaces) have changed and moved towards a focus on new urban development and sustainability. Currently, one of the elements of sustainable growth in Iran is greater equality of access to resources. When its prerequisites are taken into account, the true role of land and its value in sustainable growth are better understood. Strong land governance can be listed as one of the most significant factors of these prerequisites in Iran. In this regard, Shams Pouya et al. [126] showed that poor land governance has led to a lack of adequate and affordable housing in the metropolitan areas of Iran, especially for low-income families. Even with the centralization of the decision-making process, municipal land management remains poor and ineffective. Zoning rules, land separation laws, and housing planning flaws, as well as ignoring urban policies for low-income communities, increasing urban sprawl, and the proliferation of unchecked buildings as a result of poor land governance, have all contributed to land and housing speculation in Iran. Additionally, it should be noted that the values of good land governance are opposed by the acquisition and development of land by various institutions without permission, administrative inconsistencies, fragmented decision-making processes, the absence of local land management structures, a lack of accountability, and the uncertain status of land ownership both inside and outside the city [110,127].

In recent years, smart and flexible land use planning in Iran has primarily focused on guiding urban development and preventing irregular city growth, particularly when

there is a lack of monitoring and control during the land use planning process, which can lead to the destruction of land prioritized for conservation and agriculture. A look back at the history of change reveals that the tactics and tools of management, as well as land use planning, have lacked important substantive and practical value. As a result, more efficient and intelligent techniques to adopt new management policies must be studied and applied, simply because land use patterns and connections have a considerable effect on the vitality, character, and quality of any particular community. Using an SLG model is one of the proposed methods for the smart analysis of land use in development zones. The establishment of a distinct governance pole, namely SLG, as well as the resurgence of land concerns in land development strategies, is crucial. In recent years, various groups have debated the words and definitions of land administration. To address land challenges, these groups have often proposed employing smart approaches such as cadastral and GIS mapping [5,111]. The fundamental reason for the inconsistency and inefficiency of Iran's urban–rural land governance management structure is that it is very fragmented in terms of decision-making and lacks intelligent governance and management integration. As a result, choosing acceptable and effective models among all players and stakeholders in the land sector, as well as delegating some government power to the local level with the goal of strengthening capacity, can be an effective option. A government assessment of Iran's land management strategy and organizational framework is also necessary. By applying the SLG techniques, it is feasible to plan for the proper use of land and to improve the current management of land use.

4. Discussion

Land management is essential all over the world, and socio-economic institutions and policies may have a significant influence on land use shifts. As a result, land use management must acquire land use information in a timely manner and establish relevant policies. As a result, all governments should handle the four major areas of land management, including land tenure, land value, land usage, and land development. In response, land specialists, such as surveyors and other geospatial professionals, play a paramount role in fostering realistic land markets and appropriate land use management by guiding land management systems. These four functions foster development and creativity and form a kind of "backbone" that can encourage social justice, sustainable growth, and environmental protection in society. Therefore, in this study, focusing on land governance and smart land use, the gaps in land governance are highlighted and a new SLG approach is introduced to solve land management problems.

4.1. The Trend for Smart Land Management

Enemark [6] showed that the key goal of smart management, and in particular the core element of land governance, is its contribution to productive markets of land and efficient smart land use management (SLM) in favor of fiscal, social, and environmental sustainability. Beside this fact, Pennington et al. [128] argued that SLM requires interdisciplinary expertise spanning the natural and social sciences. Decisions on land use are mostly motivated by private economic desires, which may not inherently comply with society's interests and development [129]. SLM includes institutional mechanisms for the comprehensive and sustainable execution of land policies. However, many countries prefer to differentiate land tenancy rights from land use opportunities, which weakens the capability to connect plans and the regulation of land use with land prices and the functioning of the land market [130]. These concerns are also exacerbated by inadequate managerial and management policies that do not offer the services needed and have led to inefficient land management. The stabilization of land management is an incredibly critical and well-informed process. In recent years, there have been several reports of SLM (e.g., Vente et al. [131]; Fritz-Vietta et al. [132]; Nigussie et al. [133]; Rahman et al. [134]), and, three decades ago, its significance compelled the FAO [135] to develop a systematic collection of metrics as an international mechanism to measure SLM and governance, con-

sidering the availability of energy, the effect on the environment, economic sustainability, biodiversity, and social justice. Accordingly, SLG is the adoption of land use programs in such a way that helps landowners to optimize the land's economic and social advantages while preserving or improving the ecological support functions of land resources, so that smart land management is definitely required.

The results of some previous studies (e.g., Vente, Bautista, and Orr [131]; Hailu [122]; and Alemie et al. [136]) about SLM in Ethiopia and other African countries such as Ghana and Rwanda show that SLM refers to various interventions that use social technologies, volunteered geographic information, and crowdsourcing in combination with technical drivers of intelligent information systems and big, linked, and open data to drive solutions for land-related challenges. The issue of smartness goes beyond the uptake of technology itself. It is true that some technology can be employed passively (through independent, self-registering, and passive sensors). However, most of the smartness refers to alternative manners in which citizens express their voices and claim their rights from the government. The emerging data integration and data mining (from these human sensors) are increasingly becoming a reality. This implies, on the one hand, that access to smart services, including land and property data, is assumed and, on the other hand, that all types of personal perspectives on the existing land issues can be included in the massive volumes of data sources and decision support systems.

4.2. Significance of Planned Government

SLG involves using smart data from land and natural environments. It is vital to consider the spatial distribution of environmental and socio-economic advantages to plan and adopt adaptation programs in land governance (e.g., emphasizing areas for the protection of species within endangered ecosystems, culturally important sites, agricultural areas with high value, and SLM) and mechanisms that challenge their persistence now and in the future [137]. In order to increase SLM compatibility and improve the good performance in land management, intelligent planning methods (e.g., spatial data analysis and GIS) are being used [138,139]. The aim of common smart planning approaches is to maximize the distribution of actions and land uses to accomplish environmental and socio-economic targets, including comprehensive conservation planning [134,140–145] and integrated landscape design. Many landscape features are difficult to measure, evolving gradually over time [146]. This includes approaches other than the conventional methods used so far in land analyses.

The implementation of systematic SLG can be useful for the realistic management of land use complexity based on a set of socio-economic and environmental qualities. The SLG approach requires long-term participation, but the short-term process criteria for validating progress in target negotiations, meaningful stakeholder participation, links to policy-making processes, and the effectiveness of land governance are also necessary. This is because, in implementing SLG, long-term impact metrics are needed to assess progress, which offers a number of social benefits, including protection, production, and economic livelihoods [147].

4.3. Key Barriers to the Successful Global Governance of the Environment

Governance is the mechanism by which power and transparency are established and practiced over time, and it is also about making decisions and maintaining the conditions for their successful execution [148]. It concerns who makes choices and how, particularly in regard to educational practices and evolving social structures; it also concerns who occupies positions of authority and responsibility and who should be held accountable [149,150].

Governance is effective when it is performed in a proactive and reasonable manner, when it addresses fundamental and procedural rights, and when successful and equal outcomes are obtained. The core concepts of environmental governance include (a) the integration of the environment at all levels of action and decision-making; (b) the study of the conceptualization of cities, communities, economics, and political life as a subset

of the environment; (c) the focus on people's relationships with their living environment; and (d) the reinforcement of the transition from open-loop systems to closed-loop systems. While the lack of commitment to the success of environmental land management is troubling, it can be argued that although this is a serious concern, it is not yet considered a crisis. It has been argued that (a) GEG organizations are still young and, as such, at this point, they are appropriately based on the formation of an agreement, and the success of the agreement will follow in time; (b) active negotiation data show that negotiators are actually replaced in decision-making over time, and the emphasis on performance changes; and (c) management procedures, which rely on function building and financial assistance, have operated with specific agreements and are expected to work with other environmental frameworks over time.

SLG can play a critical role in the success of land registration systems and in order for the systems to bring full benefits to society in terms of sustainable development. This is because land governance features a few key gaps that posit serious challenges to the success of its land management. First, the structural issue of the urban–rural dichotomy of land administration has been a problem. This in turn has resulted in bifurcated institutions for urban and rural lands. Second, there is an absence of clear practice regarding the division of land management. In addition, there is also the practical problem of distinguishing and interpreting "legislating" and "administering" powers with respect to the utilization, conservation, and development of land resources. Therefore, it is necessary and timely to take steps to strengthen the intelligent governance of land by providing an intelligent governance framework that has the necessary working standards in order to implement land management as efficiently as possible under controlled executive and judicial mechanisms. Therefore, this study introduces SLG as an appropriate approach for better land management and legal governance.

In this paper, we have developed an SLG framework (Figure 2) arguing that, for a successful SLG framework, three main categories of factors must be considered simultaneously: (a) technology (physical infrastructures, spatial innovations, and smart technologies); (b) people (transparency, responsibility, participation, accountability, human rights, and gender equity); and (c) institutions (governance and policy).

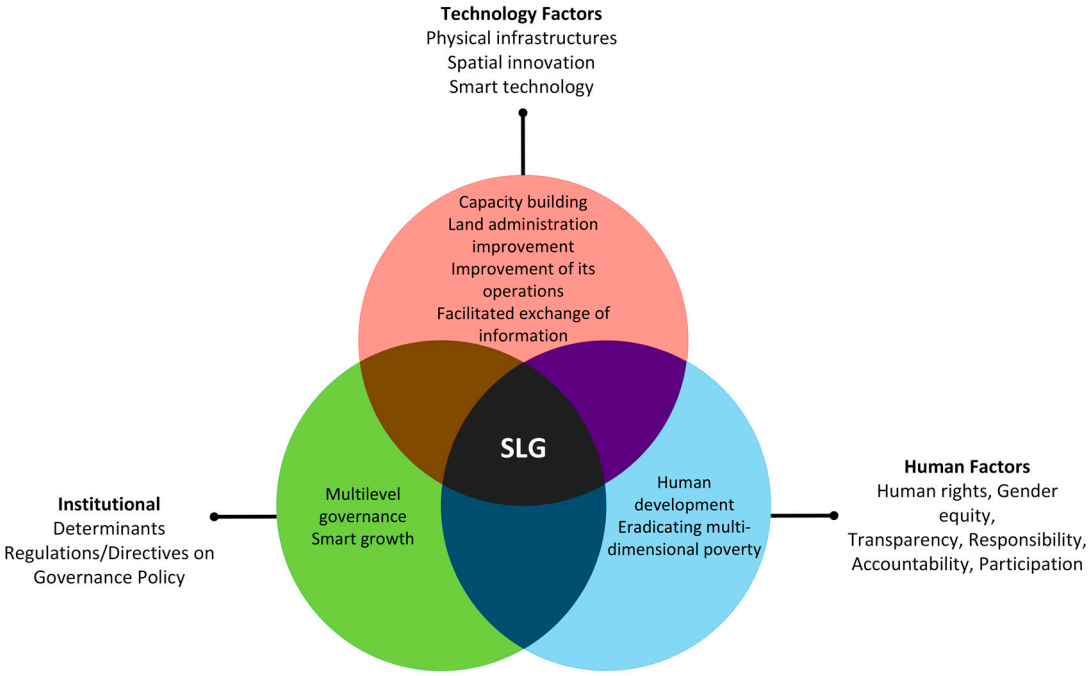

Figure 2. Conceptual model of SLG.

According to this framework, the focus on infrastructure and technologies, with regard to technological considerations, emphasizes the usability and availability of systems to create a favorable atmosphere for the exchange of knowledge, coordination, interoperability, and a smooth experience for multiple stakeholders engaged in land issues. The category "human factors" highlights the requirement of full participation from all actors to achieve the ultimate goals of sustainable access to land resources. This framework also shows that SLG focuses on human rights and equity through creating transparency, participation, accountability, and responsibility in decision-making processes, to reach a general consensus about the urgent needs of vulnerable groups in both policies and procedures. Through modeling and decision-making techniques, these multi-dimensional components of SLG will be linked to each other dynamically, creating an intelligent tool that can help policy-makers to develop adaptive governance for land. Given the findings, the connection between the clusters shows that land governance is smart when it can adapt to different contexts in order to develop strategic principles aligned with the three main multidimensional components through multi-level governance. This study divides SLG into three levels (i.e., micro, meso, and macro). This model suggests that the key added advantage of governance at various levels is that it allows for an understanding of the complexity "within" and "between" the three levels. Such a multi-layer platform defines decisions in relation to economic, historical, political, social, and environmental interests that are endorsed by a broad variety of stakeholders, including end-users, state and national agencies, non-governmental organizations (NGOs), private sector players, and decision-makers at all levels of land use.

Finally, it can be concluded that smart technologies significantly support good governance in land administration by facilitating open, transparent access to land records for all, via the land governance assessment framework. Innovative and competing public and private property information services help buyers and sellers to make intelligent decisions and allow policy-makers to monitor market trends, providing transparency and discouraging corruption. Governments establish e-planning portals, allowing citizens to access land use control information—including zoning development plans and planning regulations—and use geographical information systems (GIS) to manage the spatial complexities of managing, analyzing, deriving, and communicating new, fair parcel distributions. Data model standards help to ensure the portability of land information across generations of smart technologies, while open interoperability standards allow same-generation systems to work well with each other. Web services provide a standard means of interoperation among diverse software applications.

5. Conclusions

This study aimed to analyze SLG and create an innovative framework that requires the development of capabilities, skills, and competencies at all levels, including individual, organizational, and social levels. This paper began with a review of the historical context of GLG and SLG, discussing documentation on the ongoing climate adaptation planning process, exploration of the SLG system, studies of SLG, and how SLG establishes pro-active and resilient land governance systems. It was also discussed how land governance may be considered "smart" when it can adapt to different contexts in order to develop strategic principles aligned with the three main multidimensional components (i.e., micro, meso, and macro) through multi-level governance.

The importance of land management is particularly emphasized because land has the largest share in GEG. Land use change rooted in increasing populations and urbanization has a significant role in GHG emissions. However, global land governance has shown little success in helping GEG due to the lack of intellectual and flexible thinking over governing the land sector. This paper proposes reforming land governance "in a smart way" and highlights that efficient land administration and management are required. The quality of intelligent systems used in land management can be enhanced by the use of multi-layered platforms that take into account the economic, historical, political, social, and environ-

mental interests of a wide range of stakeholders, including end-users, government and national agencies, NGOs, and the private sector. These platforms must also be validated by actors and decision-makers at all different levels of land use. The new term SLG, as the title suggests, only refers to the initial steps toward its realization. The framework requires the development of capabilities, skills, and competencies at all levels, including individual, organizational, and social levels. This will take more time and research. Sometimes, there are conflicting social and technological components that are ineffective. As a result, coordinating these two approaches will be extremely beneficial. The main implications of the study for policy-makers are as follows: (1) establishing a structure for adaptation and mitigation strategies to reduce climate change by challenging experts to integrate climate change issues into the fields of land use, land reform, land tenure, and farm protection; and (2) establishing a smart approach that purposefully includes land reform champions, gatekeepers, and challengers; applies continuous information; and proposes strategies that could adapt to different socio-economic, political, and environmental contexts. Accordingly, it was proposed that SLG can promote shared growth and solve many land sector problems by considering all regulations of good land governance. In addition, the paper has argued that the improvement of adaptive land governance systems requires efficient land administration and management. Therefore, it is recommended to

(a) be highly responsible for food security, ensure the protection of tenure for all legal occupations of land, and pay more attention to environmental land performance;
(b) emphasize educating public administrators concerning the environmental and social effects of sustainable urban planning, land use, and the avoidance of unfavorable land use changes; and
(c) review laws related to changes in the use of agricultural lands and natural resources to achieve food and resource sustainability and security.

System dynamics techniques are recognized for their ability to involve stakeholders to increase model awareness, ownership, and use; these activities, particularly with regard to the use of flight simulators and public information platforms, are still not widely documented. As a result, the current global governance discourse reveals that the use of land management simulators, public relations channels, and educational, gender, and behavioral gaps in research requires more theoretical discussion as well as empirical research.

The present paper stresses the following three factors for further discussion. First, the discussion has not yet fully determined the meaning of economic governance and its conceptualization. There are a variety of methods that have been partially examined by this paper. Second, modern global governance systems, such as private–public collaborations, often refer to the need for a new research initiative that allows us to better understand how new legislative structures are evolving and being sustained and how to successfully legitimize them. Therefore, what is needed is a greater research initiative equivalent to the extensive sequence of comparative studies on international environmental organizations in the 1980s and 1990s. Third, increasing political polarization in the world is another issue that requires further study. It is important to further grasp how governance takes place at various levels. This includes, in particular, new approaches to understanding longstanding academic sub-disciplines (e.g., international relations and comparative politics). Much of this must obviously be discussed with regard to specific policies, which were considered in this study via the enhancement of the GEG's present structure and attention to the creation of a new global organization.

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