

## Governing Lunar Settlements

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### Abstract

Discussions about the future of space exploration have yet to address human settlement in outer space seriously. Human settlement is the growth of a civilization in outer space; it is the presence of a society that has advanced to such a degree that it has developed a culture and a way of life in a particular area [1].

Governance refers to developing management styles when private-public boundaries are not clear. Also, governance concerns collective decision-making, including public and private actors [2]. A system of governance must be created for the people and institutions planning to explore and develop the Moon. The structure of the lunar government and the timing of its creation are of critical importance. Lunar governance will commence with small groups of colonizers desiring quick solutions to their concerns. Some colonizers will prefer management on behalf of agencies from other countries. Wojtowicz and Szocik caution that we must craft the self-government form to regulate “social hierarchy, power distribution, decision-making approaches, kinship structure, and resource management” (p. 1) [3].

Models from public administration are critical for crafting governance models for lunar settlements. Applying public administration theory to lunar settlements involves using the theory’s existing principles to address the unique challenges of space governance. This includes considerations for “resource constraints, environmental conditions, community dynamics, and international collaboration,” among other concerns. As technology advances and affects space governance, we must reinvent public administration theories for lunar governance’s ever-changing needs. Zancan et al. caution that “the literature lacks a comprehensive outline of the roles and responsibilities across diverse project participant groups beyond the internal governance structures of space agencies” (p. 518). There must be an evaluation of paradigms to space settlement governance models that provide a greater understanding of how the Moon will be settled [4].

Countries planning lunar missions must collaborate and prepare protocols to avoid potential conflicts. “The ongoing development of such measures within the International Lunar Network, a collaborative initiative promoting calm and cooperative lunar exploration, underscores the significance of international collaboration in space governance” [5]. Del Canto Viterale raises numerous questions about governance and how power and decision-making are collaborated between lunar colonists (pp. 1-2) [6]. The governance of space activities has become “more fragmented, decentralized, and distributed across multiple levels or arenas, which require new examinations and explanations. Human habitats, whether on Earth or established from it, all need a form of administration according to some rules” [7]. Any governance model must include governance networks to curtail the effects of fragmented administration.

The traditional approach in space missions involves direct rule over the settlement by a mission leader or agency from Earth. We must be cautious that current military-based models will not be applied to governing lunar settlements when inhabitants are from countries with democratic principles [8].

The Space Generation Advisory Council states that a governance structure must be based on “(1) multi-stakeholder dialogue, (2)

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open-access and open opportunities, and (3) capacity building to be assimilated into future regulatory considerations” (p. 34) [9]. Schmidt and Bohacek suggest that space colonization must be founded on principles, rules, and norms, including a peaceful, stable, sustainable, and ethical society (p. 7) [8].

Exploration and use of the Moon depends upon the collaboration and interconnectivity of lunar colonists, a principle included in the Outer Space Treaty. The three elements of such governance, as identified by Horton, are “(1) become a permanent body with publicly shared precedent and reasoning, (2) create binding decisions with an appropriate enforcement mechanism, and (3) provide a forum for not only resolving disputes but also sharing information and discovery during space exploration” (p. 655) [10].

Miller states that outer space can be redefined as “the space outside of a celestial body’s gravity well relative to a state’s presence and perspective on that particular celestial body [1].” This model of celestial subjectivity changes the assumptions in our legal perspective of the universe by not permitting country competition for resources [1]. The celestial subjectivity model should be “interpreted so that outer space is subjective, depending on the location of a state, encompassing all celestial bodies outside of that state’s planetary gravity well” [1].

The Moon fits under the Celestial Subjectivity model. Moons are within the overall gravity of their planets, making them “eligible for national appropriation. If the underlying principle is to allow national appropriation, but national appropriation beyond a state’s planetary gravity” is disallowed, how can national appropriation occur. Applying this model to Article II, a country cannot claim sovereignty over the Moon [1].

To reward as many lunar settlers as possible, Collins suggests a model of “bounded first possession by landfall.” Bounded possession models offer the rights to lunar land, allowing settlements to develop their resources yet reserving land for future lunar settlers [11]. For some time, the Moon and its resources were *res communis*. However, the private sector has sought to alter this principle and interpret it as *res nullius*, where a lunar settlement does not belong to anyone unless someone seizes it [12]. It is about a possession leading to property and its resources, such as occupation, in which the possession becomes private property.

Unfortunately, the space treaties do not recommend a specific space governance model. The Moon Agreement did not include all nations wanting to colonize the Moon. Space settlements must consider a multilevel governance framework bounded by collaborative networks. This governance model names the primary stakeholders at each level of analysis within the network, specifying stakeholder roles, powers, and goals and recognizing the collaborative governance generated among them.

Several models of lunar governance are discussed, including direct democracy and *kibbutzim*, collaborative governance and governance networks, polycentric governance and multi-level governance (MLG), and adaptive governance.

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**Keywords:** Lunar Settlements, Governance, Collaborative networks, Polycentric governance, Direct democracy, Kibbutzim

## 1. Introduction

### 1.1. Governing Through Direct Democracy

Some have advocated for lunar governance using direct democracy. Direct democracy includes various decision processes, including town meetings and referendums. In a direct democracy, the lunar settlers would vote on these referendums during assemblies [13]. The Federalist Papers specified the need for a representational republic to ensure citizens were not subjugated through popular vote [14]. Assemblies include bodies designed to “set policy priorities, draft and fine-tune ballot initiatives, evaluate such initiatives, and approve or reject such initiatives” [15]. Human civilization on the Moon should not be a colony but an “independent, sovereign, autonomous political body” [16].

Elon Musk’s vision of ‘direct democracy’ in space governance (<https://www.youtube.com/shorts/1DPYaBOLz6U>) involves people voting directly on issues to limit any corruption, thereby reducing the potential for bribery compared to representative democracy [16,17]. To make direct democracy more deliberative, Gastill and Richards suggest that “random citizen assemblies could be merged with existing institutions and practices” (p. 254) [15].

However, implementing Elon Musk’s vision in a large lunar settlement is challenging. Social and economic classes will emerge when the colony needs workers who perform crucial yet unimportant tasks. This is vital for the vision of a lunar settlement that supports a settler’s identity because of these new challenges and makes the audience feel important. It is crucial to allow these

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lunar settlements to develop their technologies, governments, and values.

This presents the challenges and limitations of a direct democracy. Another challenge would be the struggle between the generations born and raised in the lunar settlement and the new settlers from Earth. Difficult living conditions on the Moon, such as catastrophes and epidemics, may need a more collaborative form of governance to maintain peace between these settlers. Therefore, a balanced and adaptable lunar governance model allows the settlers to appreciate the flexibility in that governance structure.

Direct democracy is more formal than some governance models. Still, the idea of decentralization, every person has a voice, creativity, and self-management, reflects the foundations of direct democracy [18]. A direct democracy reduces the power of one group or another trying to dominate others [18]. The rules of direct democracy decide how initiatives and referendums are applied, the participation by citizens, the timing of when initiatives and referendums appear on ballots, and even their outcome. However, direct democracy has quantitative and qualitative limits. Colonists cannot vote on all issues. As a new settlement with new problems, the number of initiatives and referendums would prevent constant participation and reduce the quality of these initiatives. This accentuates the need for a balanced and adaptable governance approach in any lunar settlement, making the audience feel the necessity of flexibility in governance.

From the perspective of deliberative democracy, many factors deteriorate democratic processes. Initiative and referendum processes rarely equip citizens with the knowledge to evaluate advantages, disadvantages, and tradeoffs. These challenges could be severe in space governance, where decisions have critical implications and require knowledge [15].

Often, direct democratic processes fall short of ensuring mutual comprehension among citizens [15]. One promising form of direct democracy is the Israeli kibbutz. Most scholarly works show that realizing autonomy, belonging, and adaptation in the kibbutz were the main reasons for its sustainability [19]. The kibbutz is conducted by direct democracy, and in only a few cases is representative democracy practiced. Most issues are discussed at a general assembly [19]. In a kibbutz, all members are on an equal footing in terms of political, social, and economic status, and they all have the same voting rights for enacting guidelines and setting policy, production of goods and services, and operation. This emphasis on equality in kibbutz governance fosters fairness and inclusivity among residents, strengthening their bond and commitment to the collective. All members set internal governance on the ballot after talks and discussions, thus indicating the majority's opinion and long-term trends [19].

All political, economic, and social affairs are available to all members in a kibbutz, for which meeting of all members has the

highest authority. One weekly meeting of all members has all members discuss and decide on development plans, significant operation decisions, and social activities. All committees are open to all members, and any kibbutz member may attend any meeting of these committees. Only directly relevant members can attend when the social committee discusses issues such as family disputes [20].

Kibbutzim established an ideal society owned by all its members, where all members could work and live together. The principle of equality among all members could be achieved [20]. The principle is "from each according to his ability, to each according to his need." The collective should take care of those without the necessary ability, and it is prohibited to hire any worker. Older adults perform easier work and are helped by the collective when life becomes difficult [20]. The residents' commitment to society fosters community and shared responsibility among all residents, heightening their dedication to the collective goals. The residents can become self-actualized, a necessity for lunar settlers while adhering to basic equality rules [20].

The high efficiency and yield realized by kibbutzim in Israel are closely related to its knowledge-based development. The kibbutz is a home, a workplace, and a settlement authority [19]. Members must weigh their interests against the common good. The majority opinion stands [19]. A kibbutz points to morals and values, offers protection against unnecessary adjustments, promotes "norms, practices, and behaviors," a method to sustain direct democracy, and includes a legal framework [19].

## 2. Governance by Collaboration

Collaborative governance has been defined as the "processes and structures of public policy decision-making and management that engage people across the boundaries of public agencies, levels of government, and the public, private, and civic spheres to carry out a public purpose that could not otherwise be accomplished" [21,22]. Primary stakeholders are linked. Each stakeholder's abilities are emphasized. This approach is required for a "shift from the [adversarial principles] of interest group pluralism and the accountability failures of managerialism" [2].

Ansell & Gash mention that collaborative governance stresses six essential criteria:

- i. public agencies or institutions commence the forum,
- ii. participants in the forum include stakeholders not related to any country,
- iii. participants engage directly in decision-making and not simply asked by public agencies,
- iv. the forum is organized and meets collectively,
- v. the forum aims to make decisions by consensus (even if consensus is not achieved in practice), and
- vi. collaboration focuses on public policy or management. (pp. 544-545)

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Collaborative governance converts adversaries into more cooperative ones [2]. Suppose some stakeholders do not have the ability, organization, status, or resources to be at the same level as others. The collaborative governance process can be adjusted to allow their involvement.

Scholars of collaborative governance have recognized that power and resource imbalances will affect groups' incentives to participate in collaborative processes [2]. Collaborative governance "displaces a technocratic model of top-down, command-and-control administration by emphasizing multisectoral collaboration, stakeholder engagement, and public participation" [22]. Collaborative governance supports a move from government agencies to collaborating stakeholders.

Facilitative leadership is a component of collaborative governance. It is essential to bring lunar settlement stakeholders together, encourage their participation, and be cooperative. Disputes between lunar settlers can be mediated as part of this governance model. Leadership is crucial for creating "clear ground rules, building trust, helping dialogue, and exploring mutual gains" [2]. Collaborative governance requires negotiation and building trust. Lunar settlers must support the collaborative process and support results from group deliberation as well as mediation. As Donald Kettl has argued, this model of governance is collaborative because it defies assumptions of bureaucratic public administration "built on a tight theory of hierarchy and authority" [22]. Collaborative governance "incorporat[es] public values" to build trust and enhance stakeholder involvement [22,23]. It is a legitimate element of contemporary public administration rather than government efficiency [22]. Cross-sector collaborative governance brings partners together, facilitates cooperation, and ensures all parties reach their objectives [24].

Collaborative governance networks can be crucial for the effective administration of lunar settlements. These networks involve the active participation of various stakeholders, including governments, private entities, researchers, and the public. By bringing together diverse perspectives and abilities, these networks can contribute to the success and sustainability of lunar settlements, making everyone feel included and valued. This is particularly important in lunar exploration, where the challenges are significant, and the need for diverse expertise is paramount.

Lunar settlements must establish collaborative frameworks involving space agencies from different countries and engage governmental and private organizations in cooperative efforts. These can include joint missions, shared research projects, and sharing expertise to ensure a collective approach to lunar settlement. Public-private collaborative networks can bring together the resources and innovation of private space companies with the regulatory oversight and public interest considerations of government agencies. Forming lunar exploration collaborative networks that unite multiple organizations, including space

agencies, private companies, research institutions, and international partners, can bring several benefits. These consortiums can pool resources, share expertise, and coordinate efforts to collaboratively plan and implement lunar exploration and settlement projects. This can lead to more efficient and effective outcomes and foster a sense of shared responsibility and achievement among the participating organizations. There must be collaboration among scientists and researchers specializing in lunar science, astronomy, biology, other relevant fields, service and technical stakeholders, and other lunar settlers. These networks can help exchange knowledge, data, and research findings to benefit lunar settlements.

Collaborative networks are necessary for the responsible and sustainable use of lunar resources. Networks include alliances focusing on mining, processing, and using lunar materials while adhering to ethical and environmental standards. This can foster innovation and efficiency in developing infrastructure and technologies for lunar settlements. Further, collaborative networks focus on education and outreach to involve other stakeholders in lunar exploration. These networks can promote STEM (science, technology, engineering, and mathematics) education, public awareness, and engagement in lunar activities.

Other collaborative networks include ethicists, legal experts, and policymakers to address ethical considerations and legal frameworks related to lunar settlement activities. This ensures that these activities adhere to international laws and ethical standards. Collaborate with space tourism companies to develop sustainable and responsible tourism on the Moon. This can include coordinating efforts to minimize tourism's environmental impact and ensure lunar visitors' safety.

Collaborative networks can handle complex tasks and problems and use social links to coordinate and safeguard exchanges and reduce transaction costs. Governance takes place within networks of complex interactions between all stakeholders. Often, public administrators use collaboration as a strategy to improve service delivery by "sharing information, resources, and capabilities through negotiation and jointly creating rules and structures to govern their relationships" [24]. Leadership can "construct networks, empower members, facilitate communication and interaction, minimize conflicts, align the interest of members, build trust, encourage creativity, model new roles, promote systematic thinking, and improve collaborative/network performance" [24.]

### **3. Polycentric Governance and Multi-Level Governance (MLG)**

Polycentricity theory emanates from Vincent and Elinor Ostrom's work. The term connotes a complex form of governance with multiple decision-making centers, each operating with some autonomy [25,26]. Rather than creating strict hierarchical systems, E. Ostrom proposes "designing multiple tiers of arenas that can engage in rapid discovery of conflicts and effective conflict resolution" [25,27]. Polycentric governance has various

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actors; it is interactive, connected, and affected by external forces [28]. Polycentric governance promotes “different rules for different systems, multi-stakeholder representation, mutually adjusting decision centers, and nested institutions with delegated responsibility” [29]. This model has overlapping decision-making because they are nested at multiple levels [27].

In the theoretical model of a functional polycentric governance system for the commons, the term “functional” refers to the capacity of the governance system to include three claims. These claims are that polycentric governance systems are “better able to adapt when faced with social and environmental change; they provide a good institutional fit for complex natural resource systems, and they mitigate the risk of institutional failure and resource losses” [27]. This ensures the resilience of polycentric governance in the face of changing social and environmental conditions, reassuring the stakeholders.

Polycentric governance is a common approach to policymaking involving multiple decision-making centers that prove independence and can participate in policy coordination [28]. Polycentric governance approaches effectively manage uncertain and changing conditions through adaptation [28]. This model generates a framework for resource governance in space, not as a monolithic system. Polycentricity describes a method of social organization in which individuals are free to pursue their goals within a general system of rules. They consider each other when competing [27].

To govern space resource activities, the Moon is not a uniform resource; it consists of many distinct resource systems, each with different physical features, use cases, and possibilities for contention [29]. The decision-making centers in a polycentric governance system include informal governmental bodies [27]. A critical function of overlap is helping information flow among decision-making centers [27].

A governance model like polycentric governance is the multilevel governance model (MLG). The governance of the space system has become “more fragmented, decentralized, and distributed across multiple levels or arenas” [6]. New paradigms and approaches that can offer a more comprehensive understanding of the increased complexity within the space system are needed [6]. A multilevel governance model (MLG) evaluates the relevance and implications of each level. The MLG model shows the most pertinent actors at each level of analysis, delineates their respective roles, powers, and goals, and recognizes the interactions generated among them [6]. The MLG model presents four principal levels or arenas within the space system (national, international, regional, and subnational), where many actors interact and decide space activities [6].

#### 4. Adaptive Governance

Adaptive governance includes mechanisms that allow for flexible rules, norms, and institutions that change over time because of

policy experimentation and new learning about the environment [28]. Lunar space activities include a diversity of stakeholders, more interconnectedness, and more links between space-related and non-space systems. This heightens the importance of adaptive governance, which involves mechanisms that allow for flexible rules, norms, and institutions that change over time due to policy experimentation and new learning about the environment [28].

First, adaptive governance involves the changing relationship of lunar settlements concerning the geopolitical and economic environment. Next, adaptive governance should be considered essential to any strategy to address risks when transformative technologies appear. Ezell posits that the vital role of adaptive governance is to mitigate catastrophic, existential, and suffering risks by developing adaptive structures (p. 8) [28].

Adaptive forums govern all stakeholders in the lunar settlement. They can govern their respective systems, creating and enforcing necessary regulations more effectively than existing structures. This makes them crucial to adaptive space governance [28]. Adaptive forums include representation of all stakeholders who are relevant to that which they govern. For example, all relevant stakeholders may have direct membership in an adaptive governance forum if a particular activity or resource only applies to a small group of stakeholders [28]. The number of groups and organizations has led to fragmentation in space governance [28]. Criticisms of the “polarization, bureaucracy, and the lack of adaptivity of current multilateral institutions are widespread” [28].

Inclusive and transparent negotiations are vital for legitimate governance in lunar settlements [9]. A robust conflict resolution mechanism is essential for adaptive governance [28]. The lunar settlement’s role in verifying that space operations follow technical standards and guidelines is vital to ensuring space activities’ safety and sustainability [28].

Adaptive governance effectively manages risky systems, fostering learning and information discovery, identifying gaps in data, and crafting networks to enable coordination between actors [9]. Risks include “resource depletion, transformative artificial intelligence (TAI), biological contamination, totalitarianism, directed panspermia, and digital minds suffering” [28]. Institutions involved in space governance tend to avoid addressing future issues [28]. Sustainable governance is critical for preserving and enabling activities across generations, upholding the right of all actors, present and future, to explore and use the Moon by promoting its technological and economic development [9].

#### 5. Conclusion

The exploration and potential settlement of the Moon present unique challenges and opportunities for governance. As humanity stands on the brink of establishing a sustained presence on the lunar surface, it is imperative to consider a structured governance framework that ensures the equitable management of resources,

environmental preservation, and the protection of human rights.

Effective governance for lunar settlements should prioritize establishing collaborative networks, drawing upon frameworks established through existing treaties such as the Outer Space Treaty. This treaty provides a foundational basis for the collective use of extraterrestrial resources and emphasizes peaceful exploration. Future governance models must include diverse stakeholders, from governmental entities to private organizations and indigenous knowledge systems, to reflect the collaborative spirit necessary for lunar exploration.

Establishing clear regulations regarding property rights, resource utilization, and environmental stewardship. As we consider the potential for mining activities and the establishment of sustainable habitats, policies that prevent conflicts and promote a shared vision for lunar development must be developed. These regulations should be adaptable to the evolving nature of lunar activities and innovative technologies.

Furthermore, public discourse and the involvement of various societal segments in selecting a lunar governance model must be established before landing settlers on the Moon. We must facilitate a collective understanding of lunar governance principles among stakeholders and the general public.

In conclusion, effective governance for lunar settlements is paramount to ensuring the responsible and equitable use of lunar resources. As we advance towards this new lunar frontier, we must learn from our terrestrial experiences and forge an inclusive, adaptive, and forward-thinking governance model that promotes collaboration, benefits future lunar settlers, and reflects our collective values as stewards of outer space [30-35].

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