

# Possible Futures for Local and International Law Applicable to the Governance of Moon Settlements as the Basis of a Settlement Strategy

*Anton de Waal Alberts and Peter Martinez\**

## **Abstract**

The stage has been set for humankind's return to the Moon. This time, however, the purpose is different as the objective has been set for a permanent presence as opposed to the historic exploratory and scientific missions. A permanent presence may result in an intention that is more than purely scientific and thus conduct different from that of the historical missions. While international space law does in broad terms regulate human conduct on celestial bodies like the Moon, there have been differing interpretations of the types of conduct sanctioned by the law. There are of course also activities that might take place in breach of the law with total disregard of any international order. Irrespective of what may unfold in the future, states and other space actors that intend to participate in any Moon settlement will have to prepare themselves strategically for varying degrees of uncertainty and unfolding futures to ensure a state of situational readiness in the settlement process. This work endeavours to showcase the strength of futures methodologies to establish a range of possible futures that can inform the future status of the legal governance system applicable to the Moon landscape. This in turn can serve as the basis from which strategy can be devised that could contribute to a successful settlement mission irrespective of the unfolding future.

---

\* Anton de Waal Alberts, Provincial Legislature, Gauteng Province, Johannesburg, South Africa. Peter Martinez, Secure World Foundation.

## **1. Introduction**

Humankind is planning to return to the Moon before the end of the current decade. States like the United States, China, the member states of the European Space Agency (ESA), and various new state- and private actors have aired their intention to establish human habitats on the Moon and make use of its resources.

In contrast with the previous human exploration of the Moon by the United States and the robotic missions by other states, like the USSR and China, the new paradigm is to return to the Moon permanently. Furthermore, in contrast with the national prestige-driven, state-borne missions carried out in the Cold War environment where states were the only actors, the New Space era is evident of the entry of private actors with their own commercial agendas. These new commercial actors conduct business in space of their own accord, but increasingly also find themselves in public-private partnerships with state actors.

This lays the foundation for a new system of space activities as it relates to the Moon and raises the question of what the nature of the new system of Moon-related space activities may be and how it might be governed.

This paper focuses on the probable and possible futures of the governance models that may unfold on the Moon. In establishing these probable and possible lunar governance models, certain Futures Studies (FS) methodologies will be used.

FS is of importance for strategy formulation in that it allows one to situate oneself within a futures paradigm. FS as a field of enquiry and its methodologies have grown in importance as a system whereby strategy can be devised and improved. The use of FS methodologies can enhance the power of strategy by creating a futures roadmap that overlays and informs strategy. In this sense strategy does not become a mere wish list of the future, but establishes foresight in possible and probable futures.

## **2. Lunar Space Law**

The space law rules currently applicable to the Moon arise predominantly from the five space treaties. In future more rules might emanate from international custom as states conduct themselves in a certain manner and intent in relation to lunar governance.

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty (OST)) is the most salient. All four subsequent treaties flow from the Outer Space Treaty, which underscores its importance as the first, most comprehensive and most legitimate treaty (in terms of the number of state ratifications). In contrast the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement), which

provides for celestial body governance, does not have the legitimacy of the other treaties due to its near universal rejection by states. Therefore, most current rules arise from the first four treaties.<sup>1</sup>

For the purposes of this paper the two most salient and problematic rules arising from the Outer Space Treaty are as follows:

**Article 1:** The exploration and use of outer space shall be the province of (hu)mankind and states (and non-governmental entities that are subsidiary to states) are free to explore and use space, and celestial bodies like the Moon.

**Article 2:** Outer space, including the Moon and other celestial bodies, are not susceptible to claims of national appropriation by claim of sovereignty.

Therefore, while the point of departure is that space actors have freedom in space, the replication of the global social order on planet Earth in the form of a state system based on sovereignty is prohibited. This bounded freedom might be tested in future as set out *infra*.

### 3. Futures Studies

#### 3.1. Nature of Futures Studies

Future Studies (FS) is a fairly new field of enquiry that acknowledges that the future cannot be predicted (*clairvoyance*) but can be studied in the form of plausible futures, probabilities and possibilities that establishes foresight (futures consciousness) for the sake of preparing for plausible, possible events (*prevoyance*).<sup>2</sup> Therefore, understanding the factors that influence the future ensures agility, robustness and antifragility, but also allows for the visioning of a desired future or futures that can be achieved through planning and action.

#### 3.2. Futures Methodologies

FS methodologies can be broadly classified into quantitative (e.g. time-series trends) and qualitative (e.g. environmental scanning, scenarios) methods with some subdivisions, e.g. Technological Futures (TF) (e.g. S-curves). It has become practice to combine quantitative and qualitative methodologies to mitigate the weaknesses of each and provide for a comprehensive and holistic study of the subject matter.

#### 3.3. Methodology Selection

The methodologies selected must fit the nature of the system being studied and align with the ontology of the subject matter.<sup>3</sup> In this paper the

---

1 United Nations Office for Outer Space Affairs, United Nations Treaties and Principles on Outer Space, UN Publication, New York, 2008.

2 B. De Jouvenel, *The art of conjecture*, Basic Books, New York, 1967.

3 K.E. Boulding, *The world as a total system*, Sage Publications, Beverly Hills, 1985.

Biomatrix systems approach will assist to establish the ontological base from which the *problematique* of possible futures will be answered. The S-curve methodology will build on the systems approach by providing an exposition of the past and intuitive projection of the possible futures of governance systems on the earth and Moon. This enquiry will be further informed by devising scenarios of possible future governance systems to come to an integrative conclusion.

### **3.3.1. Biomatrix Systems Approach**

As systems thinking is required in FS, systems terminology must be used in FS applications. The Biomatrix systems methodology will form the basis of the systems thinking used herein as it represents a holistic approach that encapsulates most of the current systems approaches.<sup>4</sup>

### **3.3.2. S-Curve**

The S-curve is usually used in relation to technology futures, but as it is a method that reflects all forms of growth, including in nature and psycho-social systems, it may be applied to a variety of domains. Interestingly Modis argues that the S-curve reflects a natural law: “No niche in nature was ever left partially completed under natural circumstances and that is why logistics possess forecasting power”.<sup>5</sup>

The S-curve (or the logistics curve) is used to indicate the performance progress of a system (natural or psycho-social) over time by marking its stages of birth and infancy, explosion and later gradual maturation. The S-curve can model possible futures.

The S-curve consists of the following stages:

**Birth and Infancy Phase:** The introduction and incubation period, where the technology is seen as having potential, but there are still significant problems to overcome before the technology can become mainstream, also referred to as the winter period, the most difficult but also the most fertile season with high innovation and creativity.

**Explosion Phase:** The next phase is one of rapid improvement in the technology as incremental performance improvements and cost-efficiency take place. The technology normally finds application in higher volume markets during this phase. This is known as the summer phase where innovation is not needed.

**Maturity Phase:** The last phase is one of maturity as the technology proximate a natural or physical limit that cannot be breached with the onset of another winter.

---

4 E. Dostal, A. Cloete, G. Járos, Biomatrix, Mega Digital, Cape Town, 2007.

5 T. Modis, The Strengths and Weaknesses of S-Curves, Technological Forecasting & Social Change, (2007).

The S-curve can be used to model the growth of technology, the psychosocial system wherein the technology emerged or the user uptake/ adoption rate of the technology (the market expansion). The modelling may be based on data or can be qualitative reflecting intuitive insights.

*In casu*, the state system will be qualitatively modelled as the salient psychosocial system within which space technology is developing and used.

### **3.3.3. Scenarios**

Scenarios explore the emerging landscape and the possible futures that may come into existence. Scenarios are not intended to be accurate forecasts, but to focus and prepare against the backdrop of a complex and uncertain future. Human existence is one of increasing complexity (systemic disequilibrium with non-linear feedback loops) with the unrelenting increase of human actors and conduct (psychosocial and technological systems) and the changes taking place in the environment (natural systems). Scenarios identify the concerns of participants and simplify the factors that shape the future for the sake of discussion and reflection. The factors may emanate from the social, technical, economic, environmental, and political (STEPP) domains.

Scenarios may consist of two or more possible futures and there is no one correct way of preparing scenarios. However, Roux proposes the steps that will be applied *supra*.<sup>6</sup>

## **4. The Future Governance of the Moon: Application of Futures Methodologies**

### **4.1. Point of Departure**

Despite the rise of the commercial era of New Space, current space law still views the state as the dominant actor. This position accords with general international law where the state is still the major constituent entity of the world social system. The renewed push to return to the Moon is also state-driven even though private enterprise is participating in the form of public-private partnerships or subsidiary service providers.

This raises the question of whether the current state of affairs might continue into the future and establishes the central rationale of this paper, namely to ascertain what the possible forms of governance on the Moon might be in the future.

As the state is currently the dominant actor to drive the Moon settlement initiative, it is apt to have regard to the history of the state. In this regard the S-curve will be used to illustrate the historical development and possible futures of state formation and proliferation.

---

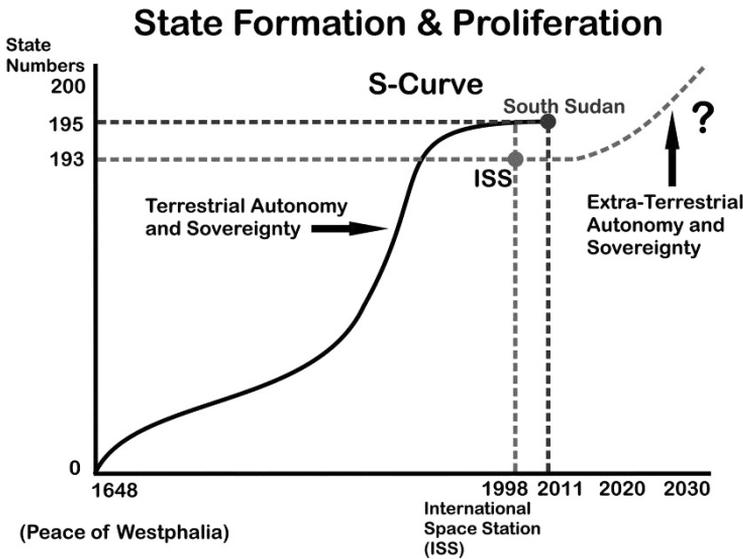
6 A. Roux, *Advanced Futures Studies – Scenarios*, University of Stellenbosch, (2009).

**4.1.1. Brief History of the State by Application of the S-Curve**

The modern nation state (also referred to as the territorial state) emerged in 1648 at the Peace of Westphalia. Since then, the state proliferated and spread across the world to become the main constituent entity of the global psycho-social system.<sup>7</sup>

The growth and proliferation of the state since 1648 has shown the following characteristics (as visually represented by using an S-curve in Figure 1 hereunder):

**Fig. 1. S-Curve: State Formation and Proliferation**



**Birth and Infancy Phase:** The Peace of Westphalia brought about the end of the Thirty Years War and the overarching authority of the Roman Holy Empire over much of Europe. Social systems of governance like the land-based feudal system and the macro-systems of the Roman Holy Empire and Catholic Church had up until that time been the dominant forces of social organisation. As a result, the emergence of territorial units with strong centralised governments were obstructed until the Peace of Westphalia. The new state system took hold in Europe first where the first modern states emerged and proliferated. Since it was a new psycho-social invention (with roots deep into the past), it was limited to Europe in its initial stages.<sup>8</sup> The

7 J. Dugard, M. du Plessis, T. Maluwa & D. Tladi, *Dugard’s International Law A South African Perspective*, Juta, Claremont South Africa, 2018.

8 *Ibid.*, n7.

colonial expansion of European states across the world seeded the concept of the nation state and self-determination deeply in the new territories that were up to that point mostly governed in different styles. Kegley and Wittkopf remark that “the result was the eventual universalization of the European state system” with Europeans governing “a third of the globe by 1800, two-thirds by 1878, and over four-fifths by 1914”.<sup>9</sup>

**Explosion Phase:** The period of decolonisation (state formation and proliferation) started in 1776 when Britain had to release its thirteen North American colonies that were to become the USA. Between 1775 and 1825 ninety-five colonies were released. However, from the 1870’s a second wave of colonisation washed over the world.<sup>10</sup> This time the USA and Japan joined the European states and by 1914 near all of Africa was governed by just seven European states. The whole of the Far East and Pacific were colonised save for Thailand, Japan and China to a certain degree.<sup>11</sup> Therefore, the beginning stages of this phase of state formation and proliferation was volatile with progress and regression. The start of the Explosion Phase inflection point came after the First World War where the colonies of Germany and the Ottoman Empire were placed under trusteeship of states pending their eventual self-rule. This phase truly took off from 1947 onwards starting with the sovereignty of India and Pakistan. The third wave of state formation and proliferation started during the 1990’s as the Cold War came to an end freeing satellite states bonded to the USSR in mostly Eastern Europe. This third wave was considerably smaller than the second indicating a slow-down of state formation and proliferation.

**Maturity Phase:** State formation and proliferation has reached a stage of relative maturity with few new states joining the global state system. The last state to join was South Sudan in 2011. Thus, 363 years since the Peace of Westphalia the state system has spread across the world and have reached maturity.

However, two new significant developments have taken place that may be indicative of the beginnings of renewed S-curves of state formation and proliferation or some derivative thereof. These new S-curves have originated parallel to the state S-curve and seems to be cascading beyond it. The new developments are as follows and are also illustrated in Figure 1:

**Terrestrial Development – Minority Rights Movement:** On planet Earth the global state system and its borders does not reflect the contours of peoples and ethnic groups as psycho-social entities. The result is that no country

---

9 C.W. Kegley Jr, E.R. Wittkopf, *World Politics – Trend and Transformation*, St. Martin’s Press, New York, 1989.

10 *Ibid.*, n9.

11 *Ibid.*, n9.

today is entirely homogenous. The UN Development Report of 2004 states that the “world’s nearly 200 countries contain some 5,000 ethnic groups. Two thirds have at least one substantial minority—an ethnic or religious group”.<sup>12</sup> Many of these groups subsumed under state authorities where they do not have much autonomy over their own affairs are actively seeking more autonomy and even sovereignty within their own territorial state. The Unrepresented Nations and Peoples Organisation (UNPO), an activist organisation that internationally represents some of these peoples and ethnic groups, currently has a membership of 39 groups. However, its own historical membership is indicative of the drive towards sovereignty. The following erstwhile UNPO members have successfully formed new states: Armenia, Myanmar (Burma), East-Timor, Estonia, Georgia, and Latvia.<sup>13</sup> Those who cannot form new states as yet or may never be able to do, however, agitate for more autonomy within the host state within the norms of minority rights. Given the great number of peoples and ethnic groups caught and subsumed within the state system, much potential exists for further state formation and proliferation for those non-dominant groups who do not find remedial comfort via minority rights. Importantly, as very little open space is left for new state formation, it will mostly have to take place by existing state division. While the existing state system is protected by the international law principle of *uti possidetis* – though being eroded by the principle of self-determination as a peremptory norm (*jus cogens*) – that negates the redrawing of state boundaries to accommodate peoples and ethnic groups, the third wave of state formation that took place after the end of the Cold War could be indicative of both the beginning of the end of the first S-curve of state formation and proliferation and of the beginning of a new S-curve of the division of existing states to accommodate peoples and ethnic groups in their own states. As with the beginning of all S-curves this period looks volatile, but if it persists could find an inflection point to take off into the Explosion Phase.

**Extra-Terrestrial Development – New Space Movement:** The New Space period has resulted in an explosion of space activity by non-state commercial actors. However, these activities still take place via the state system in the form of subcontracts. Despite this arrangement, states and commercial actors have achieved the following forms of extra-terrestrial governance:

- During the Cold War the USA, USSR, and Europe managed to launch manned and unmanned space vehicles for exploration and use purposes in accordance with Articles 1 and 2 of the OST.

---

12 United Nations Development Programme, UN Development Report, UNDP, New York, 2004.

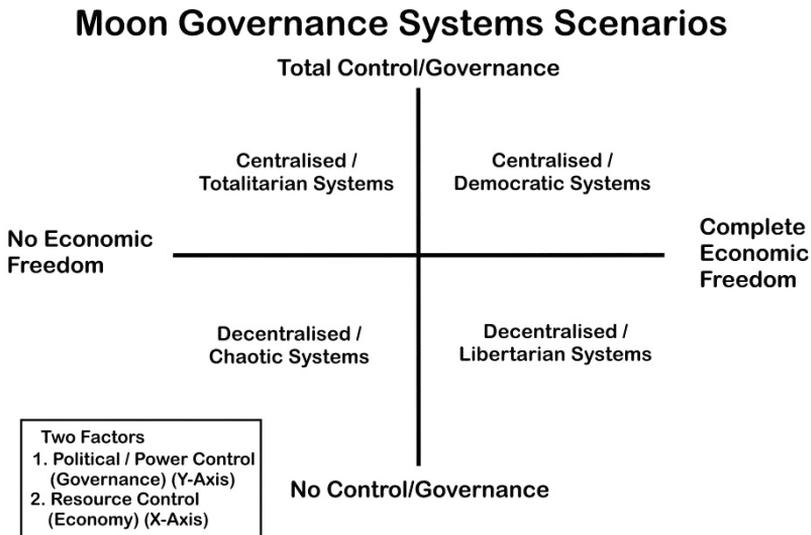
13 Unrepresented Nations and Peoples Organisation, Members, 2020, <https://unpo.org/nations-peoples> (accessed 19.08.20).

- In 1998 various states entered into the International Space Station Agreement (ISS Agreement) whereby a partnership for exploration and use of space was cemented. While no national appropriation by way of sovereignty was intended or took place, a new form of governance was established: not quite sovereignty, but a strong form of co-governance flowing from each state’s internal political system and the external international law system of equality of sovereign states. The ISS Agreement can be regarded as the truly first new form of governance to be established extra-territorially and might be the very early beginning of a new S-curve of some sort of state extension or even formation.<sup>14</sup> This is so indicated in Figure 1.

**4.1.2. Future Moon Governance: Scenarios**

Four scenarios of possible future Moon governance modes are depicted in Figure 2. The scenarios are emergent from the ontological basis established by the Biomatrix systems view, the life-cycles of the state as evidenced by the S-curve and the scenarios-process described herein.

Fig. 2. Moon Governance Systems Scenarios



14 A. Alberts, P. Martinez, An Examination of the Major Space Cooperation Forms between States as Models for the Development of Similar Forms for International Joint Ventures on Other Celestial Bodies, IAC-17,E7,7-B3.8,8,x39656, 66th International Astronautical Congress, Adelaide, Australia, 2017, 25-29 September.

Roux' 6-step process were used to devise the four futures scenarios:<sup>15</sup>

**Step 1:** Identify key concerns of the scenario users;

**Step 2:** Identify the driving forces of the concern;

**Step 3:** Analyse the driving forces and assess the importance of each: social, technological, economical, environmental and political (STEEP);

**Step 4:** Select the main themes/assumptions around which the scenarios are to be constructed: this step involves elaboration on the selected drivers. In this case the political driver is to be used in conjunction with the economic driver to establish possible future Moon governance scenarios. The political driver informs both the state and private actors' conduct and governance. However, without resources there can be little political action, and thus the political and economic drivers form the most crucial drivers within the STEEP-model that inform and affect any other drivers. In order to establish the four scenarios Figure 2 exhibits four quadrants on a crossing perpendicular X- and Y-axis. The X-axis represents the economical or resource control with the extremes on the left representing "No Economic Freedom" and the right "Complete Economic Freedom". The Y-axis represents the political/power control in the form of governance with the extremes at the top representing "Total Control/Governance" and the bottom "No Control/Governance".

**Step 5:** Develop the scenarios: The four future Moon governance scenarios – as based on the X- and Y-axis – developed naturally and logically into the following possible governance basis for states and other authorities:

**Quadrant 1: Centralised/ Totalitarian Governance Systems:** entities with these governance systems are centrally regulated, static, closed and exhibit anything from strong to total control/governance and little to no economic freedom. These systems tend to be self-governed and closed for external governance via international law due to the governing authority vesting in the system itself.<sup>16</sup> Usually, the internal and external relations are based on threat or coercion. External relations may, however, open up and be cordial or friendly (exchange and integrative relationships) based on the interests of the entity. Currently all dictatorial states and those with a highly diminished or faux democratic system and limited to no market freedom fits into this quadrant. Examples would be: North Korea (in the extreme), Cuba (though opening up slowly) and China (with regulated and open market overlapping into Quadrant 2).

**Quadrant 2: Centralised/ Democratic Systems:** entities with these governance systems are centralised unions with various degrees of democracy and exhibit

---

<sup>15</sup> Ibid., 6.

<sup>16</sup> Ibid., 4.

anything from strong to total control/governance and average to complete economic freedom. These entities are stable and tend to be economically dynamic. These systems are self-governed, but are open to various degrees of external governance. External relations are based on a mixture of threat, exchange and integrative relationships depending on the interests pursued. Centralised democracies with limited to extremely free market economic systems fit into this quadrant. Examples would be: Russia, South Africa, and many social democracies in Europe, like the Netherlands, Finland, France etc.

**Quadrant 3: Decentralised/ Libertarian Systems:** entities with these governance systems are to various degrees politically decentralised, from limited federal powers to confederal powers based on subsidiarity (all powers should be vested at the lowest level of responsibility).<sup>17</sup> Furthermore, economic governance is also to various degrees free from control, i.e., from limited to complete *laissez fair* market freedom. These systems tend to be super-dynamic in economic activity with little central control. Self-governance is important as well, but in a decentralised form. There exists an openness to external governance, but not at the expense of internal freedoms. External relations are based on a mixture of exchange and integrative relationships depending on the interests pursued. Threat relationships arise where the entity is being threatened itself. Federal and confederal democracies with limited to extremely free market economic systems fit into this quadrant. Examples would be: Switzerland, Germany, Belgium, USA, Canada, and Australia.

**Quadrant 4: Decentralised/ Chaotic Systems:** entities with these governance systems vary between decentralised power and systems with no coherent governing order into the extremes of chaotic systems. Economic freedom is severely curtailed by its chaotic nature. The more disorganised and random the system, the less economic activity can take place. At the extremes the system is revolutionary. Usually, these systems do not last and transition into another state in any one of the three other aforementioned systems in quadrants 1 to 3. Examples would be: historically the Wild West-period in the USA, the Great Trek-period in South Africa, and currently various countries under the rubric of fragile states like Zimbabwe, Somalia, and Iraq.

**Step 6:** Analyse the impact of the scenarios: while the impact of the scenarios will be dealt with *supra* under the heading of strategic insights together with the results of the S-curve enquiry.

---

17 K. Malan, *There is no Supreme Constitution – A Critique of Statist-individualist Constitutionalism*, Sun Press, Stellenbosch, 2019.

## **5. Strategic Insight Emergent from the Enquiry**

The S-curve and scenarios have enabled the establishment of foresight into possible futures that can inform any strategy for Moon settlement.

### **5.1. Historical Insights with Hints of Futures**

The S-Curve enquiry has revealed the following conclusions:

- The nation state system is still the main constituent entity of the global psycho-social system.
- The nation state system reached proliferation maturity in 2011 with the formation of South Sudan. Since it has spread across the globe, new nation states can now only be formed by subdividing existing states.
- The driving force for the formation of new states from existing ones should emerge from the minority rights movement where peoples and ethnic groups who are dominated by majoritarian groups are striving towards more independence in existing states. As indicated by the membership of UNPO where many have progressed from 'stateless' peoples and ethnic groups to sovereign states, this global movement is strong, especially since self-determination is now regarded as a *jus cogens* in international law. It is also possible for some of these peoples and ethnic groups that never achieves the establishment of an own state on Earth, to further their cause on the Moon and other celestial bodies in the future. Given the long drive for freedom on earth, there is currently little reason to see that drive diminishing extra-territorially. Chances are that new settlements will give rise to new identities on the Moon and other celestial bodies that will co-mingle with the terrestrial groups to achieve freedom in the sovereign form.
- The models of co-governance and cooperation found in the ISS Agreement will probably be the starting template for most Moon settlements. Most states will in some way cooperate due to the difficulty to establish Moon settlements at first. However, once settlements have stabilised and matured and the settling powers are more self-assured, they could start acting out of more self-interest resulting in an increase in competition and overt sovereign intent.

### **5.2. Futures Insights**

The scenarios enquiry has revealed the following conclusions:

- The governance forms and systems that have historically developed on Earth can possibly be replicated on the Moon with all of their benefits and drawbacks.

## POSSIBLE FUTURES FOR LOCAL AND INTERNATIONAL LAW APPLICABLE TO THE GOVERNANCE

- The scenario quadrants are not static and may represent various stages in an entity's possible future development. They are thus snapshots in a given space and time that can lead to another phase transition.
- The scenario quadrants represent possible futures of entities like states or other entities like intergovernmental organisations and authorities of whatever nature. One must thus be cognisant of the possibility that other state-like or corporate-like or other yet unfathomable entities might evolve around power that may exert sovereign-like influence.
- The scenario quadrants can also represent the status of the overarching psycho-social system encompassing all entities on the Moon (the Moon psycho-social system) at a given moment. As more actors settle on the Moon, the psycho-social environment will become more complex. The global psycho-social system might evolve along the lines of the Earth's system or into a novel system;
- Space law may experience different possible dynamics. The quadrants can be aligned to space law futures where no entities act in breach of the OST by claims of national appropriation. However, states or other future unknown entities, e.g., an independent company by itself or using weaker states as proxy, can decide to establish sovereignty in competition with other states and in breach of the OST. This could happen quickly or over time. Should an increasing number of states act in breach of the OST the legitimacy of the OST and space law in general may come into questions with a reset in the offing. At first acts in breach of the OST will be simply illegal and have no legal status, but a great number of such acts of breach will eventually have a political effect which may change international law. It may even result in two or more international legal regimes where different groups of entities have differing views of the law on the Moon.
- The scenario quadrants may co-exist with public commons. Examples are the open seas and Antarctica.

### 5.3. Fusion of Strategic Insights

In essence, the following themes can be discerned from this study:

- The weight of history provides momentum that can result in a future with all the fault lines inherent in the existing global state system. Humans are now faced with a new start as they prepare to venture back to the Moon, this time with permanent settlements in mind. This means the time for devising a new strategy embedded in reality has now arrived.

- A new visionary pull can be devised of which the seeds can now be sowed for a better future. Such a vision should not be ignorant of the past and its possible reflections in the future, but could be optimistic about structural shifts to avoid the worst of the current and past psycho-social governance systems.

## **6. Conclusion**

While the future is mostly unknowable, ideas about the future can be explored which leads to ideas on how to mitigate possible unwanted futures and to plan for the creation of a desired future. This study and enquiry have shown how FS methodology can be used to do the heavy lifting in exploring those possible futures.

Strategic insight and foresight can emerge from these futures exercises that can lead to the creation of a better future, the one we want and not the one that the weight of history imposes on us. We do not have to repeat the mistakes of the Earth on the Moon and other celestial bodies. We can, and should, do better in space.