Coopetition in Mearth. A Strategy Beyond Rivalry to Develop the Moon-Earth Ecosystem

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Abstract

The space economy, which refers to the diverse economic activities and industries that are related to outer space and space exploration, has been steadily growing over the years and has become a significant driver of technological innovation and economic growth. The growth of the space economy has been facilitated by technological advancements, reduced launch costs, and increased participation from private companies.

This paper explores a new geographic space called "Mearth", representing the Moon and Earth as a unified space. Specifically, the paper focuses on the innovations developed within the Mearth ecosystem that can contribute to an improved future. It is a conceptual-theoretical paper aiming to identify viable solutions to attract investments, generate technologies, and establish a new ecosystem within the novel geographic space of Mearth. This contribution supports the view that the coopetition strategy - essentially entailing cooperation among competitors - could represent the most suitable approach to join efforts to implement Mearth's economic system and its ecosystem. The primary reason lies in this strategy's ability to align the divergent interests of the ecosystem stakeholders. In terms of outcomes, the paper shows that a coopetition strategy leads to win-win solutions and will benefit all stakeholders in the Mearth ecosystem.

Keywords: Mearth; coopetition; innovations; strategy; space economy.

JEL Classification: O30; M20; D20; C71.

Introduction

Space is no longer the exclusive domain of governments. Recent technological advances in manufacturing, propulsion, and launch have made it much easier and cheaper to venture into space and conduct missions. Most importantly, lower costs have opened the door both to new startups and large established corporations to explore new opportunities that were once considered too expensive. With decreased costs and enhanced technological capabilities, businesses can begin to conduct large-scale activities, seize emerging opportunities, and potentially secure enduring and first-mover advantages.

Digital technologies such as artificial intelligence, autonomous robotics, manufacturing sensor tech, 3D Printing, and new efforts in R&D are enabling the creation of fully reusable low-cost rockets for the very first time. Moreover, together with the decrease in satellite launching costs, there are new technologies that can be embedded into satellites. These encompass higher-resolution sensors to help with advanced weather forecasting, improved precision GPS navigation capabilities, the ability to generate image and video captures, the ability to monitor crops while detecting soil moisture, the ability to look further into the universe while extending their reach to map the ocean floor, among others. Furthermore, the increasing adoption of digital technologies in space drives down costs associated with activities such as information gathering (referred to as search costs) and the replication of digital

goods, effectively approaching zero. Additionally, the cost linked to transporting information stored in bits is nearly negligible (Goldfarb and Tucker, 2019).

There are already numerous important space-for-Earth applications in sectors like agriculture, energy, manufacturing, mining, and insurance. In the not-distant future, a greater number of people may be able to live and work in space. Given the combination of lower costs and more sophisticated technology, increasing beyond-Earth activity is expanding the scope of human economic endeavors, with the potential to one day extending to the Moon.

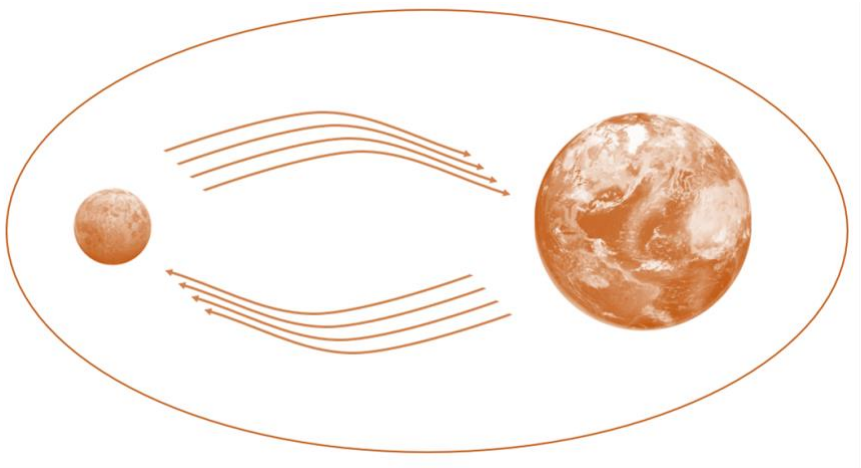
The potential establishment of permanent structures on the Moon and the regular movement of people, goods, and services between the Moon and Earth could collectively give rise to a unified economic system and ecosystem. This integrated system could be referred to as "Mearth."

This paper delves into the theme of innovation as a powerful tool to develop technological solutions for solving the Mega Challenges that humanity faces. Therefore, the purpose of this paper is to expedite research and identify solutions that facilitate the realization of the Mearth ecosystem. Simultaneously, our contribution emphasizes that a coopetition strategy is best suited to align the incentives of diverse stakeholders within the Mearth ecosystem over a sufficiently extended period, thus fostering innovations.

1. What is Mearth?

“Mearth” is the merging of two words into one. The Moon and Earth together form Mearth as depicted in Figure 1. Mearth defines a new geography. Specifically, Mearth represents the geography and the interconnectedness of Earth and its satellite planet, the Moon. The Moon is like a new continent connecting to the Earth through the space between the two celestial bodies. This new geography has the potential to give rise to a Mearth economic system and a Mearth ecosystem.

Figure 1. Mearth = Moon + space between the Moon and Earth + Earth



If we consider the Mearth economic system instead of the economic system of a single planet (for example, the Earth alone), we will have the potential for a much more expansive economic system. A major implication for economic analysis resulting from this expansion of the economic system is the emergence of a scale-up effect. This effect encompasses various facets.

First, the scale-up effect brings about a more extensive geographic and economic space, where it is possible to produce and market new goods and services. This expanded geographical space represents a more complex economic system that offers more opportunities in terms of technologies, industries, and trade. However, at the same time, it causes greater challenges accompanied by risks and uncertainties.

Secondly, the scale-up effect could determine economies of scale that, in turn, cause diminishing average costs. Consequently, suppliers could enjoy more favorable economic conditions, such as cost reductions,

heightened productivity, and increased profits, while customers could reap greater benefits, including access to new products, services, and enhanced welfare.

Thirdly, this scale-up effect carries implications for resources. The potential for increased resources emerges, unrestricted by the dimensions and capabilities of Earth. This does not imply an automatic transformation of resources into infinite quantities or a guarantee of enhanced consumption efficiency. Rather, it suggests that by fostering the development of appropriate technologies and innovative endeavors, we could shift away from a scarcity mindset and effectively harness a greater abundance of resources, potentially considered as "infinite" resources.

The literature on strategy defines a business ecosystem as the interconnected network of organizations, including suppliers, distributors, customers, competitors, but also government agencies - involved in the delivery of a specific product or service. The fundamental idea is that each entity within the ecosystem exerts influence on, and is influenced by, the others. This dynamic interplay results in an ever-evolving evolving relationship where each entity must be flexible and adaptable in order to survive.

Being a part of a business ecosystem provides mechanisms to leverage technology, harness creativity and innovation, share insights, skills, expertise, and knowledge, achieve excellence in research and business competence, create improved products, and compete effectively against other companies[1]. To build Mearth entails the bringing together of more minds, capital, and resources. Consequently, the combined efforts' value will effectively expedite the creation of Mearth. Furthermore, because Mearth broadens the geography of business opportunities that enables the expansion of the business ecosystem, we therefore can envision participants enhancing their capacity to benefit from and achieve the goals of the business ecosystem.

Organizations are seeking to attract investments, such as the Project Moon Hut Foundation, in order to develop technologies and establish a new ecosystem within the innovative geographic space of Mearth (Moon+Earth). The goal is to contribute to an enhanced future through innovations generated within this ecosystem. For instance, innovations like CAT scans, solar power, cloud computing, cordless power tools, fire department clothing, air filtration, water purification, and more have emerged as a result of efforts to develop technologies for space exploration. These innovations ultimately contribute to improving the lives of all species on Earth.

2. Innovation as Strategic Tool

The key strategic tool of the new ecosystem is innovation**.** In building a Mearth ecosystem, the focus is not on science, research, and exploration as NASA and comparable national space agencies are, but rather on the development of the infrastructure and the means to establish a Moon-Earth economy. The action involves the leveraging of innovations that come out of the endeavor, because engaging in the endeavor to establish a permanent facility on the Moon (*i.e.*, the "Moon Hut") generates the ideation needed to solve challenges in a harsh environment with extreme conditions such as on the Moon and in outer space. Consequently, this process could facilitate the resolution of numerous challenges similar to those we also have on Earth.

More precisely, the aim is to create an environment of ideation that might directly impact basic life functions (air/quality, food, water, health, reproduction) and advanced technological functions (energy, engineering, computing), and social interactions (society, science, education). These innovations, in turn, will directly and indirectly impact the next generation of ideation and merge with other ideas to produce a cascading and exponential effect. This perspective might influence, or better yet create, entirely new ideation pipelines that give humanity new means by which to live differently. For example, the technology we use today within a simple mobile phone – to

[1] In the ecosystem you build alliances as an engine for progress, especially when the parties involved look at the future (Goldsmith, 2012).

make calls, to transmit data, to locate things with GPS, and to forecast weather -- are “beyond-Earth technologies” and, in fact, were created and leveraged for the first time for this reason. The underlying tech to make this happen has been the expanded satellite communications industry that makes our lives possible today.

Innovations and new technologies constitute the great lever for advancing the technological frontier and production possibilities not only in the economy of the Earth planet, but also in the Mearth economic system. Furthermore, innovations and new technologies in the space domain *(i.e.,* developed for space) such as, for example, robotic arms, miniature cameras and other sophisticated technologies, will enrich not only the capabilities to seize new opportunities in space, but can be useful in our planet, and they can be considered part of the Mearth ecosystem.

The fast development of innovation and new technologies is a priority because our world is changing rapidly and so are the challenges. The faster and more effective development of new technological solutions that the construction of Mearth ecosystem will involve also have huge spin off benefits including the potential to change people's behavior.

The pursuit of establishing the Mearth ecosystem through various specific projects, as envisaged by a complex project such as “Moon Hut”, is to advance engineering and science, design and development, human relations and human behavior, the how we work and live together so we can solve major challenges. The development of a Mearth ecosystem also means changing how we think about ourselves and the world around us, the habits we engage in and what we consider to be valuable as a species and not just having better tools or toys for us to use.

Furthermore, the Mearth ecosystem is not just making the innovation equation happen. As a matter of fact, there are many ideas that will not work or be commercialized for beyond Earth. Likely that most innovations won’t work - yet people don’t often just give up after they have worked on an idea for years. Often inventors, investors, and people in general pivot and redirect their energies, with the same innovations to new areas of use. For example, there may be 23 organizations working water purification systems, if one is selected to be the contract winner for a project the other 22 don’t close their doors, they will most likely look to leverage the innovations they’ve developed and look for other practical applications.

Ben Duval (2023), in his short paper “Using Intellectual Property and Tech Transfer to Align Long-Term Incentives”, reminds us that the success of Mearth depends fundamentally on spurring innovation and technological development. He discusses the use of innovation as a means for attaining a self-sustaining Moon-Earth ecosystem. Duval's (2023) central argument is that the economic challenge of spurring any large technological leap lies in the difficulty of aligning the incentives of diverse stakeholders over a long enough period. Bringing together numerous experts from various disciplines to address intricate technical and organizational issues undoubtedly serves as a potent catalyst for innovation. However, achieving the goal of Mearth—integrating the Moon and Earth into a self-sustaining ecosystem - poses a considerably more formidable challenge.

In Duval’s view, the simplest way to do this might be to invest massive capital investments over many years, with no guarantee of return. This possibility, which can be called a “centrally-dictated vision”, however, usually belongs to governments and large corporations, as the scale of necessary investment far exceeds the resources of any typical organization. On the other hand, waiting for a decentralized ecosystem that can generate the needed innovation would take too long. The question then becomes: Is it possible to build out a Mearth ecosystem and related projects by capturing the best aspects of both types of incentive structures? In other words, can we combine a centrally-dictated vision with decentralized actors?

The answer depends in large part upon the way incentives are structured. If the entire payoff is deferred until the very long term, it becomes effectively impossible to keep efforts aligned. On the other side, if the work

performed produces intermediate payoffs, it is theoretically possible to distribute these among contributors in a centralized way as an alternative for a single actor backing a single project.

However, when we talk about incentives, we must identify the stakeholders of the business ecosystem, or, simpler, the market's players. It is important to make the right assumptions about market players' motivations, time horizons and consider incentives in their vision of how market systems can operate in the future.

To design, structure, and implement incentives, it is necessary to:

- identify target market players;
- identify interests;
- determine the importance and influence of stakeholders.

The intermediate payoffs for developing a fully self-sustaining Mearth ecosystem are the technologies and Intellectual Property developed along the journey. These intermediate payoffs can serve as incentives. In our case, they can motivate various actors to contribute by facilitating the distribution of the benefits of those innovations or by aiding in the formation of alliances. Furthermore, when it comes to identifying interests, market players have often divergent interests. However, they can also share common and converging interests.

The trust and hope vested in innovations and technologies are well-founded and require cultivation through appropriate investments. This involves enhancing the efficiency and efficacy of newly accessible technologies, a perspective described as the "investment-based strategy" by (Acemoglu, Aghion, and Zilibotti 2006). Additionally, an "innovation-based strategy" is crucial for nurturing the portfolio of innovations (Acemoglu, Aghion, and Zilibotti 2006), with the goal of advancing the global technological frontier and generating further opportunities within the emerging Mearth ecosystem.

We have already emphasized that enhancing and expediting innovation constitutes a central objective of the Mearth ecosystem. The goal is to stimulate innovation to tackle what are termed as the world's six interconnected Mega Challenges: Climate Change, Mass Extinction, Ecosystem Collapse, Displacement, Unrest, and Explosive Impact (defined as any large-scale human activity that disrupts the global balance, such as overfishing oceans or contaminating land and seas). These challenges can be afforded and created by the expansion of Mearth's new geographical scope. Given that reductionist approaches (which propose actions like reducing chemical usage, curbing overconsumption, recycling, reusing products, and minimizing carbon footprint) in resolving our numerous challenges have demonstrated their limits and relative effectiveness, potentially accelerating the right kinds of innovation offers the possibility of creating an alternative future for humanity from the one that was initially created.

To establish the Mearth ecosystem and make a contribution towards addressing the six Mega Challenges, a coopetition framework could prove to be a valuable strategy, offering a potential solution and an effective analytical tool. This framework has the capacity to adeptly align the incentives of various stakeholders.

3. Coopetition as a Strategy to Align the Incentives of the Various Actors of the Mearth Ecosystem

Coopetition is a strategy that considers simultaneously competing and collaborating with competitors to achieve a goal that is beyond the resources of any one firm. This strategy helps businesses to accomplish their objectives through resource sharing, knowledge transfer, and innovation performance.

Brandenburger and Nalebuff (1995, 1996) started from the competitive paradigm, highlighting its limitations, and adopted the notion of coopetition, as both competitive and cooperative characteristics play a role in shaping the interdependencies of firms. They followed an approach to coopetition that applies the game theory perspective, perceiving coopetition as *a* win–win relationship and addressing the balance between value creation and value appropriation. According to Brandenburger and Nalebuff (1995, 1996), coopetition is a framework that:

- mobilizes the resources and technical expertise of entire industries and sectors;
- allows to get a win-win solution, *i.e.*, a solution that is mutually beneficial and satisfying;
- creates a competitive environment which incentivizes innovation.

In a more recent article published in *Harvard Business Review*, (Brandenburger and Nalebuff, 2021, 1) claim: «The moon landing just over 50 years ago is remembered as the culmination of a fierce competition between the United States and the USSR. But in fact, space exploration almost started with cooperation. President Kennedy proposed a joint mission to the moon when he met with Khrushchev in 1961 and again when he addressed the United Nations in 1963. It never came to pass, but in 1975 the Cold War rivals began working together on Apollo-Soyuz, and by 1998 the jointly managed International Space Station had ushered in an era of collaboration. Today a number of countries are trying to achieve a presence on the moon, and again there are calls for them to team up. Even the hypercompetitive Jeff Bezos and Elon Musk once met to discuss combining their Blue Origin and SpaceX ventures. There is a name for the mix of competition and cooperation: co-opetition. In 1996, when we wrote a book about this phenomenon in business, instances of it were relatively rare. Now the practice is common in a wide range of industries, having been adopted by rivals such as Apple and Samsung, DHL and UPS, Ford and GM, and Google and Yahoo».

These authors continue to argue that «there are many reasons for competitors to cooperate. At the simplest level, it can be a way to save costs and avoid duplication of effort. If a project is too big or too risky for one company to manage, collaboration may be the only option» (Brandenburger and Nalebuff, 2021, 1).

Bengtsson and Kock (2014), on the other hand, argue that coopetition stands apart from other interorganizational interactions due to its paradoxical nature. The fundamental aspect of coopetition is a relationship that juxtaposes two contradictory yet interconnected elements, cooperation, and competition. Both of these elements are equally vital in deriving benefits from the relationship. They also maintain that it is not necessary to restrict coopetition to a relationship between two firms; numerous firms can simultaneously engage in both cooperation and competition with one another.

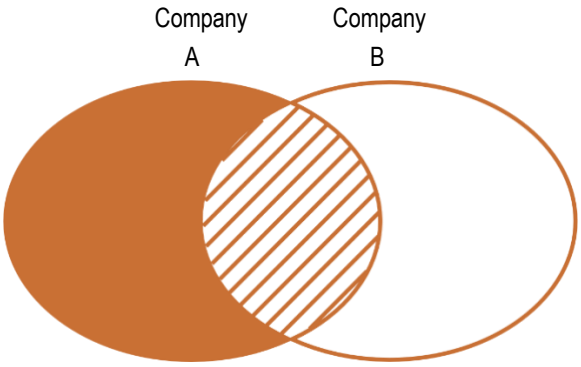
Carfì and Schilirò (2012, 2019) adopt a game theory approach in their papers on coopetition. They demonstrate that a strategy based on coopetition, which promotes the adoption of innovative (low carbon) technologies serving as a shared (or coopetitive) variable among the players, constitutes a win-win solution for the stakeholders involved and for the environment. Nevertheless, splitting the gains (or the payoff) of the shared activity becomes a zero-sum game, with outcomes strongly dependent on the competitive strength of the players. Carfi and Schilirò (2019) also posit that players have a longer-term view, aiming for economic returns and pursuing innovation.

After all, Simon (1972) highlighted that agents possess limited rationality stemming from imperfect knowledge and make decisions in the presence of prevailing uncertainty. Consequently, they seek solutions that are 'satisficing' - meaning the best possible solution given constraints imposed by limited information. This approach aligns with their long-term perspective, aimed at achieving positive payoff while paying less heed to short-term issues.

Ritala (2012), who follows Brandenburger and Nalebuff's game theory approach to coopetition where partners are competitors, argue that empirical literature on industry studies provides evidence that the success of a firm's coopetition strategy is heavily affected by the industrial and economic context in which it is embedded. Within the literature examined by Ritala, some studies highlight that coopetition occurs in knowledge-intensive sectors in which rival firms collaborate in creating interoperable solutions and standards, in R&D, and in sharing risks. However, coopetition is not necessarily a successful strategy in sectors that are less knowledge-intensive. Ritala adopts a portfolio perspective on alliances, focusing on the number of rivals in the firm's alliance portfolio (operationalized as coopetition alignment) and on the performance implication of this alignment. Ritala (2012) finds that three distinct contingencies are deemed important for determining the success of a firm's coopetition alignment: market intensity, network externalities, and competition intensity. His empirical results show that a coopetition strategy is beneficial under high market uncertainty. Moreover, under high network externalities, firms that share risks and costs with their competitors are able to increase their innovation and market performance[2]. Additionally, a coopetition strategy is advantageous in industries with low competition intensity.

Padula and Dagnino (2007), instead, take a different approach to the coopetition construct. They explore the drivers of the intrusion of competitive issues within a cooperative context. Padula and Dagnino (2002) view coopetition as a kind of interfirm strategy that allows the competing firms involved to manage a partially convergent interest and goal structure and to create value by means of coopetitive advantage. Therefore, these authors regard coopetition as a coopetitive game where firms interact among each other based on a partially convergent interest structure (Padula and Dagnino 2007). The theoretical approach of Padula and Dagnino (2007) makes clearer the idea that coopetition leads to a sharing of certain activities due to a relative overlapping of interests. This overlap results in the sharing of investments in research and development, as shown in Figure 2 below for the case of two companies, A and B; while the overlapping area identifies the common interest that can be generated by investment in R&D, the so-called 'shared' variable.

Figure 2. A "shared" variable represented by a common interest in investment in R&D



Further literature on coopetition has demonstrated that coopetition offers firms certain advantages arising from the synergies of sharing costs, risks, economies of scale (Luo 2007; Gnyawali and Park, 2009, 2011;

[2] The value of the offerings increases along with the number of users.

Osarenkhoe, 2010), R&D operations (Walley, 2007), and access to knowledge and external resources (Bengtsson and Kock, 2000; Akdoğan and Cingšz, 2012) as reported in Roig-Tierno, Kraus and Cruz (2018, 379), who assert: «Coopetition is more than just a mix of cooperation and competition».

Finally, Sun *et al. (*2022) point out that ecosystems have emerged as a crucial mechanism for corporate value creation and value co-creation among multiple participant actors. However, the participants' interests are not fully aligned, and each is committed to maximizing its own interests while expanding shared values. Most scholars have identified coopetition as a core feature or fundamental premise of ecosystems. In the last decade (2011 to 2021), research on ecosystem coopetition has grown rapidly and, with the impact of the digital economy, platform ecosystems have become the most prevalent type of ecosystem.

Ecosystem coopetition research focuses on strategic management, organizational form, and related topics. Scholars are interested in understanding the competitive interaction behaviors of members within the new organizational form of ecosystems, how these coopetitive behaviors impact organizational performance, and how companies should manage coopetitive strategies within the ecosystem (Sun *et al.* 2022). Furthermore, recent literature has started to focus on issues regarding multi-level coopetition in ecosystems, with particular attention to the dynamic evolution of coopetition within these ecosystems.

Therefore, we believe that to establish the Mearth ecosystem, a coopetition framework could be a valuable strategy, as it can help align the incentives of various stakeholders. Additionally, considering the substantial scale of the project in economic and technological terms, there is a necessity for global coopetition that will benefit all parties involved, thereby creating an entirely new economic system and ecosystem on which to expand.

Furthermore, the creation of Mearth foresees the need for the development of a multidimensional platform named MearthLink. A part of the platform's design would be to help facilitate the acceleration of alliances to leverage coopetition, while the platform as a whole would enable all forms of innovation. In addition, within the Mearth Discovery unit, there would be teams responsible for transferring technology and intellectual property generated by various actors to others who could leverage the technology within the 'beyond-Earth' ecosystem and outside the ecosystem, extending to adjacent or entirely disconnected players. This perspective implies that both large corporations and start-ups are incentivized to collaborate and work together. They are able to raise enough capital and set up an incentive structure sufficient to foster innovation. The emergence of the smart economy and the joint efforts of all the innovators are creating a hyper-innovation environment, where the potential for discovering the next solution is significantly amplified. The driving concept behind the creation and development of the MearthLink platform is not to stop people from doing this or that, but rather to encourage to think about, confront, cooperate, and create a new way of addressing innovation, and redefine possibilities that improve life on Earth. MearthLink centers around cooperation and takes on a pivotal role in reshaping the trajectory of tomorrow.

Conclusion

Lower costs and increasingly sophisticated technology are making the utilization of space more accessible to many actors, thereby creating a more favorable business ecosystem. Through the establishment of the Mearth ecosystem, which requires an incredible amount of innovation, we can increase the possibilities of improving life on Earth. The MearthLink platform and Mearth Discoveries tech transfer mechanisms, both integral components of the Project Moon Hut Foundation, facilitate the mobilization and joining forces of the various stakeholders in the ecosystem. The notion of accelerating technological progress through a coopetitive approach could serve as a valuable model for the Mearth ecosystem. The goal is to mobilize the resources and technical expertise of entire industries and sectors.

The most significant economic challenge in establishing the Mearth ecosystem is aligning the incentives of various actors. The coopetition framework can aid in aligning these incentives. Incentives are crucial for creating long-term economic profits. For instance, we might consider providing participants with shares or options in MearthLink that represent long-term value accretion, while aiming for inclusivity. To keep people motivated to act over time, the idea is to enable long-term scenarios with incentives, wherein agents seek long-term gains that benefit everyone (win-win), rather than pursuing "maximization solutions in the short-term." Such scenarios must lead to satisfactory long-term solutions for profits and earnings. Coopetitive structures are very likely to provide valuable solutions.

To conclude, in this paper we endorse the perspective that coopetition, a strategy that essentially considers cooperation between competitors, could be the most appropriate approach for realizing the Mearth ecosystem, as it has the potential to satisfy all stakeholders engaged within the ecosystem. Across many Boards of Directors, this concept of coopetition is already acknowledged as a valuable, viable, and economically sound strategy among companies.

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Conflict of Interest Statement

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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