Journal of Industrial and Business Economics
https://doi.org/10.1007/s40812-026-00403-5

Three, two, one, ignition! Exploring the transition process of firms towards the space economy

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Received: 28 July 2025 / Revised: 30 December 2025 / Accepted: 21 March 2026

Abstract

In recent years, the Space Economy (SE) has increasingly attracted the interest of different companies, including a growing number of firms that have based their business diversification strategy on the development of innovative technologies and solutions in the space landscape. In this context, this paper investigates the transition of firms originally operating in non-space sectors into the SE, aiming to understand how such diversification processes are implemented. Through a multiple case-study analysis which adopts the theoretical lens of the Actor-Resources-Activities framework, this research highlights both commonalities and differences in the trajectories of two entrepreneurial firms shaped by internal resources and external interactions. Our results highlight three key phases of this transition process: (1) evolution of the company; (2) access to the space economy; and (3) consolidation and growth in this industry. Two main contributions are derived from the empirical analysis. Firstly, the transition process towards the SE is characterized by the sequencing of distinctive behaviors—resource upgrading, exploring, visionary jumping, network positioning and exploiting—where "visionary jumping" emerges as a specific feature. Secondly, diversification processes in the SE imply substantial and simultaneous changes along the actor, resource and activities dimensions. These parallel and interdependent changes represent a key challenge for firms in transition towards the SE.

Keywords Space Economy · Business Networks · Innovation Networks · Diversification strategy · ARA Framework

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Published online: 17 April 2026

JEL codes O30 · L25 · M13

1 Introduction

Over the last decades, the Space Economy (hereinafter, SE) has been growing in terms of interest and investments by both firms and governments, becoming strategic in the light of its political, economic, and technological implications (OECD, 2023a; Robinson & Mazzucato, 2019). The SE could be described as "the full range of activities and the use of resources that create value and benefits to human beings in the course of exploring, researching, understanding, managing, and utilising space" (OECD, 2012).

According to Statista (2025), in 2023 the global SE reached approximately $570 billion in revenue, up from $531 billion in 2022, with Europe, United States, and China as key players. Following this strong growth, the market structure has progressively changed, involving both private customers and international and national government agencies acting through their public procurement systems. In parallel, the business sector has been pursuing novel opportunities related to new space-related products and services, with the active participation of both key large players and startup firms willing to grow rapidly in this sector (Bousedra, 2023; OECD, 2023b), often belonging to technological clusters (Silvestri et al., 2022) or acting in international innovation networks (Song et al., 2024). In this regard, the European Space Agency (2025) recently highlighted that private investment in space reached 7 billion euros in 2024, up 20% from 2023. Thus, a New Space Economy era has been started, shaped by a revolutionary shift characterized by the transition from government-led monopolies to a dynamic, commercially driven, and global market.

In this context, one emerging distinctive phenomenon is the increasing interest and involvement of companies operating in various manufacturing and service sectors, which plan or already implement diversification processes in the SE, whose technological needs concern a wide range of products and solutions from a variety of industries (D'Costa, 2025). These processes imply start-up and scale-up trajectories in the space sector (Giraldi, 2025).

Notwithstanding the increasing interest by scholars on innovation and networks in the SE (Alberti & Pizzurno, 2015; Ferreira et al., 2016), thus far the involvement of non-space sectors' firms in the space value chain and networks has not been explored in depth. Recent studies have analysed the strategic and resource dimensions (Vittori et al., 2025). We argue that a better comprehension of this specific process is needed for two interrelated reasons. Firstly, the SE could represent a valuable playing ground for innovation, learning and business growthfor companies, often struggling in their historical business and markets (McKinsey & Company, 2022). Secondly, becoming a player in the SE might require a substantial change in the overall business model, which represents a complex and challenging task (Vittori et al., 2025).

Therefore, the focus of this research is on the transition process of firms operating in a previous sector to become key players in the SE. The main goal is to unveil the micro-processes shaping this specific type of diversification, which might show novel features in the light of the nature and complexity of the space context (Raswant et al., 2025). Therefore, this paper aims to answer the following Research Question (RQ):

> How do non-space firms implement the transition process to the Space Economy?

We conducted a qualitative research based on a multiple-case study analysis, involving two firms belonging to different sectors—additive manufacturing and fashion—that have implemented diversification trajectories towards the SE. Under a conceptual perspective, this paper adopts the Actor-Resource-Activities (ARA) framework, as proposed within the Business Network approach (Håkansson & Snehota, 1995; Håkansson et al., 2009) in the analysis of complex innovation processes. This perspective, which conceives "markets as networks" (Johanson & Vahlne, 2011), is deemed useful for two reasons: (i) it provides a dynamic view of resources development and combination while dealing with complex innovation trajectories (Håkansson & Waluszewski, 2002); (ii) it highlights the inter-organisational and network view of innovation processes (Håkansson & Waluszewski, 2007), which represents a key feature of the SE (Vidmar et al., 2020).

The paper is structured as follows. In section two, the SE is analysed and discussed in its main components and features, also concerning recent scholarly work in economics and management studies. Section three addresses the theoretical background with a focus on diversification strategy and innovation networks. In the fourth section, the methodology adopted to answer the RQ is illustrated. Section five draws the findings of the empirical research and the following sixth section addresses the discussion of results. The last section outlines concluding remarks along with limitations and further research directions.

2 The emergence of the space economy

In the last twenty years, the SE has emerged and become relevant both economically and politically (PwC, 2024). Its evolution has been characterized by the shift and co-existence of the "Old Space System"—based on traditional actors such as governments, space agencies and large companies—and the "New Space System" (OECD, 2023b), whose features include the increasing role of businesses of various size—including startups—and the convergence and combination of upstream (i.e., manufacturing and launch of space systems) and downstream activities (i.e., space operations-related software and services) (OECD, 2023a, 2023b).

One of the main outcomes is the complex articulation of the space value chain, which includes R&D, manufacturing, and advanced IT services, with the involvement of both public sector and private business (PwC, 2024). Notably, an increasing role is played on the one hand by large firms with financial resources, on the other hand by recently established startup firms providing niche technologies and attempting to exploit the opportunities brought by the so-called "democratization of space" (OECD, 2023b). The decrease in size of satellites and space operations and the search for additional orbit spots pave the way for new space missions and projects. Moreover, governments and firms are increasingly attracted by the opportunities linked to low, medium, and grand orbits (PwC, 2024).

However, the development of New Space Economy initiatives is impaired by the uncertain timing and the high level of resources needed to support them. Space-related activities are even increasingly complex because of the emerging geopolitical conflict in various regional areas and the higher inherent risk in this type of endeavour. There is evidence of increasing “congestion” in terms of infrastructure in space, contention in terms of resources and orbits and competition between governments and large business players (Raswant et al., 2025). The result of this growing uncertainty is the sudden slowing in financial investment since 2022, which is creating difficulties in planning future space-related projects, for both governments and firms (PwC, 2024).

The development of the SE has raised the interest of researchers in the economics and business fields. Most of the studies have been undertaken within the innovation stream and are concerned with the development of space-related technologies and the diffusion and transfer of technological and organisational knowledge. Various studies have been concerned with cooperation among firms, universities and knowledge providers (Alberti & Pizzurno, 2015). Technological complexity has been pushing firms to take part in innovation-related networks to share knowledge and R&D costs. Such collaborative effort has been promoted and supported also by local, national, and supranational institutions and governmental organizations, aiming to set up space-related projects and technological hubs and poles in this strategic sector (Robinson & Mazzucato, 2019; Silvestri et al., 2022). The specific nature of the interplay of technologies, firms, and institutions in the SE reveals a system of high complexity, where interdependencies are structural and the features of actors, resources and boundaries are extremely blurred (Raswant et al., 2025).

In this context, the development of the SE and its growing relevance in terms of potential future business opportunities is attracting increasing interest from companies operating in more traditional sectors such as pharmaceuticals, nutrition and healthcare (McKinsey & Company, 2022). This shift has been actively supported by national governments pursuing new opportunities in the SE. For example, the Italian Government has established a forum for non-space companies interested in diversification strategies to become players in the SE. Firms are attracted by the possibility of undertaking R&D projects within space missions, enabling innovative experiments that could lead to high-impact results, which could then be translated into new solutions and products for business and consumer markets.

Despite the opening of the SE to new players, existing business and innovation research has primarily focused on the analysis of companies already active within the space value chain (PwC, 2024; Silvestri et al., 2022). Recent studies have focused on the emergence of an innovation network for satellite development and production (Song et al., 2024). Only a few studies have addressed diversification strategies in the space sector. A recent contribution by Vittori et al. (2025) examines the market entry of non-space firms with a focus on strategic decision-making and resource development, highlighting a variety of different strategies to become a player in the SE.

Given the widening scope of the SE, embracing new technologies and services, we argue that a greater attention should be addressed on the diversification processes—

centred on innovation and resource development in a networked context—implemented by non-space firms in their transition towards the SE.

3 Theoretical background

3.1 Diversification strategies and processes

Since the seminal works of Ansoff (1957, 1958), Chandler (1962), and Gort (1962), diversification strategies have been conceived as opportunities for firms to enhance their competitiveness and secure long-term market leadership, improving flexibility value creation, risk spreading, and resilience (Oladimeji & Udosen, 2019; Stevens & Teal, 2024; Wiersema & Bowen, 2008).

Notably, corporate diversification has been considered a multifaceted phenomenon (Guerras-Martín et al., 2020) and one of the main issues in the field of strategic management (Grant et al., 1988) and in economics and finance (Benito-Osorio et al., 2012). Recent studies (Nigam & Gupta, 2023; Qian et al., 2025) highlight the re-emergence of diversification strategies—after the strong emphasis on core-business strategic focus—as an answer to the increased uncertainty and change in markets. However, few studies investigated different dimensions of diversification strategies, such as level, processes and mode of diversification (Hafner, 2021).

The diversification strategy has been traditionally associated with the entry of firms into new businesses which are different from the existing ones (Ramanujam & Varadarajan, 1989). This entry strategy often requires changes in the firm's structure, systems and processes (Nagarajan et al., 2023), allowing the configuration of a new offering in industries adjacent—related diversification—or remote—unrelated diversification—to the firm's original business.

Adopting a diversification strategy requires undertaking a complex process, which might require substantial changes in organisational configuration, as well as in capabilities and resources (Hafner, 2021), leading to innovation. As anticipated by previous research, corporate innovations increase the extent of diversification: "Since innovative firms continuously innovate, it is natural to expect that these firms continuously search for good matches between their innovations and business lines through diversification" (Rong & Xiao, 2017: 476). Indeed, the innovative products, in addition to the solutions previously adopted by the firms, can support firm's growth (Braguinsky et al., 2020).

In this vein, the connection between diversification and innovation processes has been deeply investigated adopting different perspectives (Lysek, 2019; Rodríguez-Duarte et al., 2007; Statsenko & de Zubielqui, 2020). While scholarly inquiries into the nexus of innovation and diversification vary significantly in their specific objectives and methodological approaches, the theoretical core of the debate remains anchored in the firm's resources and capabilities.

Business diversification leads to new resource composition and more generally to the generation of new opportunities for knowledge integration and knowledge cross-fertilization (Ng, 2007), providing the basis for product variety and innovation, which might concern technologies, organisational processes, and marketing practices

(Bonesso et al., 2020). Innovation processes, on their turn, activating new resources and knowledge, push firms to explore new opportunities in diverse markets and sectors from those of the "origin" (Lysek, 2019; Rodríguez-Duarte et al., 2007).

From an internal point of view, diversification processes are fundamentally contingent upon the cross-functional capabilities of the organization. This involves the strategic mobilization and transfer of a diverse array of complementary resources, ranging from managerial know-how and technological expertise to financial support and marketing intelligence (Hitt et al., 1997).

From an external perspective, however, diversification processes frequently transcend internal boundaries, necessitating the active development of relationships with strategic partners (Najafi-Tavani et al., 2018; Statsenko & de Zubielqui, 2020). The process of innovating a product offering to penetrate a new business environment often requires the acquisition of external complementary resources, which are subsequently integrated and reconfigured into novel value-creating combinations (Kim et al., 2022). Consequently, the integration of innovation processes and diversification strategies is increasingly managed within a framework of collaborative innovation. This approach facilitates an effective exchange of ideas, specialized knowledge, and market opportunities that extend beyond the traditional boundaries of the firm (Barbosa et al., 2024).

However, various contributions highlight that the inter-organizational dimension of innovation processes could be very complex in the light of the nature, goals and behaviour of partnering actors, thus requiring adequate resources and capabilities (Cheng et al., 2022; Kobarg et al., 2020). In addition, in this process firms might suffer the lack of legitimacy and the liability of newness (Fisher et al., 2016). Legitimation is considered as "the intentional engagement of social actors in specific practices that may lead to achieving legitimacy" (Drori & Honig, 2013: 349), related to the activities' recognition of practices as desirable (Wang et al., 2017). Through legitimation firms can overcome the liability of newness, accessing to resources belonging to different business partners. According to some scholars, the liability of newness can be overcome through social network embeddedness (Gebhardt et al., 2026).

In the next section, the theme of innovation through collaboration is addressed in more depth by adopting an innovation network view.

3.2 Innovation networks

Researchers from various fields (economics, organization studies, strategy, marketing, entrepreneurship) have paid increased attention to collaboration in innovation in various industrial sectors (Aarikka-Stenroos et al., 2014; Barbosa et al., 2024; Colombo et al., 2023; Najafi-Tavani et al., 2018; Powell et al., 1996).

Collaboration with external actors allows for knowledge sharing and market knowledge acquisition, sustaining a firm's innovation capability (Najafi-Tavani et al., 2018; Nieto & Santamaría, 2007), which includes product and process innovation capability (Camison & Villar-Lopez, 2014). Collaborative innovation can be facilitated by geographic, cultural, institutional, organizational, and technological proximity (Tsai, 2009; Cantù, 2010). Notably, innovation processes are supported by geographic proximity, which facilitates the sharing of tacit knowledge (Balland et al., 2015). These advantages are deemed crucial for SMEs, in the light of their limited resources.

Collaborative innovation has been recognized in various forms of inter-organizational relationships, such as alliances, cooperative and collaborative initiatives, partnerships and joint ventures, platforms and networks (Ollila & Yström, 2024; Ma & Ozer, 2024). In this respect, inter-firm collaboration for innovation could lead to the setup and development of innovation networks (Najafi-Tavani et al., 2018), where a wide variety of actors, such as suppliers, customers, competitors, research organizations—universities, research centres, laboratories—and institutions could be involved.

The phenomenon of collaborative innovation has been studied by numerous scholars referring to three main perspectives: macro, meso, and micro (Hage & Meeus, 2006). Based on previous analysis (Corsaro et al., 2012), in a macro perspective, an innovation network plays a key role in terms of economic and institutional system; while the meso perspective deals mainly with processes on dyadic and network levels. Finally, in adopting a micro-perspective the attention is concentrated on the single firms.

Focusing on meso-perspective, the "locus of innovation" has been identified in networks of learning, characterized by the main advantages of risk sharing, access to a new market and technologies, and the pooling of complementary skills (Powell et al., 1996). In this sense, innovation networks relate to a form of economic coordination of innovation activities based on social relationships (Tseng et al., 2016). Furthermore, the innovation network is conceived as the result of the interaction between different actors (Håkansson & Waluszewski, 2007), as proposed by the stream of studies in line with the Business Network perspective (Håkansson et al., 2009): actors "outside" the company (suppliers, customers, competitors, and research organizations), through networking, influence its ability to innovate (Freytag & Young, 2014; Mitrega et al., 2017). Innovation networks evolve and change, as they are characterized by the effort of each company in mobilising resources, activities and other actors (Håkansson & Waluszewski, 2002). Through business relationships, actors share resources and develop activities, as depicted in an explicit manner by the ARA (Actor-Resource-Activity) framework (Håkansson & Snehota, 1995), which has been adopted in various studies on innovation processes involving a variety of actors (Håkansson & Waluszewski, 2007). On the one hand, technical, administrative, and commercial links support the configuration of Activity links. On the other hand, Actor bonds shape the web of actors, which includes both business and non-business, political—actors (Welch & Wilkinson, 2004). Actors relate to each other over time and in several dimensions and allow the process of combining resources. Resource ties concern the resources combinations in business interactions. In this framework, resources have been deeply investigated, especially concerning innovation and technological development processes. Resource interaction (Baraldi et al., 2012; Bocconcelli et al., 2020) plays a primary role in pushing actors to collaborate with each other and adjust activities, for innovation.

From this point of view, firms' accessibility to external sources of knowledge and innovation ability depends also on their degree of embeddedness and position in networks (Möller et al., 2005). In this regard, innovation networks are characterized by purposeful design and orchestration management approach, as firms often play a variety of roles in multiple innovation networks (Möller & Halinen, 2017).

4 Methodology

In the light of the explorative nature of our RQ—*How do non-space firms implement the transition process to the space economy?*—we adopted the case study approach (Eisenhardt, 1989; Yin, 2009). In particular, we conducted a multiple-case study analysis due to its enhanced reliability and higher generalizability compared to single case study research (Eisenhardt & Graebner, 2007). Given the exploratory and processual nature of the RQ, following Aaboen et al. (2012), we designed a longitudinal retrospective multiple case approach in an extended effort to capture the evolution of companies. This allowed us to improve reflections over time to strengthen in-case analyses and to reveal longitudinal patterns that can then be contrasted between the cases.

As the aim is gaining an in-depth understanding of micro-processes within business networks and relationships with an emphasis on resource access and development, the analysis is based on the Business Network approach (Håkansson et al., 2009) and specifically on the ARA framework (Håkansson & Snehota, 1995) as our conceptual guide in the empirical analysis. The adoption of the ARA framework is motivated by its suitability for investigating inter-organizational collaboration and innovation processes, as it allows to analyse how activities, resources, and actors are reconfigured through relationships during the transition to the SE. Our attention is particularly focused on the identification of the main resources shared and combined through business relationships, considering the implications of change to enter and to grow in the SE (Halinen et al., 2012).

As in other studies that use the ARA framework (Keegan et al., 2023), a purposeful sampling (Patton, 2002; Piekkari et al., 2010) approach was adopted to identify participants who were able to articulate the evolution of companies in the SE. Secondary data and LinkedIn were consulted to compile a list of possible startups and informants based on their experience in the transition process towards the SE, then participants were contacted to ask for their availability to participate in the study.

The analysed cases are two Italian companies operating in the SE: Company *Alpha* (from here on, Alpha), founded in 2017, and Company *Beta* (from here on, Beta), founded in 2021 (see Table 1). Alpha adopted a diversification strategy by a scaleup that founded its core high-tech business in another industry; Beta has been

Table 1 Case study description

Alpha	Foundation year	Location	Products	No. of employees	Key informants
	2017	Italy	Software components for space industry	70	Co-founder and CFO (3 interviews)
Beta	2021	Italy	Space suits	< 10	CEO and Chief designer (*3 interviews)*

settled as a new company—a startup—in the SE by founders with a background in a different and more traditional business.

The two cases have been considered representative of current patterns in the transition towards the SE. The selection of the two firms is theoretically motivated. First, Alpha and Beta represent two distinct and exemplary cases of entry into the SE—scale-up diversification vs. startup creation (Giraldi, 2025)—enabling theoretical replication. Second, they meet two purposeful sampling criteria: *(1)* both companies are already established actors within the SE, ensuring their capacity to reflect on a completed or ongoing transition process; and *(2)* each company originates from a different industrial background (high-tech −3D printing and robotics- vs. traditional sector -clothing/fashion/textile-), allowing us to compare how heterogeneous resource bases influence the transition. These criteria support theoretical replication logic and strengthen the robustness of our analysis (Eisenhardt, 1989).

Data collection is based on combining primary and secondary data. The collection of primary data (Table 1) concerns semi-structured interviews with key informants of selected space companies, such as founders and CEOs. The semi-structured interviews were guided by a protocol including questions that explore: *(a)* the firms' relational strategies for the evolution and growth of the company; *(b)* the role of collaborations for innovation and technological development for the access to SE; and *(c)* the specific collaborative practices and resources activated within the SE context. 6 semi-structured interviews were conducted by phone call/video-call during the period 2022–2025 and lasted approximately 60 min each. With the informants' consent, interviews were recorded and fully transcribed ad verbatim. When that was not possible, researchers took detailed notes to analyse and discuss together with the transcripts.

The primary data we collected from semi-structured interviews were triangulated with secondary data, i.e., documentation provided by key informants and reports from various sources, such as OECD, Statista, and space tech-specialized websites and LinkedIn groups. Secondary data were used also to outline the chronological evolution of each firm (e.g., key partnerships), validate the events mentioned by interviewees, and refine our understanding of the broader SE context. For Beta, direct observation within the local Space Cluster further enhanced the validation of our interpretations.

The data analysis phase of this study involved examining the transcripts of the collected semi-structured interviews with professionals from the two case companies and the secondary data. These materials were analysed by the researchers using coding strategies (Strauss & Corbin, 1990), which allowed for the identification of key themes related to the case companies' transition to SE. Specifically, a thematic analysis approach was used to analyse the materials, i.e., a structured process which allowed researchers to identify similarities and differences among the various findings which emerged from this process. These emerging converging and divergent perspectives were also compared with the theoretical background developed for this study. Specifically, intra-case and cross-case analyses were combined to provide a comprehensive examination of the collected data—this data analysis method ensured an in-depth exploration of the phenomenon under investigation.

5 Findings

The results of this study focus on the transition process of the two case companies to the SE by leveraging their diversification strategies. More specifically, the findings highlight three phases of this transition process, i.e., (1) evolution of the company, (2) access to the space economy, and (3) consolidation and growth in the space economy. These phases also reflect the progressive reconfiguration of actors, resources, and activities—consistent with the ARA framework—along the transition path.

5.1 Alpha

Alpha was founded in 2017 by four Italian entrepreneurs who met during their studies at the Polytechnic University of Milan. Before founding Alpha, each of the four co-founders brought distinct expertise, which shaped their roles within the company. Specifically, the Chief Executive Officer (CEO) had prior experience in international consulting and finance, having worked with global strategy firms and financial institutions. His background in corporate strategy and operations enabled him to lead Alpha's growth, fundraising, and global expansion efforts. The Chief Financial Officer (CFO) had a finance and administrative management background, with a strong focus on financial planning and control. At Alpha, he oversees the company's economic strategy, investment management, and compliance. The Chief Operation Officer (COO) had a technical foundation in engineering and product development, with experience in additive manufacturing systems. He is responsible for operations, production, and deployment of Alpha's manufacturing platforms. Finally, the Chief Designer Officer (CDO) specialized in design engineering and digital fabrication. At Alpha, he leads innovation, product design, and R&D, managing the evolution of the company's proprietary technology and applications.

The innovative idea of these four co-founders was to overcome the limitations of traditional industrial 3D printing by developing a robotic system capable of producing large-scale components using high performance materials, i.e., by introducing the large format additive manufacturing (LFAM). Alpha has positioned its brand in the international context of additive manufacturing thanks to a radically innovative vision of 3D printing.

5.1.1 Evolution of Alpha

Thanks to the ambitious vision and targeted investments, Alpha evolved from a startup into an international scale-up, revolutionizing the field of LFAM. Indeed, Alpha was founded with the purpose of overcoming the limits of additive manufacturing in terms of size, efficiency, and sustainability in the automotive, architecture, and industrial machinery sectors. To achieve this business goal, Alpha develops an integrated hardware and software technological platform which allows the production of large industrial components. In particular, with some patented industrial components and with the development of dedicated software for the use of robots, Alpha's innovation consists in facilitating the production and handling of large industrial components. Indeed, as reported in the corporate website of Alpha, *"LFAM technology stands out* *in the production of lighter and more robust components thanks to scalability, design freedom, high customization, reduced material waste, faster and more cost-effective production, lower tooling costs, less complex assemblies, optimized supply chain management, and innovative applications."*

From its early phases, the company built a network of relationships with research institutions, universities, and major manufacturing firms, positioning itself as a technological partner in sectors such as automotive and industrial design. Specifically, in these early stages of development, a crucial role was played by the incubator that hosted Alpha, providing access to a network of industry experts and other companies, and the support needed to transform their project into a viable business. The incubator created an environment where experimentation and the development of business relationships were encouraged, allowing Alpha to develop its technology, validate its market fit, and attract the first partners. This support was key in shaping the company's direction and accelerating its growth. In this regard, our key informant stated: *"The incubator has always sought to create connections and synergies, even if these relationships don't always lead to results for the company. Then, out of necessity, we left the incubator because it was no longer possible to maintain our assembly and plant technologies."* (Co-founder and CFO, Alpha).

Its growth has been driven by a corporate culture focused on sustainability and experimentation. For example, during the Covid-19 pandemic, Alpha leveraged its technology to quickly produce protective equipment, demonstrating a strong commitment to the social value of innovation. In general, as stated by Alpha's CEO, the company has always focused on flexibility and the ability to reinvent itself according to market trends and emerging opportunities: *"In markets as dynamic as these, capable of overturning the paradigms that govern them from one year to the next—such as technology and advanced industry -, it is essential to have the ability to be 'eccentric' in problem-solving. One must have the capacity to constantly reinvent oneself, while maintaining a strong long-term value proposition."*

Over time, the company expanded by accessing international markets, opening new operational sites and production facilities abroad, such as in the US, for participating in new projects in foreign environments.

5.1.2 Access to the space economy

Since 2021, to diversify its business activities, Alpha has entered the SE with an innovative approach. The diversification strategy of Alpha was based on the introduction of LFAM technology to create unique large components (up to five meters) with complex geometries and "direct printing" of materials with high mechanical and thermal performance in the space industry. This decision was in line with the vision of the company: *"… to drive the organizational and technological evolution that can promote the diffusion of large-format additive manufacturing in the most advanced sectors"* (Alpha's CEO).

More specifically, the idea to enter the SE for Alpha arose from relationships developed with firms specialized in this industry. In this regard, Alpha's CEO stated: *"Thanks to our partnership with key players in the technological innovation sector, we will have the opportunity to accelerate technological development and establish* *ourselves as a leading company in large-scale 3D printing for advanced applications in high-performance sectors, such as automotive and aerospace."*

In particular, the relationship activated with the incubator supported Alpha in developing informal and formal relationships with its startups and its business partners belonging to different industries, also considering the SE. In this way, the entrepreneurs identified and evaluated the potentialities of SE. Thus, for Alpha SE represents a significant market opportunity, driven by the growth of space activities and rising demand for innovative solutions. In addition, the decision to enter the new industry has been supported by the evolution of Alpha large-scale 3D printing technology, which offers features highly valued by this specialized and innovative market. The co-founders recognized that the SE requires components with complex shapes, high-performance materials, and weight reduction—all challenges addressed by Alpha's LFAM technology. The ability to produce large, lightweight, and durable parts through robotic printing overcomes the limitations of traditional manufacturing methods. Through its LFAM technology, Alpha supports the production of components used in satellite structures, launch vehicle parts, and space prototypes.

Moreover, the founders' strong technical background and existing collaborations with universities and research centres favoured new projects and partnerships with companies and institutions already active in the space industry. This encouraged their entry into a market with significant growth potential and high demand for innovative solutions.

In line with their corporate values based on the culture of sustainable innovation, to make the production process of space components more sustainable, Alpha's approach provides that by printing directly from pellets, most of the production waste will be eliminated and reused. In fact, as regards specifically the supply chain for the manufacturing of aerostructures, drones, and space applications, traditional industrial firms operating in this sector usually adopt numerous tools for the creation of flying metal parts. Alpha has improved its production process, which has been characterized by zero-to-positive environmental impact, using only raw and recycled material. Furthermore, Alpha supports manufacturing on demand with a digital library to limit the impact of logistics and sustain a circular economy. In general terms, the innovative and sustainable approach of Alpha, as stated by its Co-founder and CFO, allowed the company to enter the SE: *"... Our approach has truly had an impact on saving material and weight in the handling of components. Aerospace companies introduced robotic technology to physically make components on-site, and this has been the biggest entry into the aerospace industry."*

The access to the SE, however, required a series of efforts from Alpha, in particular in terms of competences and resources, such as the purchase of software licenses and hiring new employees: *"... We had to foresee the hiring of three 'field engineers', who are space engineers with experiences in the aerospace sector: unlike other sectors, for example, files cannot be managed with traditional metadata but through complex software, that must be known to use."* (Co-founder and CFO of Alpha).

In addition to these investments, Alpha also had to overcome other barriers to entry into this new market. Among the main challenges, the company had to make itself known in the SE without a previous history and without the possibility of providing guarantees to the buyers and development managers of client companies. In this regard, business relationships with client companies and other actors operating in the SE have been fundamental for the growth of Alpha. Specifically, the sector fairs represented the most effective opportunities to establish business relationships with key actors. For example, the company attended a fair two years ago in the UK dedicated to the SE, where contacts with key actors have been developed. Indeed, the objective of the Alpha's marketing strategy was not only to sell directly through the commercial force, but also to establish relationships with "channel partners", i.e., other companies operating in the Italian or international context that sell traditional technologies. These partner companies needed innovative technologies like those of Alpha. Through these partner companies, Alpha, for example, accessed the Japanese market by selling its technology to an established company: *"If our company had gone alone to a Japanese customer of that size, it would not have received any attention. Approaching that company with a major brand with an established name in the industry, there was a lot of attention."* (Co-founder and CFO of Alpha).

Business relationships with other actors, such as companies operating in the same sector, have also been crucial for the development of Alpha's innovative space products. In this regard, the Co-founder, referring to a new robotic tank for space applications, stated: *"This project is 85% managed by us and has also seen the involvement of another company operating in the space sector, and the support of the Space Agency, which has led to the sharing of important know-how for this project."* (Co-founder and CFO of Alpha).

In general terms, product development for the space market required the company to carry out new activities concerning the selection of key suppliers and business partners operating in the domestic and international markets. Entry into the space industry has enhanced Alpha's internationalization strategy, and clients have diversified across Europe, North America, the Middle East, and Asia. In addition, the business experience in SE enabled Alpha to strengthen its positioning also in different industries, considering the potentialities of the technology and the knowledge sharing with various actors. Thanks to the adoption of advanced manufacturing techniques and the partnership with Additive Engineering Solutions (AES), a world leader in LFAM services, Alpha has been also expanding into the defence sector. In this regard, the CEO of Alpha stated: *"We are very pleased with this partnership with AES. Their experience and expertise in developing advanced applications for the aerospace and defence industries perfectly complement our DNA".*

5.1.3 Consolidation and growth in the space economy

Alpha covers a growing and strategic role in today's SE by providing advanced manufacturing solutions to address the challenges of space applications. Notably, in recent years, additive manufacturing, thanks to its flexibility, sustainability, and cost-effectiveness, has become increasingly recognized in the space industry, and this achievement is driving the growth and consolidation of Alpha in this market. The SE is characterized by long lead times and the use of traditional manufacturing techniques. In this context, Alpha is leveraging new LFAM technologies to advance its offerings to its customers and stakeholders. Thanks to the "TechFast" tender promoted by the Lombardy region, Alpha has developed a project to more efficiently produce space applications, such as pressure vessels. This project, in line with Alpha's culture of innovation, aims to innovate manufacturing processes in the space industry through the additive manufacturing of pressure vessels.

To grow in the SE, Alpha had to develop and certify new competencies. Indeed, in the SE, certifications are essential for obtaining funding, participating in public tenders, and increasing the company's credibility. Alpha was the first Italian company to obtain the AS/EN 9100 certification, i.e., a prestigious space quality management standard essential for operating in the space and aviation industries. Achieving this certification demonstrates the Alpha commitment to the highest levels of safety, reliability, and process excellence. This accomplishment required a comprehensive review of internal business processes, rigorous quality control measures, and close collaboration with certification bodies and industry partners. This AS/EN 9100 certification, allowed Alpha to activate new contracts and collaborations within the SE and to reinforce its brand reputation in the industry.

Moreover, in this phase of consolidation and growth within the SE sector, technology partners play a key role. In this regard, Alpha's CEO stated: *"In just a few years, we have built strong global traction, doubling our revenues year after year ... and bringing on board some of the world's leading deep-tech investors. With their support, we are ready to accelerate our global expansion and help advanced industries strengthen production and supply chain resilience through the flexibility, efficiency, and sustainability of our technology."*

Recently, Alpha has received a grant from the European Space Agency (ESA) to lead the Artificial Intelligence-Based Monitoring of Large Robotic Format Additive Manufacturing in Space (AIMIS LFAM project). This initiative, developed in collaboration with Polytechnic of Milan and OBO Space, is part of ESA's "Assessments to Prepare and De-Risk Technology Developments" program. This project aims to advance large-format additive manufacturing technologies for space applications, focusing on creating autonomous and self-monitoring production platforms capable of operating in extreme environments such as orbit or extraterrestrial surfaces. By integrating robotics, composite polymer extrusion, and artificial intelligence, AIMIS LFAM seeks to enable manufacturing capabilities during long space missions.

In conclusion, Alpha's consolidation in the SE is rooted in its ability to systematically reconfigure actors, resources, and activities to meet the specific requirements of the space industry, rather than in a generic culture of innovation. Its transition illustrates how a non-space firm redefines technological capabilities, establishes credibility, and embeds itself within SE-specific networks. The transition process involved overcoming barriers to entry, such as the need for specialized competencies, building trust in a new network, and adaptation of production processes for aerospace standards. By facing these challenges, Alpha accessed the SE and consolidated its position through targeted technological development, collaborative projects (e.g., ESA's AIMIS LFAM initiative), and internationalization.

5.2 Beta

Company Beta is an innovative startup established in 2021 and active in the development and production of space suits. Currently it is managed by two founders (owning the company with two other individual professionals) and has three employees. Company Beta is a recent entrepreneurial initiative where a key role is played by the two founders, who are currently the Chief Designer and the CEO, both with long and deep experience in the fashion sector.

5.2.1 Evolution of beta

The Chief Designer (CD) has been a consultant and Creative Director for well-known fashion brands, and later he established, with the CEO, a fashion company. Over the years, both the CEO and the CD have developed a wide range of skills and competences related to the fashion sector. While the CD has specialized knowledge in design, development, materials, textiles, and production, the CEO has gained deep experience in the planning and management of business processes concerning the fashion industry's value chain.

A turning point in their professional career is represented by the start of a collaboration with the top management of well-known brands in the car industry. Their fashion company oversaw the design and production of all lifestyle merchandising (clothing, jewellery, furniture). The new idea was to develop a smart jacket that can connect and interact with the car. The project was financed by the customer firm and it ended up with a smart jacket equipped with visors, touch screens, solar panels, and with the granting of two patents. This project has been very important because it allowed the company to engage in a "visionary" activity and for the first time in the design and manufacturing—using internal production and external suppliers—of wearable high-tech devices.

After this stimulating experience, the CD and the CEO became increasingly aware of the need to engage in more breakthrough and long-term oriented innovative activities, moving beyond the "standard" incremental innovation process diffused in the fashion industry, perceived as a mainly "conservative" setting. Competition in the fashion market was increasing, and profit margins were shrinking, in the light of the changing needs and preferences of consumers in both the luxury and fast fashion markets.

5.2.2 Access to the space economy

A relevant opportunity emerged through initial contacts with the Italian Air Force. During meetings with Air Force pilots, attention has been raised to some problems related to the use and comfort level of their pilot suits, which could have been improved in terms of transpiration and waterproofing. After this initial interaction, thanks to the Italian Air Force, the CEO and the CD had the opportunity to have contact with the Space Division of the Italian Air Force and start a collaboration over new materials for suits for space missions.

CEO and CD started thinking and working on developing an innovative offering for the SE and thus established a new startup named *Beta*. The reason behind this choice is related to the idea that this type of "context"—the SE—*"... allows for experimentation beyond well-known limits*, *leading to higher levels of improvement of products*, *technologies*, *and materials*, *with possible spillover in current and future* *businesses. The space context is our extreme lab*, *allowing to raise the bar.”* (CD of Beta); or in the words of the CEO of Beta *“The study and development of innovative space clothing also pave the way for future usefulness and usability here on Earth and opens a new leadership ‘space’ for Made in Italy.”*

The features of the “space” setting push for innovative combinations of different materials having specific properties, generating benefits for product users. The founders of Beta felt ready for this new venture: *“As designers and entrepreneurs*, *we came from a parallel world*, *with specific design and materials*, *but having cooperated with car makers for eight years helped us to make this jump; we made a radical and brave choice*, *meant to create something new.”* (CD of Beta).

After the start of the collaboration with the Italian Air Force and its Space Division, the company had the chance to have contacts and start the cooperation with the Italian National Research Council and with *Delta*, a key space player based in the UK, and its astronauts. The main result of this effort has been the successful participation in two important and complex space commercial missions as producers of the space suits used by Italian astronauts.

Space Mission 1 concerned a sub-orbital flight in collaboration with Delta with the goal of implementing thirteen experiments set up by the Italian National Research Council and a group of Italian Universities. Experiments were mainly concerned with the monitoring of body reactions during the flight as experienced by the Italian crew members. The space suit developed by Beta was designed to withstand pressures of up to 12G and is made up of over one hundred and fifty components, assembled using fire-resistant yet breathable and lightweight materials, with the goal to collect biomedical data through textile sensors (Beta website).

Space Mission 2 has been a more ambitious project as it concerned the transport of an international team of astronauts to the International Space Station (ISS), including an Italian Astronaut using the new improved space suit developed by Beta. The improved suit has successfully passed the qualification process for spaceflight in accordance with the most stringent international standards. Made from over two hundred components and featuring a next-generation fabric that is lightweight, breathable, fire-resistant, and thermoregulating, the suit collects numerous medical data from the astronaut, also integrating a high-precision device that does not need to be in close contact with the body.

In this commercial mission, Beta was part of a group of Italian firms leading thirty specific experimental projects. In addition to its tasks, Beta had thus the opportunity to collaborate with another high-tech Italian firm in a project concerning the resistance of advanced textiles against gamma rays, which have very negative effects on the health of astronauts. Participation in this space mission has been very complex as Beta had to comply with very strict and complex regulations and audits required by the Federal Aviation Administration and by the National Aeronautics and Space Administration (NASA).

The expansion in space-related activities has meant for Beta the set-up of an innovation network comprising both providers of scientific knowledge and professionals, and firms with strong product expertise. The space suits developed by Beta have reached very high standards as they were required to be comfortable for the astronaut, completely fire-proof, to maintain body temperature, and to reduce frequent washing.

Water is a very precious resource in space and therefore, washing of clothing must be kept to a minimum, even though Astronauts are supposed to undertake extensive athletic exercises every day. To achieve these goals, Beta has been interacting with various actors. First, Beta had access to astronauts who were able to share all their experiences, ideas, and concerns about flight conditions and the living context in the International Space Station: *"Interacting with an astronaut means having direct contact with his/her dimensions as athlete, scientist, and person."* (CD of Beta). To translate these ideas and needs into effective solutions, Beta has been actively collaborating with the Engineering Department of a local University, able to provide support for developing and testing the novel space suits. Moreover, Beta has fully involved—in Beta's words—*"Engineer fashion tailors"*, characterized by strong traditional design and handcrafting skills combined with openness towards advanced technological devices. For both types of resources—design skills and devices—the company has involved three specialized Italian partner companies, thus displaying strong and distinctive "relational competences" in this field. Lastly, Beta has become a very active member of a regional formal cluster in the aerospace industry, sharing its vision and market knowledge to promote the upgrading of other local firms with valuable resources for operating or entering the SE.

5.2.3 Consolidation and growth in the space economy

The involvement in space missions and related projects has allowed Beta to develop specialized knowledge about user needs, innovative materials, and smart solutions applied to clothing: *"... Maybe in the future we will use t-shirts and trousers originally designed for those who go into space ... with interesting materials and an attractive design."* (CEO of Beta). Beta has gained a strong reputation in the sector, also due to the active participation of the founders in public events related to the space economy and in the media, and this has allowed direct contact and interaction with key players in both the institutional context, at the international and national level, and in the business domain. Well-known fashion brands have started cooperation with Beta for possible joint projects concerning future developments related to the Artemis program for the exploration of the Moon.

In this phase, the main goal for Beta is to develop new products and their related industrialization processes to become a market player and thus pursue an economic return from the R&D investments undertaken over the previous years: *"If you want to enter in this sector you need to make high R&D investments, starting with your own financial resources."* (CD of Beta).

The emerging strategy is to develop a product offering—in terms of specialized clothing—in the "sky" and "sea" segments—for both civil and military uses. The product offering embodies various innovative solutions developed in the space projects: *"We aim to put on the ground and simplify the knowledge gained in the space domain."* (CD of Beta).

This capability makes Beta highly competitive when compared to existing and potential competitors: *"Our vision is to create an innovation pipeline that unites space and Earth ... The space sector is not for everyone"* (CEO of Beta).

6 Discussion

This paper aims to provide, through a qualitative research methodology, an in-depth understanding of how the transition of firms active in non-space sectors towards the SE is implemented, highlighting the main factors involved.

The SE is gaining relevance in terms of financial investment and scientific and technological development (OECD, 2023a) and is therefore attracting firms searching for new opportunities and entering new markets (Vittori et al., 2025). However, the SE has distinctive features and, therefore, is a complex context to be dealt with by firms attempting to enter and implement diversification processes in this industry (Robinson & Mazzucato, 2019).

The two case studies under investigation show trajectories with both common and different features, shaped by a variety of both internal and external factors. Both cases follow lateral diversification processes, as they exploit available resources to enter into the SE (Hafner, 2021). This section discusses the key features of the transition process of both firms using the ARA framework, highlighting the role of actors, resources and activities (Håkansson & Snehota, 1995). First, it analyses the distinct phases of the evolution of companies before the entry in the SE, of their entry process and of the following consolidation, then it examines in more depth each of the layers of the ARA framework.

In their evolution before the entry in the SE, both firms are characterized by a strong entrepreneurial drive by the founding team and a distinct propensity for experimentation and innovation, with the support of close partners in the business and R&D settings. While Alpha is an active node in the local innovation network for 3D printing (LFAM platforms for large-scale industrial parts), Beta instead has the opportunity to have an intense interaction with large innovative customers for fashion-related products. Entrepreneurs in both firms have a clear vision of creating innovative products, shaping the technological evolution in their respective sectors. In other words, both Alpha and Beta before the entry were "trained" to deal with complex and advanced product solutions, to implement activities based on structured organisational processes and to collaborate with multiple business networks, considering mainly the supply perspective, the R&D, operations and customer side, to gain access to required external resources. In other words, both companies had already undertaken "resource upgrading" processes. These resources and the support provided by key players sustained the configuration of a strategic innovation network (Möller et al., 2005).

The entry process in the SE could be explained by a combination of market opportunity exploitation (Shane & Venkataraman, 2000), in the light of the technological and organizational resources already held by the two companies, and a strong orientation for experimentation and discovery. In both firms, the triggering event is represented by unexpected interaction with a few key space actors, paving the way for further exploration and for joining innovative R&D projects. These initial steps have allowed for engaging in a preliminary learning process about the space sector and its key attributes, where both companies experienced a strong sense of "liability of outsidership" (Schweizer, 2013) in terms of space-related knowledge and relationships. This initial phase is therefore based on exploration activities, where companies have the chance to test their resources and strategic interest for the SE. This is the stage where then the decision to diversify in the SE takes place, apparently in the form of a "jump" (Bessant et al., 2012) showing some distinctive features: the development of a visionary strategic goal (Schilling, 2018) related to the evolution of the space sector, the adoption of the long term perspective and the substantial commitment of company resources (technological, financial, human). “Visioning” (Abrahamsen et al., 2023) by the two companies involves external actors as active parties (Baraldi et al., 2007). This substantial shift implies accepting to play with the specific competitive rules of the SE, pushing firms to become resilient over time while facing the institutional, technological and financial uncertainties.

This risky and unpredictable phase is undertaken with a strong focus on setting up a partially new and emerging innovation network. Both companies expanded their network ties (Butticè et al., 2023) by reinforcing relationships with key partner suppliers, willing to follow them in the SE, as well as activating new relationships (Guercini & Milanesi, 2019) with certification organizations, international/national agencies and institutions, and universities. In both cases, the development of innovative solutions, characterized by the integration between products and related services, has been supported by the first involvement in complex inter-organizational R&D projects under the coordination of key space players and agencies. In this phase both firms have experienced the different logics of the SE in terms of content and timing of innovation processes—with a strong science orientation, higher failure risk and long term horizon—and institutional relationships management, with the need to join different types of political and public networks, at the regional, national and international level, with the goal of increasing their market visibility and reputation among key space stakeholders. Notwithstanding these barriers, both firms have shown strong commitment in terms of entrepreneurial drive and investment of resources, including financial ones (Vittori et al., 2025). All these initiatives and steps shape the complex network positioning process effort of both companies (Gadde et al., 2003).

In the most recent phase, both firms have been active in consolidating their presence in the SE. This evolution is characterized by three distinct patterns. Firstly, companies have become well-known players and therefore they have been able to join some of the inner networks in the SE, thus building a clear and visible organisational identity (Husmann et al., 2020) leading to market reputation and increased legitimacy in the SE. In this regard, both firms develop also a network identity focusing on the credibility recognized by the most important network partners, becoming a reference point for the other firms (Partanen et al., 2020). This step has made it easier to cooperate with leading space institutions, key space players, and large firms willing to provide technologies and resources for space projects. Secondly, the development of space-related knowledge learning processes has allowed the further expansion of their innovation networks, with new relationships established with valuable research institutions, space knowledge providers, and innovative suppliers. Thirdly, the main effort is put on establishing a stable business network in terms of relationship development with customers and channel partners and setting up a production and supply base to foster the industrialization and commercialization of space-related innovative solutions. It is worth noting that, in this last process, both firms have the opportunity to modify and innovate their offerings in their traditional markets. After time and resources devoted to resource seeking and network development, in the consolidation phase the product/offering dimension emerge as a key focus, leading companies to emphasize exploiting the upgraded resource base and the multiple networks in place.

Therefore, according to the empirical analysis, the transition process towards the SE is characterized by three phases shaped by five emerging company behaviours that characterize their diversification process: resource upgrading, exploring, visionary jumping, network positioning, and exploiting.

Taking a micro-process perspective on the single ARA components, findings show that undertaking this transition implies simultaneously addressing various challenges in terms of interaction with key actors, accessing and developing valuable resources, and implementing required activities (Table 2).

In both cases, firms have been eager to exploit their existing networks and valuable resources. Relationships activated in the past and the availability of technological knowledge and equipment adequate for starting space-related projects have played a key role in the launch of the first initiatives in this new sector. This is in line with well-known diversification processes, also in advanced and complex high-tech sectors (Najafi-Tavani et al., 2018). However, the shift from the previous specialization to the SE setting has implied the need to establish relationships with new actors, notably different customers, including government agencies, final users—in the case of Beta—and business organizations—as shown in the Alpha case. In this regard, the transition process has also brought a change also in the role of certain actors, initially considered as institutional partner (government agencies) and ultimately as customers.

Both companies selected key actors to access to key resources and develop key activities (Möller & Halinen, 2017). However, the development of new relationships and the interaction processes have been difficult mainly because key actors in the SE follow different logics in their behaviour and choices. The main characteristics of these logics are the relevance of public-led processes—such as in public procurement and regulatory settings—the strong experimental orientation, and the long-term perspective, all having an impact on strategies, organizational choices and resource commitments. In this process, both companies developed heterogeneous relationships with actors belonging to the supply chain as well as with actors belonging to university/research and public actors. Innovation has been generated by the actors involved in academia, industry, and government as depicted by the Triple Helix Model (Etzkowitz & Zhou, 2017). In this context, a key role has been recognized for facilitating actors, such as business associations and trade agencies, that can support the connections between private and public actors. Other key actors have been identified in incubators and accelerators supporting startups' growth with the sharing of competences for innovation development. Particularly, accelerators also provided financial support for substantial investments required by innovative projects. Furthermore, incubators and accelerators enhanced the networking process, allowing firms to identify new business partners and thus new business opportunities. In this perspective, the firm's ability to innovate has been influenced by actors "outside" the company (Clauss & Kesting, 2017). Therefore, the entry in the SE has implied the active and simultaneous participation in multiple innovation networks, showing different logics and patterns, with the goal of building up a recognized reputation and therefore a legitimacy as a SE player. This higher relational complexity has pushed firms to develop adequate networking capabilities (Freytag & Young, 2014) mainly embodied in the top management team, representing the company in the various business and institutional contexts.

Table 2 Analysing ARA in the three phases of development of Alpha and Beta (common elements are in bold)

	Alpha	Beta
Evolution of the company		
Actors	**Suppliers** **Customers** Incubator University Research institutions	**Suppliers** **Large customers**
Resources	**Founders' innovation capabilities** **Product development capabilities** **Managerial capabilities** Experience in international consulting and finance Financial planning and control capabilities Engineering capabilities	**Founders' innovation capabilities** **Product development capabilities** **Managerial capabilities** Experience in fashion design and materials
Activities	**Product development processes** **Market analysis** Business planning	**Product development processes** **Market analysis**
Access to the Space Economy		
Actors	**Universities** **Key suppliers** Research institutions belonging to the space industry New international customers	**Universities** **Key suppliers for materials and devices** Military Air Force Government organisations Local aerospace cluster Space Agencies (NASA, FAA)
Resources	**Technology** **Managerial capabilities** **Product development capabilities** **Technical and material competences** Sustainable innovation capabilities	**Technology** **Managerial capabilities** **Product development capabilities** **Technical and material competences** Knowledge of expert users (astronauts)
Activities	**Product development processes** **Institutional networking** **Business networking** **Search for new skills** Production process improvement Business process change	**Product development processes** **Institutional networking** **Business networking** **Search for new skills** Certification/audit processes
Consolidation and growth in the Space Economy		
Actors	**Space Agencies (ESA)** **University** **Certification firms** **Supply chain partners**	**Space Agencies (NASA, ISA)** **University** **Certification firms** **Supply chain partners** Local aerospace cluster

Table 2 (continued)

	Alpha	Beta
Resources	**Technical competences** **Relationships with Space Agencies and Institutions** **Knowledge of the space sector** Process technology Equity funds	**Technical competences** **Relationships with Space Agencies and Institutions** **Knowledge of the space sector** Organisational competences R&D investments
Activities	**Product development processes** **Public relations activities** **Supply chain management** Certification/audit processes Production processes	**Product development processes** **Public relations activities** **Supply chain management**

Such complexity also requires different and appropriate resources. Being innovative and highly specialized in the main sector seems to be a necessary but not sufficient condition for firms attempting to become key players in the SE. In both cases, consolidated technological knowledge had to be upgraded and combined in novel ways to comply with technical standards in the SE (Vittori et al., 2025). This has meant moving beyond well-known technological boundaries, involving newly hired personnel and new suppliers. However, venturing into this new business requires specific entrepreneurial skills, including "visionary" capabilities (Schilling, 2018) and risk-taking approaches, to discover and exploit market opportunities, combined with planning skills and experience. Particularly, technical knowledge development has been combined with market knowledge in a parallel process, with the goal of reducing the distance between innovative outputs and their possible market applications. This "visionary" attitude has been developed jointly by the entrepreneurial teams (Anderson, 2024) and shared with partners in the various supply chain networks to support the often difficult and non-linear transition process, thus building up a form of "resilience" (Watanabe et al., 2004) in overcoming obstacles to become a well-positioned SE player.

Entering the SE pushed firms to engage in highly complex activities, often required to address the uncertainties related to the need to deal with business networks with different logics and to gain access and develop adequate resources, without losing effectiveness and efficiency. Both firms had to engage in novel innovation-related and administrative processes. On the one hand, market analysis and new product development and design had to become more structured and adequately planned and managed, often in the form of R&D and innovation projects with key partner firms and organizations (Silvestri et al., 2022). On the other hand, engaging with public and private procurement in the SE has pushed both firms to effectively engage and comply with compulsory government authorizations and required certifications (Vernile, 2018), often requiring additional and time-consuming novel administrative tasks and processes, to be dealt with internally—as in the Beta case—or with the support of space business partners, as shown by Alpha. The dimension of "certification" for becoming a SE formally legitimate player has represented both the ending of a long process of innovation and change and the starting of a recognized role to be maintained and sustained over time.

7 Conclusions

This paper has the objective to depict the process of transition of "traditional" non-space firms towards the SE by leveraging diversification strategies and processes.

Vittori and colleagues argue that it is important to further "explore how firms balance structured *[...]* strategies with flexibility *[...]* examining how they harness both intentional planning and emerging opportunities to navigate complex, dynamic markets like the Space Economy" (2025:32). Moreover, the authors call for contributions that could track firms' trajectories over time to understand how these strategies adapt to changing conditions.

With this in mind, this paper aims at participating to the emerging scientific debate on SE evolution and related firms' trajectories. Notably, the main contribution of the research concerns the analysis of the transition process in terms of access and consolidation in the SE, exploring the longitudinal underlying micro-processes of the evolution and change of innovation networks using the ARA framework, based on the lens of the Business Network approach.

Two main contributions derive from the empirical analysis. Firstly, the transition process towards the SE is characterized by the sequencing of distinctive behaviours—resource upgrading, exploring, visionary jumping, network positioning and exploiting—where "visionary jumping" emerges as a specific feature. Even though companies have implemented lateral diversification processes, the decision to commit resources in the SE has meant a leap forward characterized by high degree of uncertainty on the one hand and strong innovation propensity on the other. Secondly, diversification processes in the SE imply substantial and simultaneous changes along the actor, resource, and activity dimensions. These parallel and interdependent changes represent a key challenge for firms in transition towards the SE, as they are involved in: *(i)* becoming active player in multiple networks, such as supply networks, institutional networks, R&D networks; *(ii)* implementing complex resource combination processes across many scientific and technological fields; *(iii)* pursuing upgrading of activities in terms of business processes, with the goal of managing interdependencies across networks and achieving compliance with the requirements of SE certifications and standards.

In synthesis, the transition process to the SE is shaped by the interplay of innovation (Colombo et al., 2023; Etzkowitz & Zhou, 2017) and business networks (Håkansson & Waluszewski, 2002, 2007), developed in the R&D, production and user/market settings. It could be argued that the Business Network conceptual perspective and notably the ARA framework (Håkansson & Snehota, 1995; Håkansson et al., 2009) represent useful tools for analysing the behaviour of firms in the SE, as they allow for gaining a better understanding of the underlying processes, of the nature and role of key players in terms of network position and available resources, of the emergence of complex and novel activities placing emphasis on their interdependence processes.

This paper is not without limitations. The research is based on a case study methodology, and this approach does not allow the generalizability of results. The sectoral specialization and size of the selected firms could influence the results and thus offer a specific perspective on the transition process towards the SE. Lastly, the collection of data is related to informants belonging to the selected firms. A more exhaustive and fine-grained empirical analysis could consider also the perspective of other partner companies and institutions, providing resources and support in the transition process.

Notwithstanding the research's limitations, some relevant managerial implications for firms interested or active in the transition towards the SE can be drawn. The first one is related to the actor and resource dimensions. Entering the business networks in the space economy implies interacting with a variety of business, government and scientific actors. Handling these relationships could be very difficult and complex, and therefore relational and networking capabilities are highly required. This could be a challenge for small and startup firms, which should invest in managerial roles and activate partnerships with broker organizations and business associations. Once the "liability of outsidership" is overcome firms might develop "coalitions" with trusted and capable partners (Manning, 2017). The second managerial implication is related to the evaluation and management of the time horizon for both strategies and business processes. Becoming a player in the SE means to acquire a deep market knowledge and to exert a high strategic and operational flexibility, while being aware that performance in the short and often also in the long run could be affected by failures and additional costs. This implies that transition to the SE means entering a different "business world" and thus requires a careful assessment—of existing and potential networks, required resources, novel activities—a long-term commitment and the availability of adequate funding.

Future research could analyse in more depth the transition process towards the SE in various ways. On the one hand, future studies could investigate in more depth the impact of original sectoral specialization, which could influence the trajectory of firms in terms of technological adaptation and organizational upgrading. Also, the size and age of firms could influence the transition process, in the light of the limited available resources. A more in-depth analysis of the entrepreneurial dimension, highlighted in this paper, is encouraged, as the space economy represents a novel "context" (Welter, 2011). On the other hand, it could be argued that additional studies could focus on the evolution of innovation and business networks, in terms of in depth analysis of interaction processes between key actors—such as firms and space agencies—and of fine-grained analysis of the wide variety networked activities, such as inter-organizational project management, space missions and regulatory audit, which are "politically-embedded" (Raswant et al., 2025; Welch & Wilkinson, 2004). Research on these specific processes could help in unveiling the nature and impact of specific barriers and provide useful insights for developing adequate industrial policy measures, in the light of the increasing attention of national governments and space institutions towards the growth and impact of the SE.

Funding Open access funding provided by Università degli Studi di Urbino Carlo Bo within the CRUI-CARE Agreement.

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