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Regulation of the new space economy: opportunities and challenges of the new Italian law 89/2025

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Abstract

Driven by rapid technological advancements and evolving market dynamics, the space sector is undergoing a profound transformation, emerging as a commercially reconfigured industry in which private firms play an increasingly central role. Over the past decades, private actors have demonstrated not only their capacity to enter the space market, but also to lead innovation, shape technological trajectories, and redefine competitive structures. These developments call for regulatory adaptation, both to reduce uncertainty for institutions and firms and to enhance the sector's competitiveness and innovative capacity. In this context, Italy promulgated its new Space Economy Law in June 2025. This paper examines the opportunities and challanges of this legislation. Our study contributes to existing literature providing a documented and critical analysis of the law's key features, highlighting its potential to support emerging private firms, sustain research activities, strengthen public–private collaboration, and advance a coherent strategic industrial vision. The paper also makes a theoretical contribution to the Sectoral Systems of Innovation (SSI) literature by extending the framework toward an "inter-sectoral systems of innovation" perspective, better suited to capturing innovation dynamics that span multiple technological and industrial domains. Finally, the paper proposes a set of policy recommendations aimed at ensuring the effective, competitive, and sustainable implementation of the new law.

Keywords New Space Economy · Policy · Competitiveness · Sectoral System of Innovation

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1 Introduction

The space sector has undergone a period of deep transformation in recent years, exhibiting dramatic industrial dynamics worldwide. Technological advancement and evolving market conditions have given rise not merely to a new cohort of private economic actors, but to a new vision of space and a fundamentally different model of commercial engagement within the space sector (Vittori et al., 2022). These activities have been called the "New Space Economy". The OECD defines the new space economy 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, 2019).

The new space economy is conventionally categorised into two primary sectors: the upstream and downstream domains (OECD, 2019). The upstream segment comprises the capital-intensive phases of space infrastructure development, including research and development, the manufacturing of satellites and launch vehicles, and their subsequent deployment. High fixed costs, significant technological uncertainty, and long investment horizons characterise these activities. The downstream segment encompasses market-facing applications that leverage the outputs of space infrastructure. These include services such as satellite broadcasting, telecommunications, global navigation satellite systems (GNSS), and Earth observation. According to the European Space Policy Institute, the downstream sector is increasingly integrated into broader digital and data-driven economic systems, representing a key channel through which space-related investments generate spillovers and socio-economic returns.

The increasing involvement of private actors, the changing geopolitical landscape, and the constraints on supranational harmonisation make comprehensive national space legislation necessary for EU Member States. However, within the European Union, Article 189 of the Treaty on the Functioning of the European Union (TFEU) limits the harmonisation of space law at the supranational level. As a result, the core legal and regulatory framework governing space activities must be developed primarily at the level of individual Member States.

In this paper, we focus on the Italian regulation of the space economy. On 13 June 2025, Italy enacted a new regulation, Law No. 89 "Disposizioni in materia di economia dello spazio". In the economic literature, there is no unanimous consensus on the impact of new regulations on economic growth. Some authors claim that strict regulations are generally harmful to growth (e.g. Bassanini and Ernst, 2002; Scarpetta et al., 2002; Broughel and Hahn, 2022; Tomasi et al., 2023), while other research focus on the positive opportunities and impacts that clear regulations can have on economic growth (e.g. Jaffe and Palmer, 1997; Amici et al., 2016; Goo and Heo, 2020; Janikowski, 2025). This debate is particularly relevant given the importance and growth of the space sector in the Italian economy, as well as in many other advanced economies. Based on the most recent full-year data (Di Pippo et al., 2025), Italy's space economy continues to expand, reaching a record level in 2024 with revenues exceeding 4.5 billion Euros and employment above 15,000. Compared to the previous year, revenues grew by 12.3% and employment by 5.6%. Growth was largely driven by major industrial groups, whose revenues increased by 13.5% and

accounted for approximately 75% of total sectoral expansion. At the same time, small firms recorded a 60% rise in revenues, reflecting both new market entry and strong performance among existing companies. The Italian space sector is characterised by a comprehensive, vertically integrated industrial chain spanning all levels, from specialised small enterprises to large-scale corporations capable of managing complex, end-to-end projects.

The original contribution of this paper lies in its analysis of Italy's new Law No. 89, highlighting its key provisions to support emerging private firms, enhance public–private collaboration, and ultimately promote socio-economic development. We claim that Italy's regulatory capacity in the space economy could provide institutional credibility and serve as a reference case of how legal certainty can be effectively transformed into economic dynamism. Drawing on the literature on Sectoral Systems of Innovation, we argue that the Italian space sector exemplifies innovation in governance, in which the government maintains a leading role that serves as a form of institutional entrepreneurship.

However, some critical issues and challenges remain. In particular, the threat of excessive bureaucracy, the need to harmonise rules at the EU level, limited financial support, and the need to scale up to compete globally can hamper the potential positive effects of the law. We acknowledge that, in the context of frequent geopolitical changes and the current situation, the defence/dual-use component, including military applications, accounts for a significant share of the market and is highly relevant from an economic perspective. At the same time, since the law does not address these aspects, we do not consider this dimension in our analysis, focusing instead on issues related to the private sector and the commercialisation of space.

The methodology of this study draws on qualitative research from primary and secondary sources. The study is grounded in an extensive analysis of the relevant academic literature and other sources, including Parliamentary acts and official documents, policy briefs, industry and foundation reports, conference proceedings, books, and relevant websites. In addition, the authors actively participated in the 2025 States General of the Space Economy, a major forum for dialogue and in-depth exchange among policymakers and key stakeholders. This participation enabled engagement with various actors in the space economy, including venture capitalists, entrepreneurs, institutional representatives, and academic researchers, facilitating further discussion and exploration of the ongoing dynamics shaping the sector. As part of the primary data collection, we identified and interviewed eight representatives of the key actors actively involved in the current debate surrounding the new Italian space legislation. The interviews yielded valuable insights into the key issues, their potential effects on socio-economic development, as well as risks and remaining challenges. Given the recent approval of the law and the still-pending executive decrees, it was not possible to collect empirical data.

To ground our study within the broader scholarly debate on the relationship between regulatory frameworks and development, as well as on space regulation, Sects. 2 and 3 provide a discussion of the most relevant research and evidence. Section 4 discusses the methodology, and Sect. 5 presents the results. In Sect. 6, we discuss our main contributions, and Sect. 7 concludes.

2 Background literature: regulation, innovation, and growth

The importance of a sound regulatory framework as a driver of national development has garnered growing attention in the economic literature. Regulatory structures are an integral component of a country's broader economic institutions, which are themselves shaped by the underlying political institutions (Acemoglu and Robinson, 2013). Then, institutions can act as key actors in promoting and sustaining innovation and competitiveness: this capacity is particularly needed in periods of transition, when States must assume a more active, not diminished, role (Rullani et al., 2016). During such transformative phases, there is an acute need for collective socio-economic and political leadership to mitigate the ambiguity and uncertainty that limit the perspectives of enterprises, communities, and individuals. Faced with heightened unpredictability and constrained resources, there is a common tendency to adopt a defensive posture. However, both the resistance to change and passive adaptation are ultimately detrimental, as they undermine long-term innovation potential and discourage capital commitments. In this context, the State emerges as the most appropriate actor to offer a strategic direction.

In a seminal contribution, Ergas (1987) discusses how different economic, as well as institutional, environments generate different outcomes in terms of innovative performance, analysing the technology policies of various countries. In his taxonomy, technology policies are designed to achieve strategic national objectives, such as advancing and deploying new generic technologies that underpin sovereign capabilities. These policies are characterised by clearly defined goals and the allocation of targeted public investment to achieve specific technological outcomes. However, policies may also focus on the widespread dissemination and adoption of technological knowledge, often through initiatives that support its practical application and intersectoral transfer, exemplified by the promotion of key enabling technologies expected to generate positive spillovers across multiple industries and firms. Accordingly, based on North (1990), a growing body of literature emphasises that regulation can positively affect economic performance by providing clarity, coordination, and predictability, particularly in complex and uncertain markets. Regulation is increasingly framed as a governance mechanism that stabilises expectations and facilitates coordination among economic actors, thereby acting as an economic asset rather than a constraint (Jordana and Levi-Faur, 2005).

The strand of research related to the concept of National Systems of Innovation (NSI) emphasises how a diverse array of actors, including firms, universities, research institutes, and governments, interact in the production, diffusion, and use of new and economically useful knowledge, thus shaping the innovation capacity and performance of countries (Lundvall, 1992). More broadly, institutions can be understood as the formal and informal arrangements that govern political, economic, and social interactions among agents, thus mitigating uncertainty arising from information asymmetries and transaction costs and enhancing the efficiency and predictability of market exchanges (North, 1990). From an economic perspective, the efficiency of an NSI depends not only on the volume of R&D investment but also on the coherence of policies, the strength of stakeholder linkages, and the presence of mechanisms for knowledge spillovers and absorptive capacity.

Variations across national contexts reflect differing historical trajectories, industrial structures, and policy orientations, which in turn influence innovation outcomes and long-term competitiveness. Following this line of research, a similar systemic view on innovation has been proposed with a narrower geographical scope, emphasising the local nature of knowledge under the name regional systems of innovation (Cooke et al., 1998).

Alternatively, with a specific focus on technologies, the Sectoral System of Innovation (SSI) refers to the configuration of actors, institutions, demand structure, knowledge base, and technological regimes specific to a particular industrial or technological sector that shape the processes of innovation and knowledge diffusion (Malerba, 2002, 2004). Although these approaches vary in scope, they share a common goal: to understand the interactions among actors, networks, and institutions that collectively generate and sustain innovation. SSIs evolve through path-dependent processes shaped by historical trajectories, policy priorities, and technological opportunities. Economic performance and the pace of innovation vary significantly across sectors, depending on the intensity of R&D, the appropriability of returns, the degree of cumulative technological learning, and regulatory frameworks. Early research on innovation systems primarily emphasised their structural dimensions, particularly the ways in which linkages among actors enable the flow of knowledge, finance, and influence.

Over time, scholars have developed functional approaches that focus on what innovation systems do to promote innovation (Negro et al., 2007; Aguiar-Hernandez and Breetz, 2024). For example, Hekkert et al. (2007) propose a functional framework that identifies seven key functions of innovation systems: entrepreneurial activity, knowledge generation, knowledge diffusion, guidance of the search (or coordination), market formation, resource mobilisation, and legitimacy creation. Rather than merely cataloguing system components, this approach examines the processes that shape system performance. It is dynamic and recognises that different actors may perform different functions over time and that institutional contexts influence both the configuration of actors and their functional effectiveness. Moreover, a functional perspective enables policymakers to identify targeted policy interventions to develop or strengthen specific system functions (Bergek et al., 2008).

Whether analysed at the national, regional, or sectoral level, the innovation systems frameworks agree on the need to define a proactive policy in a dynamic, interconnected environment to direct and sustain innovation and economic growth. As a consequence, it is crucial to understand how institutions can tailor policies to govern innovation trajectories. Well-functioning institutions promote market development and facilitate economic coordination. Conversely, weak or poorly designed institutional frameworks may impose high costs on economic actors, impeding productive activity (Borrmann et al., 2006).

A different view is given by the Entrepreneurial Ecosystem (EE) approach (Stam, 2015; Stam and Spiegel, 2017; Spiegel, 2017; Audretsch et al., 2018). An entrepreneurial ecosystem is commonly defined as a set of interconnected actors, institutions, and cultural attributes within a specific geographic area that collectively support entrepreneurial entry, growth, and survival. Entrepreneurial activity is at the centre of analysis. Core elements typically include entrepreneurs, investors, support organ-

isations, universities, public agencies, and social norms that valorise risk-taking and innovation. Unlike SSI, the EE approach is explicitly place-based. Geographic proximity, local networks, and face-to-face interactions are considered fundamental for fostering entrepreneurial learning, opportunity recognition, and resource mobilisation. Innovation is often treated as an outcome of entrepreneurial experimentation rather than as a systemic process driven by sectoral knowledge bases.

Although SSI and EE originate from distinct intellectual traditions and emphasise different units of analysis, they are not mutually exclusive. Rather, they offer complementary insights into the dynamics of innovation and entrepreneurship. SSI provides a robust framework for understanding how innovation unfolds within industries through coordinated interactions among multiple actors and institutions. EE focuses on explaining why entrepreneurial activity concentrates in certain regions and how local conditions facilitate or hinder entry. Importantly, both perspectives acknowledge the role of institutions, but differ in how institutions are conceptualised and operationalised, either as core components of sectoral dynamics in the SSI framework or as enabling conditions for entrepreneurship in the EE theory.

Institutional entrepreneurship theory provides an alternative perspective, focusing on how institutions, understood as formal rules, informal norms, and shared cognitive frames, can shape and constrain individual and organisational behaviour (DiMaggio, 1988; Battilana, 2006). Nevertheless, institutions are not fixed constraints but can be strategically modified. The core argument here is on agency, highlighting the capacity of certain actors to intentionally alter the institutional arrangements that structure economic and organisational activity. Institutional entrepreneurs are actors who recognise that existing institutional configurations limit the development of new activities or markets and who engage in purposive action to transform them. These actors may include individual entrepreneurs, incumbent firms, coalitions of organisations, and public agencies. From this standpoint, entrepreneurs not only innovate technologically but also work to reshape legal frameworks, standards, and public expectations, often interacting with State actors in mission-oriented policy contexts. Thus, institutional change is an endogenous process: change arises from within the field, as actors respond to institutional contradictions and crises that create openings for transformation.

Many papers attempt to measure how different regulatory designs impact market entry, innovation, investment, and growth. However, this literature is vast and fragmented, without a unified analytical framework across economics, management, and policy studies (Minniti and Palubinskas, 2023), and the empirical evidence provides no unanimous consensus. For example, Bassanini and Ernst (2002) study the impact of economic regulation on innovation and provide evidence of a negative correlation between the intensity of regulations and the intensity of R&D expenditures. Scarpetta et al. (2002) provide empirical evidence on the roles of policy and institutional settings in shaping productivity and firm dynamics in product and labour markets. Using a firm-level database covering ten OECD countries, complemented by industry-level data for a broader set of countries, the authors show that burdensome regulations on entrepreneurial activity and high workforce adjustment costs negatively affect the entry of new small firms. A similar result is reported by Tomasi et al. (2023), who argue that excessive bureaucracy slows down economic dynamism (especially

through time delays) and disproportionately harms small firms, ultimately weakening growth and innovation. Further, Broughel and Hahn (2022) report results from a multi-country study that seem to reflect a consensus that entry regulation, anticompetitive product and labour market regulations are generally harmful to growth.

On the other hand, not all regulations inhibit growth, innovation, and entry, and some research provides evidence that the impact of regulation is contingent on market uncertainty. In a relevant study, Blind et al. (2017) present an empirical analysis that includes manufacturing and service firms, based on the German Community Innovation Survey. They show that regulation improves innovation efficiency under low uncertainty, but hinders it in highly uncertain markets, while formal standards play a positive role in the latter. Related contributions stress that regulation can create standards, reduce uncertainty, and channel innovative activity, with benefits arising from clarity and coordination (Blind, 2012). More broadly, clear and credible rules enhance investment by committing the State and lowering perceived risk (Rodrik, 2000). Similarly, Elmawazini et al. (2022) claim that regulation has a positive impact on innovation, particularly concerning the strength of competition policy and the intellectual property rights protection system, which have a complementary effect. Alam et al. (2019) provide empirical evidence in emerging markets on the effect that regulatory quality has on R&D investments, suggesting that policymakers should develop a stable and robust institutional environment in order to attract R&D investments. Following the Porter Hypothesis (Porter and van der Linde, 1995), environmental regulations are shown to have positive and significant effects on R&D intensity and environmental innovation (Lanjouw and Mody, 1996; Jaffe and Palmer, 1997). Positive effects are also found with reference to growth and productivity. Nicoletti and Scarpetta (2003), analysing OECD countries, provide evidence that pro-competitive regulatory reforms are associated with higher productivity growth, especially in industries further from the technological frontier.

More specifically, Klapper et al. (2004) claim that investor-protective regulations, such as high-quality accounting standards, tend to improve access to credit and, in turn, facilitate firm entry. Entry rates are relatively higher in industries that rely heavily on external finance in countries with stronger accounting standards, and entry is more pronounced in R&D-intensive industries in countries offering stronger intellectual property rights protection. Regulations that expand access to finance and human capital appear to promote entry, whereas regulations that directly screen or restrict entrants tend to hinder it. With respect to firm entry, effective regulatory reform can lower barriers to market access, providing clarity and trust and reducing uncertainty. Amici et al. (2016) study the introduction of a one-stop-shop reform for business entry across Italian municipalities and find that reducing administrative burdens leads to a statistically significant increase in firm entry rates and early firm survival. Goo and Heo (2020) analyse the introduction of regulatory sandboxes in the fintech sector and show that the adoption of these new regulatory frameworks is associated with higher venture activity and ecosystem growth, suggesting that regulatory clarity and supervised experimentation reduce uncertainty, thereby facilitating firms' market participation and easing effective entry.

With specific regard to the space industry, Janikowski (2025) explores how the enactment of legislation recognising ownership and resource rights in space mining

and the development of space resources influences private investment. The statistical analysis suggests that countries with clear regulations to facilitate space resources development have experienced higher levels of investment in their commercial space sectors, alongside an expansion in the number of firms and employment and notable advances in technological capabilities (Janikowski, 2025). Table 1 summarises these results.

Taken together, these studies suggest that new or reformed regulations can have positive economic effects if they provide regulatory clarity, reduce uncertainty, fund research and innovation, and improve market functioning. This rationale holds only if regulations avoid excessive bureaucracy, which can lead to delays and protracted procedures. In designing new regulations, there is a clear trade-off between providing clarity to reduce uncertainty and imposing bureaucracy that may hinder firm success. Consequently, the economic effectiveness of regulation depends critically on its design, the efficiency of administrative procedures, and the broader institutional context. In the next section, we analyse how regulations have been designed to organise and govern the space economy.

In light of the preceding discussion, we formulate our first research question (RQ1): can new regulation sustain development in the space industry?

Table 1 Selected research highlighting the positive impacts of regulation

Regulation	Impact	Context	References
Legal restrictions	Increase in innovation in low uncertain markets	Cross-sectors	Blind et al. (2017)
Formal standards	Increase in innovation in highly uncertain markets	Cross-sectors	Blind et al. (2017)
Simplification of procedures	Firms' entry increase	Manufacturing, construction and private services	Amici et al. (2016)
Introduction of sandboxes	Firms' entry increase	Fintech	Goo and Heo (2020)
Space property rights	Firms' entry increase	Space sector	Janikowski (2025)
Intellectual property rights	Innovation increase	Cross-sectors	Elmawazini et al. (2022)
Pro-competitive regulation	Higher productivity growth	Cross-sectors	Nicoletti and Scarpetta (2003)
Reduction of regulatory burden	Investments increase	Cross-sectors	Eifert (2009)
Government effectiveness	R&D increase	Cross-sectors	Alam et al. (2019)
Pollution control	R&D intensity and innovation increase	Manufacturing	Jaffe and Palmer (1997)

3 Regulation of the space economy

3.1 Approaches to the regulation of space: from centralisation to decentralisation

Traditionally, space governance has been centralised under State control, both because of the political impulse of national prestige related to the advent of the space race after the launch of the Russian satellite Sputnik in 1957, and the economic rational that public goods (like national defence) tend to be inadequately supplied in a market-driven environment (Weinzierl, 2018; Peeters, 2022; Zancan et al., 2024; Punnala et al., 2025). This centralised model of space governance, known as the "legacy space" model, was shaped by geopolitical competition and the pursuit of technological supremacy, with space activities largely organised through State-led and mission-driven programmes. In the United States, NASA was established during the Cold War era precisely to fulfil these needs. Its hierarchical, command-oriented structure was a natural outgrowth of this mandate, as the urgency of State-directed objectives outweighed the potential advantages of decentralised approaches. Under this centralised paradigm, together with Russia, the United States emerged as the leading global space actor, with NASA positioned at the cutting edge of technological advancement.

Certainly, the most emblematic success of this model was the Apollo programme, culminating in the historic Moon landing of 1969. The Moon landing symbolised the culmination of the space race and contributed to a shift to a new stage, known as the "Commercial" (Peeters, 2022) or "Transitional" phase (Zancan et al., 2024; Punnala et al., 2025). The achievement effectively brought an end to the intense geopolitical competition in space, resulting in a significant decline in public investment and government expenditure in the space sector. The changes of the 1970 s undermined the centralised political approach. The fading geopolitical rivalry led to diminished public and political support, leaving NASA without a clear strategic direction (Logsdon, 2015). When NASA resolved to focus its efforts on the development of the Space Transportation System, i.e. the Space Shuttle, it largely retained the centralised operational model that had characterised its successes in the 1960s.

However, the outcomes of this approach proved more ambivalent. Shuttle missions facilitated several of NASA's major accomplishments over the following two decades, such as the deployment of the Hubble Space Telescope and the assembly of the International Space Station. Despite these achievements, the Shuttle programme was burdened by substantial cost overruns and underwhelming outcomes, achieving less than half its projected annual launches. Following the failures of the Challenger in 1986 and the loss of Columbia in 2003, public and institutional confidence in the Shuttle programme, and by extension the centralised paradigm it exemplified, began to erode. In 2011, the Shuttle programme was formally terminated.

In parallel, starting in the 1970 s, space technology began to be disseminated more broadly into the public domain and the commercial sector, mainly thanks to advances in launching communication satellites into orbit. Telecommunications represented the first commercial application within the space sector and initiated the era of commercial space-based telecommunications. Following the success of satellite telecom-

munications, commercial activity began to expand into adjacent domains such as space transportation and remote sensing, marking the early stages of a broader commercialisation of space. Aware of the limitations of centralised governance and of the growing interest of private firms, advocates of legislative reform called for a partial decentralisation of space governance and an expanded role for the private commercial sector, symbolised by the US Commercial Space Launch Act in 1984. Nevertheless, these early policy initiatives would not gain full traction, again, until the Shuttle programme's conclusion, which created the political and institutional conditions necessary for a more market-oriented model to emerge.

This moment opened a new stage, the so-called "New Space Economy". Some academic papers temporally classify this transformation starting from 2000 to 2010 (Weinzierl, 2018; Peeters, 2022; Zancan et al., 2024; Punnala et al., 2025). The term "New Space Economy" captures a crucial change in the space sector, encompassing not only the rise of private entrepreneurs and increasing revenues but also a reconfiguration of institutional roles, business models, and innovation processes. Profound technological progress has given rise not merely to a new cohort of space-oriented firms but to a fundamentally transformed business paradigm within the space industry, with significant policy implications. The need for a new regulation of the space economy, then, stems largely from technological advancements that have made space more accessible to private economic actors. Technological progress has facilitated the entry of private economic actors into space missions, effectively transforming outer space into both a commercial arena and an economic domain. Breakthroughs such as integrated edge computing in satellites, the miniaturisation of electronic systems, reusable launch vehicles, and the incorporation of AI and machine learning into Earth observation and debris tracking systems mark significant milestones (Heitor et al., 2024). These developments hold transformative potential and often arise through persistent collaboration between public and private institutions, underscoring the importance of co-evolution and robust public infrastructure.

The space economy is presently experiencing robust expansion and is expected to continue this trajectory in the coming decades, requiring a new, comprehensive regulatory framework that supports not only public investment but, more critically, private sector participation and private investment. Accordingly, space agencies have shifted from centrally directed, mission-based models toward more decentralised and market-shaping strategies (Robinson and Mazzucato, 2018). This transformation has been driven not only by private sector–led innovation, but also by emerging pressures such as grand societal challenges and the diffusion of Industry 4.0 paradigms based on digitally interconnected industrial systems. Under this approach, space agencies actively shape the direction of economic activity by defining measurable objectives and orchestrating cross-sectoral innovation ecosystems, with the governance of space evolving from a legacy space model to a new space one (Zancan et al., 2024; Punnala et al., 2025).

In addition, for several nations, involvement in space exploration has served as a vehicle for asserting global influence and technological credibility. The industry is tightly interwoven with defence priorities and aspirations for geopolitical dominance. For instance, US-based SpaceX, despite originating as a commercial new space venture, has increasingly relied on funding from defence-related sources in the

United States. The global space economy has also been shaped by the recent geopolitical reconfigurations marked by the accelerated decoupling of the United States and China (Senato della Repubblica, Camera dei Deputati, 2024). This phenomenon suggests the formation of two dominant geopolitical blocs. The implications of this shift are profound: it threatens to undermine the efficacy of international space law, weakens global multilateral institutions, and elevates the importance of regional legal regimes, such as the one emerging within the European Union (EU).

In this context, strategic autonomy, particularly that of the EU, has become a pressing political objective. A broader conception of economic security is emerging, wherein traditional market concerns are now interwoven with strategic and security imperatives. For example, after Russia's invasion in 2022, Ukraine requested the activation of SpaceX's Starlink satellite internet service to compensate for the destruction of terrestrial communication infrastructure. Thus, Starlink has been utilised across civilian, governmental, and military sectors in Ukraine (The Economist, 2023).

3.2 The international context

Space activities are governed by a layered framework that goes from the Outer Space Treaty of 1967 (together with another four treaties: the Rescue Agreement, the Liability Convention, the Registration Convention, and the Moon Agreement) to customary international laws and finally to implementing national legislations (Petroni and Bigliardi, 2019; Masson-Zwaan and Hofmann, 2024). Due to the influence of the Cold War, the Outer Space Treaty mainly focused on risks of escalation and the avoidance of military uses, offering limited and ambiguous regulations for newer space activities such as space mining or private sector utilisation. However, Article VI requires that private initiatives need to be authorised and supervised by an appropriate State in order to carry out space activities (Tronchetti and Liu, 2021). Moreover, it establishes that States bear international responsibility for all national space activities, including those carried out by private entities. National legislation allocates authorisation, continuing supervision, and liability management to domestic authorities. For private firms, the last layer is decisive: it determines who can obtain authorisation, how fast, and with what insurance terms, ongoing compliance burdens, and access to State indemnification, R&D grants, or procurement.

De facto, today States are engaged in regulating an industry that did not exist when the basic treaties were developed. An increasing number of States have already started to enact policies in order to grasp the emerging business opportunities and to manage risks from commercialisation, debris, mega-constellations, and new actors' space activities. This point is crucial, as the absence of a comprehensive legal framework and the resulting uncertainty constitute a major impediment to private investment.

On the one hand, there are regional initiatives to identify common points and promote mutual support for creating and updating a law on space. For example, the Asia-Pacific Regional Space Agency Forum (APRSAF) was established in 1993 in order to enhance space activities and international cooperation in the Asia-Pacific region. In 2019, the National Space Legislation Initiative was launched to enhance Asia-Pacific countries' capacity to implement national space legislation.

Australia (with its first law in 1998 and major reforms in 2019) and Japan stand out as the most advanced in terms of space legislation, particularly in regulating the space economy. Japan's approach to space legislation originates with the Basic Space Law of 2008, which emphasises the use of outer space to enhance citizens' quality of life and contribute to the advancement of human society. Although the law explicitly promotes industrial development and places strong emphasis on economic and social objectives, it provides limited detail on the regulatory mechanisms required to ensure safe access to and use of outer space. These aspects are addressed more concretely in subsequent legislation, most notably the Space Activities Act of 2018, which introduced a comprehensive framework for licensing, supervision, and ownership with a clear orientation toward supporting private and commercial space activities. The Basic Space Law has been further complemented by additional legislative initiatives, including the Space Resources Act of 2021, among the first national laws to establish a permitting regime for space-resource activities, and the Space Security Initiative adopted in 2023.

Notably, China, despite being one of the new superpowers in the new space era, does not yet have a single, comprehensive national space law. Instead, its activities are managed through a patchwork of national regulations and agency-level bylaws, which is more critical if we consider the strong interdependence between the government and private companies (Zhang and Yang, 2023). However, efforts are underway to establish a unified national framework. In 2008, China inaugurated the Asia-Pacific Space Cooperation Organisation (APSCO), an intergovernmental organisation operating as an independent non-profit organisation with full international legal status, modelled after the European approach.

The most relevant regional institution that is promoting supranational legislation is the EU, where more than a dozen Member States have adopted their own national space rules, creating a fragmented legal framework. From late 2018, the Council of the European Union began discussing the need for a new regulatory framework for an EU Space Programme. In 2021, the Council adopted its first-reading position and established the financial framework for the period 2021–2027.

On 25 June 2025, the first draft of the EU Space Act was presented to the European Parliament, followed by the publication of an updated version on 5 December 2025. Rather than introducing detailed operational rules, the proposed Regulation seeks to establish harmonised requirements that Member States must implement, with the objective of reducing disparities across national regulatory approaches. As noted in the opening paragraph of the proposal, such disparities "can adversely impact the provision of space-based data and space services in the Union". The EU Space Act addresses regulatory areas that are not yet comprehensively covered at the national level but are of increasing relevance, such as cybersecurity, and aligns with broader EU policy priorities, including the Green Deal and the ESG framework.

Moreover, the European Union Agency for the Space Programme is expected to play a central role in supporting the implementation of the Regulation, including acting on behalf of Member States without a national space agency. The Regulation is intended to apply from 1 January 2030 and will cover only space assets launched after that date. More broadly, EU rules shape national regulatory frameworks and innovative environments across Member States, and the way national governments

implement and enforce those rules can either strengthen or weaken the EU's overall impact on innovation (Pelkmans and Renda, 2014). Thus, the primary objective of the EU Space Act is to replace the existing patchwork of national space regulations with a unified rulebook, enabling the EU space sector to operate in a safer, more competitive, and more sustainable manner. By providing legal certainty and common standards, the Act seeks to support innovation, economic growth, and the competitiveness of the European space industry, foster the development of a coherent European space market, and enhance the protection and long-term sustainability of critical space infrastructure. However, the slow pace of EU legislative development represents a risk. In a rapidly expanding and highly competitive sector such as the space economy, delaying regulatory clarity until 2030 could significantly weaken Europe's position, as waiting is not a viable option in a market that is evolving at an accelerated pace.

Although shaped by distinct institutional traditions, the regulatory frameworks governing space in all States, both in EU and non-EU countries, converge on the core principles of international space law: authorisation, supervision, liability, and sustainability. Their differences lie mainly in how each State has translated the international obligations into domestic law, particularly with regard to the administrative design and policy emphasis. This situation has given rise to a range of models for regulating space.

For example, France represents the classic, fully-fledged national law model, with a prescriptive and safety-centric approach, based on the French Space Operations Act (FSOA) of 2008. The law primarily focuses on authorisations, documentation, procedures, and the role of the competent administrative authority, following a prescriptive, safety-centred approach that does not include economic policies. Its main objective is to regulate space activities and clearly define responsibilities to ensure compliance with international space treaties. France is acknowledged for its State oversight with highly developed technical regulations and institutional experience that make it a key player in safe operations. Interestingly, French law specifically addresses intellectual property rights for inventions made or used in outer space and explicitly requires the monitoring of space-based data applications for safety purposes. While the law does not explicitly consider the economic dimensions of this new sector, intellectual property protection can still serve as an important incentive for firms, given that appropriability conditions allow innovators to appropriate returns from their innovation efforts (Griffith et al., 2006). In general, the focus on rigorous technical scrutiny and the procedural complexity of authorisations could be a barrier for private actors; however, this framework creates predictability and high safety standards (Masson-Zwaan and Hofmann, 2024).

In contrast, the US model lacks a single space law statute. The regulatory regime is sectoral and multi-agency, with specific authorities: the Federal Aviation Administration (FAA) licenses launches, re-entries, and ad commercial spaceports; the Federal Communications Commission (FCC) manages radio spectrum and satellite communications licensing; the National Oceanic and Atmospheric Administration (NOAA) regulates remote sensing; and, in addition, agency authorities covering national security, export controls and NASA for civil programmes. The US model has historically been oriented toward enabling commercial development through agency licens-

ing and market incentives, with a flexible, innovation-driven approach. However, this fragmentation can generate administrative complexity and create coordination challenges.

Germany does not yet have a dedicated national space law. In September 2024, the Federal Government published a policy paper entitled Key Points of the Federal Government for a German Space Act (WRG), setting out preliminary guidelines for the drafting of a Space Act. The document acknowledges the growing role of private stakeholders in the German space sector and states that the future German Space Act is intended to strengthen the competitiveness of the national space industry. Nevertheless, the proposed key points remain focused on authorisation, financial coverage, and supervision, with no explicit provisions on economic or industrial support, thus largely following a regulatory approach similar to the French model. At present, space-related activities in Germany are governed by a set of sectoral laws, including the Air Traffic Act, the Telecommunications Act, and the Satellite Data Security Act.

Luxembourg has likewise emphasised a centralised regulatory approach with the adoption of its Law on Space Activities (2020). This legislation defines the authorisation procedures released by the Minister in charge of space policy, with policy support from the Luxembourg Space Agency (LSA). It sets operator requirements (Luxembourg presence, governance, fit and proper management, technical and financial capacity), risk assessment, insurance and financial guarantees, establishes full operator liability for damage caused during space activities, provides fees for applications and sanctions for violations, and creates a public national register of space objects (Hofmann et al., 2022). Also, with the approval of the Law on Exploration and Use of Space Resources (2017), Luxembourg offers a legal framework that ensures that private operators can be confident about their rights to the resources they extract in space. Such laws place strong emphasis on the sector's economic development, adopting economic instruments such as tax exemptions for insurance contracts or tax credits for investments. These efforts show the declared intent of Luxembourg to position itself as a European space hub for private companies.

Another example of recent increased efforts to address space activities in a centralised framework (with the aim of supporting private actors) is the space law in the United Arab Emirates (UAE), which establishes a single authority that issues permits and supervises activities. The UAE seeks to position itself as a leading space actor in the Middle East and to attract a wide portfolio of space-related ventures, including prospective space-resource extraction (Abashidze et al., 2023). In 2017, it concluded a memorandum of understanding with Luxembourg that expressly addresses the utilisation of space resources. This instrument enables UAE-based firms to establish and operate in Luxembourg, thereby accessing that jurisdiction's specialised regulatory framework and grant schemes dedicated to space-resource activities. By also facilitating the exchange of technical and research information, the memorandum generates cross-border knowledge spillovers and further consolidates Luxembourg's role as a hub for space resources development (Rubin, 2024; Janikowski, 2025).

Table 2 summarises the key features of each primary space law in select countries and compares their approaches to regulation and environmental considerations. We do not examine the entire *corpus iuris* of space legislation for each country, as this

Table 2 outlines the key features of each primary space law in selected countries

Issue	Italy	France	United States	UAE	Germany	Japan	EU (Proposed Space Act)
Authorization authority	Central government with Italian Space Agency technical role	Government licence under FSOA; CNES technical oversight	Fragmented: FAA (launch), FCC (satellites), NOAA (remote sensing)	UAE Space Agency (single regulator)	No comprehensive act yet; sectoral regulation	Cabinet Office (launch) and METI (satellites)	Sets harmonized standards: licensing remains national
Liability cap (Operator)	€100 M standard (possible reduction to €20 M)	Effectively limited to mandatory insurance amount	$500 M (3rd party) + $100 M (US Gov property) cap on required coverage	Set case-by-case (risk-based)	No unified statutory cap	Generally capped at mandatory insurance level (case-dependent)	No harmonised EU-level liability cap proposed
Insurance requirement	Mandatory; aligned with cap	Mandatory; fixed regulatory amounts	Mandatory up to FAA-determined MPL	Mandatory; amount set by Agency	No unified nationwide regime	Mandatory insurance/ financial guarantee required	No EU-wide cap
Debris obligations	Required via licence conditions	Strong, explicit technical debris rules	Required (primarily via FCC licensing)	Explicit statutory duty	Indirect/sectoral; future act expected	Required; includes mitigation and end-of-life planning	Core pillar: harmonised debris mitigation standards
Sustainability	Integrated into licensing review	Detailed safety and environmental standards	Regulator-specific requirements	Integrated into authorisation criteria	Policy direction only (no consolidated regime yet)	Embedded in safety and mitigation licensing regime	Strong focus on sustainability, STM, cybersecurity, resilience
Approval timeline	120 days	Several months (technical review driven)	≤ 180 days after FAA acceptance (launch licence)	Fast review once complete (file-dependent)	No unified timeline	Several months; case-dependent review	Not a licensing body; timelines remain national
Space resources property rights	No explicit statutory ownership regime	No explicit statutory ownership regime	Explicit ownership of extracted resources recognised	Explicit ownership of extracted resources recognised	No explicit statutory regime	No explicit ownership recognition comparable to US/UAE	No EU-wide property rights regime proposed

lies beyond our scope. Instead, we focus on comparing each country's initial legislative efforts with Italy's law. We further develop this issue in the next section.

3.3 Key pillars of the new Italian regulation, law 89/2025

Until June 2025, Italy relied on various autonomous rules and administrative practices to license and supervise space activities. On 13 June 2025, the first Italian comprehensive space economy framework law was promulgated (Law no. 89, "Disposizioni in materia di economia dello spazio"), with the aim of providing clear authorisation, liability, insurance, and sustainability rules, and to align national practice with international standards. This legislation represents a shift from a fragmented approach to a formal statutory framework. We taxonomise the main key pillars of the law below.

- Goal: the law aims to regulate access to outer space and to promote investment in the new space economy to enhance national competitiveness, support scientific research, develop space-sector expertise, and foster the advancement of technologies related to Earth observation.
- Authorisation of space activities: the law creates a legislative authorisation regime for public and private actors, with the State empowered to license launches, on-orbit operations and related facilities. To ensure both security and high standards of innovation, the law establishes quality requirements, objective and subjective, for private firms engaging in space activities. Any operations conducted on Italian territory or by national operators abroad must obtain prior authorisation (subject to compliance with safety, resilience, and sustainability standards), with a single authorisation covering satellites within the same constellation.
- Sustainability: the law identifies environmental sustainability as a core requirement for the conduct of space activities, mandating the assessment of the environmental footprint across the entire life cycle of a space object, from design, development, and production through operation and end-of-life phases. The law further guarantees fair and non-discriminatory access to the data, services, and resources of national space infrastructures. This provision aims to support sustainable development and to leverage the potential of outer space for environmental resource management, mitigation of the local effects of climate change, enhancement of telecommunications and logistics systems, and the forecasting and prevention of risks arising from natural or anthropogenic phenomena.
- The role of the Italian Space Agency (ASI): the request for authorisation to carry out space activities is submitted to the Governmental Authority through ASI. ASI supervises operators and may revoke authorisations in case of violations, while liability for damages is regulated through mandatory insurance coverage of up to €100 million per incident. To guarantee secure access to space, firms must submit a comprehensive plan covering the full life cycle of satellites and space equipment, including end-of-life management, and maintain adequate insurance to ensure accountability and uphold Italy's commitments under international treaties. Space objects for which Italy is the launching State are registered in the National Registry of Objects, according to the Convention on the Registration of Objects Launched into Outer Space of 1975.

- Operator and State liability: the law regulates the State's recourse against private operators that have caused damage to persons or property in accordance with the 1972 Convention, and it governs protection for those injured in Italy by foreign State activities. Further, it introduces the requirement for insurance/financial guarantees with a standard maximum coverage of €100 million (risk bands can be reduced to €50 million, or €20 million for research/start-ups), with direct third-party action against the insurer.
- Economic support: the law establishes a 5-year National Plan and the Space Economy Fund with €35 million allocated by the Ministry of Enterprises and Made in Italy (MIMIT) for 2025, rising to €160 million in 2026. The fund aims to promote the sector and grow the market for space technologies and infrastructure, including those developed under the National Recovery and Resilience Plan (PNRR) and international collaborations. In particular, there is specific support for SMEs and start-ups: in order to facilitate their access to public contracts in the space and aerospace sectors (in cases where contracts are not divided into lots), the law stipulates that at least 10% of the contract's value must be reserved for them. The Space Economy Fund can cover up to 70% of project costs, and procurement rules favour innovative small firms.

With the enactment of Law 89/2025, Italian regulators have faced a common challenge: the tension between facilitating economic growth and State control (Masson-Zwaan and Hofmann, 2024). Table 2 reports the main features of the Italian law in comparison to the other space laws discussed in Sect. 3.2. On the one hand, centralised systems like those in France can ensure safety and legal certainty, at the risk of excessive procedural rigidity that may deter smaller actors. On the other hand, more decentralised models like those in the United States show how modular licensing and regulatory flexibility are able to encourage commercial participation. We claim that Italy's framework represents a hybrid approach that joins oversight with administrative rationalisation. Italian regulators have chosen a different model from the multi-agency US framework, which could prove to be powerful but risks over-fragmentation. This reflects on the new role of ASI, which shares similarities with other young cases, like the UAE Space Agency established in 2014: both agencies centralise space-activity authorisations and supervision as well as exert an industrial policy role, investing in programmes, partnerships, and human capital to expand the national space capabilities and economic impact. The Luxembourg case is partially different because the Minister in charge of space policy (with support from the Luxembourg Space Agency) issues authorisations.

Another key feature of the Italian law is its focus on direct economic support to private firms and public–private partnerships (PPPs), which reflects its attention to the development of the economic sector, as seen in laws such as those from Luxembourg, the UAE, or Japan.

With respect to liability and financial responsibility for space activities, regulatory approaches differ across jurisdictions. The United States adopts a modular system, whereas Italy, similarly to France and the UAE, establishes a unified liability regime consistent with its national framework. In line with the Outer Space Treaty (1967) and the Liability Convention (1972), the Italian law seeks to reconcile international

State responsibility with the promotion of private sector participation, aiming to attract investment while managing systemic risk. Nonetheless, significant differences remain. France and the United States operate explicit risk-sharing models that combine mandatory operator insurance with State indemnification mechanisms, thereby limiting exposure and enhancing investor confidence. In contrast, Italy, like the UAE, relies on defined insurance caps and places greater ultimate financial responsibility on operators, reflecting a comparatively more cautious regulatory orientation that may serve as a barrier to entry for private firms.

The Italian framework is similar to other recent legislation regarding the development of national plans to encourage innovative firms and R&D. Also, the sustainability requirements in Law 89/2025 are aligned not only with international treaties and priorities for sharing space resources but also with both EU sustainability directives and global sustainability goals. They also align with other countries' space laws, such as the UAE Space Law of 2019 and its executive regulations (2020), which require licence applicants to submit debris-mitigation plans, demonstrate safe end-of-life disposal strategies, and ensure compliance with established environmental and safety standards.

Under the law 89/2025, unlike other cases, Italy has not introduced any provisions governing the development of space resources and mineral exploration, a sector widely regarded as central to current efforts to build a new space economy and to unlock the commercial potential of outer space. To date, the United States, Luxembourg, Japan, and the UAE have enacted such laws.

In conclusion, the new Italian law shares many similarities with recent legislation that governs space activities under the guidance of a centralised authority in other countries (see Table 2). Although the Italian space law remains a framework awaiting refinement through statutory instruments and implementing decrees, it already allows for the formulation of certain economic expectations and policy implications, which we discuss in the next section.

Based on this discussion, we formulate our second research question (RQ2): how well do the provisions of Italy's new space economy legislation align with the goal of fostering socio-economic development in the space industry?

4 Methodology and data

To answer the research questions, we draw on a qualitative research methodology. Our research design is structured in four steps. First, we conducted a literature review and a secondary data analysis, which enabled the formulation of research questions RQ1 and RQ2 and the development of the interview protocol. The interview questions were formulated to capture stakeholders' perceptions of the role of Italy's new space law and its socio-economic implications and challenges.

Second, we identified the key actors in order to represent the relevant stakeholders in the Italian space sector: European governments, the Italian government, the space agency, university research centres, business incubation centres (BIC), clusters of firms, incumbent and start-up firms, and venture capitalist (VC) firms. To represent these actors, we contacted representatives of the following 11 organisations: the EU

Intergroup on Sky and Space of the European Parliament; the Parliamentary Intergroup on the Space Economy of the Italian Chamber of Deputies; ASI; the Space Economy Observatory of the Polytechnic of Milan; the European Space Agency (ESA) BIC Brindisi; the Lombardy Aerospace Cluster; two incumbent firms; a start-up; and two VC firms.

Eight participants agreed to take part in the interview process (Table 3). The sample was purposively selected to include high-level experts from different segments of the Italian space sector, including individuals with presidential and executive positions. Their expertise enabled us to collect informed insights and assessments on the research topic. While the expert-based sample is not intended to be statistically representative of the whole Italian space sector, given its limited size, it provides valuable expert perspectives that complement the documentary and literature analysis. All respondents have been anonymised, including their names and specific roles.

Third, we collected our primary data. We adopted a semi-structured interview approach, a method particularly suited to capturing heterogeneous viewpoints across institutional and sectoral contexts (Sovacool et al., 2018), to ensure comparability across participants, while retaining the flexibility to explore and capture emergent topics and themes. Therefore, while a predefined interview guide was used to maintain a degree of consistency across interviews, interactions were deliberately conducted in a flexible and dialogical manner (Newcomer et al., 2015). The interviews were carried out between May 2025 and April 2026, including five conducted via video conferencing, two in person, and one administered in written form. Interview durations ranged from 30 to 60 min. Interviews were conducted in Italian and the quotes have been translated into English. The overall research design was guided by pragmatic considerations, particularly constraints on time and participant accessibil-

Table 3 Eight stakeholders in the interview process

Interview	Stakeholder	Respondent	Role
IntA	EU Government	EU Intergroup on Sky and Space	Presidency
IntB	National Government	Parliamentary Intergroup on the Space Economy	Presidency
IntC	Space Agency	ASI	Presidency
IntD	University-Research	Space Economy Observatory of the Polytechnic of Milan	Directorate
IntE	Business Incubation Centre	ESA BIC Brindisi	Directorate
IntF	Cluster	Lombardy Aerospace Cluster	Presidency
IntG	Incumbent firm	Telespazio (Leonardo)	Presidency
IntH	Startup	SpaceV	Directorate

ity. Data collection involved simultaneous note-taking by two researchers, complemented by audio recordings obtained with participants' consent.

Fourth, we carried out the data analysis, which was guided by the principles of qualitative analysis outlined by Miles and Huberman (1994), including data reduction, descriptive and interpretative coding, and data display, as in Eldering et al. (2026). Transcripts were systematically organised through the identification of key themes and sub-themes using a thematic analysis approach (Braun and Clarke, 2006). More specifically, following Braun and Clarke (2006), we structured the analysis into five main phases. We started with a familiarisation phase, during which recordings and notes were systematically revisited to clarify ambiguities and address discrepancies in interpretation. This dual documentation strategy supported subsequent cross-verification and alignment between researchers. Interview data were re-read several times, and during the post-interview stage, recordings and notes were further reviewed to refine the material for grammatical clarity, highlight key points, and extract relevant passages. At this stage, most of the content was retained and organised to avoid the loss of potentially important information.

In the second phase, we generated initial codes following a two-stage descriptive and interpretative coding approach. For each interview and relevant excerpt, we first captured the descriptive content of participants' statements and subsequently developed interpretative codes that reflected their underlying meanings. This process resulted in the development of an initial codebook of emergent codes (Braun and Clarke, 2006). Then, once the codebook was consolidated, the codes were systematically grouped into broader patterns to identify candidate themes. This process involved organising related codes into higher-level categories, or macro-themes, based on conceptual similarity and shared meaning.

In the subsequent phase, the two researchers jointly reviewed and refined the coding structure, finalising it around twenty-two elements, and assessed the emerging themes to ensure consistency and analytical rigour. In line with established qualitative analysis principles, this step involved assessing whether themes were coherent within coded extracts and adequately representative of the dataset. Finally, the themes were refined, defined, and finalised by clearly articulating their scope, focus, and underlying meaning. Representative quotes were selected to illustrate each theme and support the interpretation of the findings. This analytical procedure led to the identification of nine key themes, which are examined in the Results section. The themes are labelled as follows: Change of paradigm, Bureaucracy, EU and international harmonisation, Role of ASI, Sectoral ecosystem, Intersectoral synergies, Competition and innovation, Sustainability, International leadership.

5 Results

Drawing on our primary and secondary sources, this section discusses the potential implications of Italy's Law 89/2025 for economic and social development. The following sections, structured by theme as outlined in the methodology, present the key findings of the research and discuss them under each core topic, supported by selected quotes from the stakeholders interviewed as part of the qualitative analy-

sis. Quotes were chosen not merely for illustration, but to support and reinforce the underlying conceptual insights (Eldering et al., 2026).

5.1 New regulation

We begin with the first research question (RQ1), focusing on the capability of the new regulations to sustain economic development.

5.1.1 Change of paradigm

The literature provides evidence that barriers to entrepreneurial activities and investments arise not only from technological and financial constraints but also from legal uncertainty and regulatory discretion (Raghuram and Zingales, 2003). In the absence of a clear and predictable legal framework, investments and potential entrants may be discouraged even when the necessary technological capabilities are in place. For example, IntD explicitly claims that "without a structured regulatory framework, there is a grey area that prevents companies from entering the market". IntF makes the same claim: "having a space law provides clear guidance for national strategy and also signals to investors that the market is open and offers opportunities for investment".

Our data support the idea that the adoption of a dedicated new space law is necessary because it fills a regulatory gap: the TFEU (Article 189) limits EU-level harmonisation of space law, leaving the main legal framework for space activities to be developed by Member States. It is also necessary because it captures the ongoing changes and dynamics of the sector, as pointed out by IntC, who reports: "given the gradual shift in context, what is often referred to as a change in paradigm, a clear regulatory framework was absolutely necessary". The same idea is supported by IntB, who clearly recognises that "private companies, operating in a competitive environment, have developed new approaches, taken greater risks, accelerated timelines, and reduced costs. As a result, a new paradigm has become necessary to adapt to the evolving dynamics of the market".

The Italian approach to the traditional space economy was based on the legacy space model, with a centralised system based on public procurement from major aerospace firms. As we discussed in Sect. 3.1, the numerous actors that have entered space activities in recent years have resulted in a hybridised governance environment, where public–private partnerships (PPPs), mixed missions, and shared infrastructures have increasingly become the norm. The Italian Parliament explicitly stated its observations of the limitations of existing legal frameworks designed primarily for a State-centric model of space governance (Senato della Repubblica, Camera dei Deputati, 2024). It suggests that the new law is designed to create a flexible framework, with centralised control, rules, and incentives for private actors' activities. IntD clearly recognises this goal: "this law helps raise awareness among companies, including those that had never considered it before, that space can offer valuable opportunities when viewed from a commercial perspective. Moreover, the rules contribute to a broader process of raising cultural awareness". This view reflects that the law pro-

motes PPP solutions that serve to rebalance the relationship between State bureaucracies and the private sector, fostering a model of organisational co-evolution.

In this respect, the implemented framework of law could represent a structural shift in the governance of innovation, wherein public agencies actively respond to economic, technological, and societal challenges through more systemic and adaptive policy frameworks, in line with the mission-oriented innovation policies analysed by Mazzucato (2018) and Robinson and Mazzucato (2018). Empirical economic research documents a positive relationship between effective regulation and economic performance: evidence from highly regulated, capital-intensive industries shows that comparable reductions in regulatory uncertainty and administrative burdens can increase productivity, innovation, and firm entry (Table 1). In particular, space-specific evidence suggests that the introduction of clear legal frameworks, such as space-resource laws, has been associated with increases in private investment, which represents a necessary precondition for firm entry in this sector (Janikowski, 2025).

5.1.2 Bureaucracy

A key concern surrounding the new law is the risk of excessive and slow-moving bureaucracy, as emerged from different interviews. For example, IntG points out that "the authorisation process established by the law already involves a number of bodies, which could lead to excessive bureaucracy and procedural burden". In fact, the law states that the application for authorisation to carry out space activities shall be submitted to the competent Authority (i.e. the President of the Council of Ministers or the political authority delegated to space and aerospace policies) through ASI. Upon receipt of the application, the Agency shall, within sixty days, carry out the necessary assessments and communicate the outcome to the competent Authority for the continuation of the procedure. In the event of a positive outcome of the technical assessments, ASI shall forward the documentation to the competent Authority, the Ministry of Defence, and COMINT (i.e., the Interministerial Committee for Policies relating to Space and Aerospace Research). COMINT, supplemented by the Secretary General of the Presidency of the Council of Ministers, shall conduct the review and may consult other administrations concerned with the space activity subject to the authorisation request, as well as the intelligence and security bodies referred to in Law No. 124 of 3 August 2007, the Department for Administrative Coordination of the Presidency of the Council of Ministers, and the National Cybersecurity Agency. Considering this already complex procedure, i.

t is essential to ensure that the executive decrees remain clear and do not become overly bureaucratic. Those criticisms were clearly expressed during the interviews, as reported, for example, by IntH: "authorisation procedures are excessively bureaucratic; moreover, approval times are too long". Taken together, these findings suggest that excessive bureaucracy could discourage investment and the formation of new firms, ultimately undermining the law's goal of fostering growth and innovation. Therefore, in the policy recommendations, we stress the importance of minimising administrative complexity in the authorisation procedures.

5.1.3 EU and international harmonisation

As a member of the European Union, Italy must align its national framework with the EU Space Act, helping reduce regulatory fragmentation across Member States and ensuring greater consistency in licensing standards, sustainability requirements, and supervisory practices. This is a key challenge, as put in evidence by IntA, that is to say, the "need to avoid excessive fragmentation at the European level, considering that the Space Act, presented [on 25 June 2025] by the European Commission, aims to harmonise rules on space activities across Member States". IntB reinforces the idea that in the space sector "it is always essential to collaborate closely with others, particularly with European countries". These answers illustrate how this convergence can significantly lower compliance duplication for firms operating in multiple jurisdictions, reduce administrative and legal transaction costs, and shorten market-entry timelines. In turn, this suggests that such harmonisation can facilitate cross-border scaling opportunities for space companies, enabling them to expand more efficiently within the EU internal market. In general, the alignment with ESA and EU programmes (e.g., STEP, Horizon Europe) is also essential to leverage funding and maintain coherence with broader European space governance.

We also note the need for international coordination with regard to a missing aspect of the new Italian law, as reported in Sect. 3.3, i.e. the definition of property rights over space resources and mineral exploration. Within the EU, Luxembourg has already recognised ownership of extracted resources under national authorisation (as have other States, e.g. the United States, the UAE, and Japan). Without asserting sovereignty, these frameworks grant firms transferable rights in extracted materials, subject to international law, providing the legal certainty needed for financing and offtake deals. Without such legislation, Italy risks losing its attractiveness to investors in these activities.

5.1.4 Conclusions

We conclude this section by answering our first research question (RQ1). Unlike the legacy model, the "New Space Economy" requires a different paradigm in which private companies are increasingly involved as co-investors, assuming both the risks and the prospective benefits associated with space ventures (Vittori et al., 2022). We argue that the new law is designed to provide a new paradigm that could support economic development by operating as an investment, enabling policy shocks by reducing regulatory uncertainty, clarifying liability allocation, and increasing the predictability of authorisation procedures, thus expanding the set of legally and economically viable activities.

However, this can occur only if Italy is able to create the conditions to effectively address and overcome two challenges. First, in the implementation procedures and subsequent executive decrees, bureaucracy and response times should be streamlined and efficient, with clear roles defined and coordination improved to accelerate interactions among the various authorising bodies. Second, Italy should align its national framework with the EU Space Act in a clear, streamlined manner, thereby reducing regulatory fragmentation across Member States and ensuring greater consistency in

licensing standards, sustainability requirements, and supervisory practices, without duplicating legal frameworks or increasing the bureaucratic burden on firms.

5.2 The impact of the new law

In this section, we attempt to answer our second research question (RQ2) and investigate how well the provisions of Italy's new space economy legislation align with the goal of fostering socio-economic development.

5.2.1 The role of ASI

Traditionally, under the legacy space model, ASI operated primarily as a coordinating and funding body within Italy's civil space sector, rather than as a regulatory authority. Its role was primarily programmatic, focused on supporting scientific research, managing space missions, and representing Italy in international collaborations, especially within ESA. In the new paradigm, many respondents highlighted that the new law transforms ASI from a funding and coordination agency into Italy's central regulator for space activities, deeply involved in licensing, compliance, oversight, sustainability, and strategic funding. IntC supports this role, reporting that "ASI has a duplex approach: top-down but also bottom-up to still listen to main actors of the ecosystem". This role helps in assessing a critical issue, as reported by IntE: "often there is a misalignment between what companies perceive or intend to propose to Space Agencies and the Agencies' actual needs, which are not always clearly defined or understood". These views suggest that entrusting ASI with a prominent role in the evaluation of proposals submitted by private actors constitutes a significant step toward a new proactive role in promoting innovation and entrepreneurship safely and securely, in line with the fundamental principle governing access to space.

As a result, the effective implementation of the new legislation requires strong centralised authority, supported by growing technical expertise to evaluate applications and make timely, well-informed decisions: this is a capacity that ASI must be fully equipped to assume. However, IntE highlights that "managing space security issues is also closely analogous to aviation security, and differs from the more technical matters that fall within the remit of ASI". This statement suggests that it is crucial to expand current technical expertise, involving also administrative, entrepreneurial, and safety managers. In recent years, the government has already expanded ASI's workforce from 287 employees in 2021 to 363 in 2022, with plans to reach a total of 600 personnel[1]. We claim that the government should continue investing in the Agency's human capital and enlarging its skills while ensuring coherent institutional coordination, thereby preventing fragmented or overlapping procedures that could generate uncertainty for investors and increase administrative burdens.

[1] Relazione alle Camere contenente l'illustrazione delle attività e dei risultati degli investimenti nel settore spaziale e aerospaziale, a.i. sensi dell'art. 2, comma 6, lettera q), legge 11 gennaio 2018, n.7, Anno 2022.

5.2.2 Sectoral ecosystem

The new Italian law embraces the necessary systemic view, expected to encourage interaction among government agencies, private firms, universities, start-ups, and financial actors. This systemic governance model is conducive to building an innovative ecosystem where these bodies collaborate to scale up investments and advance technological frontiers. In this direction, IntF reports that the Italian space sector "covers the entire supply chain, with the exception of launch capabilities: propulsion, avionics, optical instruments, and radar systems are just some examples". IntE reinforces the idea that in this sector, Italy "has very strong capabilities across the entire supply chain". This is a key strategic asset, as asserted by IntC: "a robust exchange and constructive dialogue across the entire space ecosystem, now fully integrated and extending beyond private companies of all sizes to include Agencies and other actors, is essential".

We note that the Italian space sector has developed in 15 aerospace technology clusters distributed across the country, which are associated with the National Aerospace Technology Cluster (CTNA), a private-public association that supports the competitiveness of the sector. This structure reflects how a local knowledge base, geographical networks, interactions with universities, and regional policies have helped foster entrepreneurial activities, in accordance with the logic of EE theory. This ecosystem is embedded in a research and higher education system that combines acknowledged scientific capabilities with strong engineering traditions. Universities and research institutes constitute the learning core of the system, building the knowledge base, preparing human capital, and enabling translation from discovery to applications and technology transfer.

Many Italian firms specialised in space technology were born from such centres, showing that such collaboration should be encouraged and sustained, with regional and national governments acting as the main proponents of the dissemination of ideas and knowledge through conferences, events, and knowledge dissemination. Fruitful examples are SatenLight (University of Milan), T4i (University of Padua), Ticinum Aerospace (University of Pavia), Stellar Project (University of Padua), RF Microtech (University of Perugia), SpaceV (University of Genova), Deplotic (Polytechnic of Turin), some supported by Italian incubators or international projects such as ESA BIC. The principles of the new law explicitly state that the purpose is to favour, in particular, scientific research. However, "translating basic or university research into spin-offs, turning it into entrepreneurial ventures, remains challenging, particularly when it comes to technology transfer and the valorisation of research", as emphasised by IntE. Therefore, we argue for the need to strengthen the involvement of entrepreneurial and business research in space projects.

5.2.3 Intersectoral synergies

The new law supports the commercialisation of space and opens the sector to other non-space sectors. In the interviews, many respondents emphasised the importance of intersectoral collaboration, citing examples such as "the textile industry, advanced manufacturing, automotive, precision engineering, and the energy sector", as high-

lighted by IntF, who also noted that "this law, if all stakeholders play their part, can serve as a lever for the digital transition". Similarly, IntD observed that "across all verticals, energy, agriculture, insurance, logistics, transportation, and beyond, the space economy has the potential to enhance competitiveness across the entire economic system". The exchange is bidirectional, as highlighted by IntB: "technologies developed for space are often applied in other sectors of human activity. Conversely, technologies originating in industries such as automotive or naval engineering can be adapted and effectively utilised in the space sector". This reciprocal dynamic also extends to workforce competencies, where approaching challenges from different perspectives or with diverse experiences can significantly enhance problem-solving and innovation. As IntB further notes, "it is noteworthy that the first individual to enter this market with great success [Elon Musk] came from entrepreneurial experience in other sectors, rather than from the aerospace industry". Then, the space sector appears to be a cross-technology and cross-industry ecosystem (Cavallo et al., 2026).

Taken together, these responses lend support to the view of cross-synergies as a strategic asset for economic growth, as explained by IntD: "it is increasingly clear that no country can develop a robust industrial and economic strategy without placing the space economy at its core, not as an isolated sector, but as an enabling force that, together with other technologies, drives innovation and competitiveness across all industries". Intersectoral synergies can become novel sources of innovation and profits, thus contributing to national economic growth and encouraging cross-fertilisation between the space and non-space industries. We expect that emerging actors will originate from adjacent industries, contributing with fresh capital, technological capabilities, and cross-sectoral expertise to the development of next-generation space infrastructures and services (Messeni Petruzzelli and Panniello, 2019; Paravano et al., 2023). An open approach can also generate positive externalities and boost knowledge spillovers that benefit sectors beyond space, e.g., AI, cybersecurity, and green tech (Cavallo et al., 2026; Messeni Petruzzelli and Panniello, 2019). The opportunities for applying satellite data are varied; for example, Earth observation imagery for monitoring ecosystems and biodiversity, land-use and land-cover mapping, disaster management, carbon biomass assessment, and air and water quality management (Messeni Petruzzelli and Panniello, 2019; Paravano et al., 2023).

Some noteworthy examples of cross-fertilisation include the following: GVM Assistance, which created the SpaceHealth App, enabling remote consultations and real-time monitoring of astronauts' health via wearable devices, including the first live medical connection from Italy to the International Space Station in mission Ax-3; SpaceV is studying how to grow plants in space, which could also benefit Earth, particularly in the development of indoor greenhouses and vertical farming; Synchropal uses satellite data for time synchronisation, providing protection against hacker attacks targeting terrestrial digital infrastructures; Volta Structural Energy aims to create structural batteries integrated into the structure of satellites based on the use of aluminium ions. These recent cases reinforce and extend the entrepreneurial landscape articulated by Messeni Petruzzelli and Panniello (2019) and Paravano et al. (2023), providing additional validation of their findings within the current context.

5.2.4 Competition and innovation

The new law establishes a regulatory framework designed to foster development, start-ups, and innovation. First of all, the law is expected to have an immediate effect because "it establishes that space is commercial, thereby encouraging companies, including those from other industries, to view space through a commercial lens", as observed also by IntD.

Second, by offering clear rules for licensing, oversight, liability and accountability, the new law may reduce transaction costs and legal uncertainty, two primary barriers to private investment and entrepreneurial activities (Klapper et al., 2004; Goo and Heo 2020). Regulatory clarity has the potential to make space activities more predictable and manageable for firms, which is especially important in a sector characterised by high initial costs and long development cycles. Therefore, the law could create a more attractive environment for new investments. In fact, "firms cannot operate without a clear definition of their responsibilities", reports IntG. Clear rules are crucial for all economic actors. The new law opens the market to large firms, start-ups, and SMEs. IntF emphasises that "large companies translate the government's strategic vision into tangible economic impact and employment," and adds that the law "encourages the entry of new players into the sector because it recognises the discipline and participation of private operators. This will therefore have an impact on innovation". Other respondents highlight the key role of SMEs and start-ups. For example, IntC notes that "the possibility of greater involvement of small industrial entities is certainly an advantage".

Third, to promote the development of space activity as a promising driver of economic growth, the law establishes the 5-year National Plan, the Space Economy Fund, and specific policies and measures to develop skills and capabilities for SMEs and start-ups. Also, to improve SMEs' access to public procurement in space and aerospace, contracts that are not split into lots must allocate at least 10% of their value to innovative start-ups and SMEs through mandatory subcontracting. These concrete measures are meant to provide tangible incentives to encourage new entrants into the space sector and stimulate competition, as underlined by IntD: "you can discover features tied to technical potential; discovering these features requires an entrepreneurial spirit, a disruptive approach, and an approach that isn't path-dependent, that is, one that isn't caged in past success stories, because you don't have any stories that cage you in. And here, start-ups and SMEs essentially have a lot to contribute". We also believe this measure is well-designed because it sustains incumbent firms within a hub-and-spoke framework, ensuring robustness and spillover effects across the network of actors, which is particularly relevant in the growth phase of the sector.

However, some crucial challenges emerge. The potential effects of the new regulatory framework and "these measures can become real only if the actual implementation of the executive decrees will be effective", as stated by IntG. To effectively attract investment, it is crucial to keep executive regulations clear and flexible, and to

avoid excessive bureaucracy. Moreover, the €100 million cap[2] required for insurance coverage, while providing greater protection for the State on the one hand, could, on the other hand, represent a barrier to entry, "hampering competitiveness of the Italian market, considering that in other countries the requirement is lower", according to IntG. In addition, IntA points out that "much will also hinge on the scale of investment, both in the Space Economy Fund and in support for SMEs and start-ups". "These public funds need to be managed and distributed efficiently", as observed by IntD.

Nevertheless, two drawbacks related to funding underline its potential effects: "first, the fund is currently insufficiently resourced, particularly for upstream activities; second, it lacks a structural, long-term framework", as IntE reports. Also, IntA claims that "it will be necessary to understand the actual size of the public investments that will accompany the development of the sector after the PNRR funding". In conclusion, the vision and framework of the new law are promising, but the operational implementation of its measures and the increase in structural economic resources are needed to achieve effective results in the medium- to long-run.

5.2.5 Sustainability

Many respondents agree that the space economy is inseparable from the concept of sustainability, as IntH emphasises: "in space resources are very limited and very expensive; this is a formidable lesson for terrestrial applications". In fact, the law frames space activities within a lifecycle perspective, requiring operators to minimise environmental harm associated with debris, emissions, and orbital congestion while ensuring the long-term viability of space infrastructure and equitable access for future generations, in line with UNOOSA guidelines[3]. Authorisation is contingent upon the submission of a comprehensive lifecycle management plan covering design, operation, and end-of-life disposal of space objects. Collectively, these provisions institutionalise orbital sustainability as both a legal and economic imperative, promoting responsible industrial conduct while safeguarding outer space as a global commons.

We believe this represents an important step forward, contributing positively to economic and social development by fostering responsible innovation. Satellite technologies enable more timely and comprehensive monitoring of environmental changes, urban development, and resource management, empowering decision-makers to better assess progress toward the SDGs and design more informed policies for sustainable development (Paravano et al., 2026). However, the law does not define detailed provisions about sustainability. In fact, some respondents believe that the law's reliance on broad sustainability principles and requirements can be seen as an

[2] The cap is adjustable across different risk tiers, reflecting the scale of space activity, documented prior experience, the orbital regime in which the space objects operate, and the duration and nature of the activity.

[3] UNOOSA guidelines define the long-term sustainability of outer space activities as "the ability to maintain the conduct of space activities indefinitely into the future […] in order to meet the needs of the present generations while preserving the outer space environment for future generations".

effort to avoid contradictions and imposing burdensome obligations on operators, while also preserving flexibility to align with future EU regulations (IntA, IntG).

Taken together, the interviews and the literature suggest that the law represents a significant step toward sustainable development, while also indicating that it does not explicitly incorporate more recent frameworks that may become increasingly relevant to resilience in the sector. A circular space economy would further extend sustainability by promoting reuse, modularity, in-orbit servicing, and lifecycle optimisation to reduce waste and preserve orbital and material resources, generating cost savings and economic gains (Paladini et al., 2021). Circular practices in space have emerged from technical necessity rather than deliberate conceptual design; however, a more systemic and policy-integrated circular framework is now required (Bahlmann et al., 2024). ESA's recent white paper, "Enabling a Space Circular Economy by 2050", reflects this shift.

However, Italian firms are already moving in this direction. Among others, D-Orbit emphasises circular strategies, including in-space manufacturing and recycling, and became the first aerospace company worldwide to receive B-Corp certification. Thales Alenia Space, an Italo-French joint venture, is developing building blocks in its technologies that enable sustainable management of satellites in orbit to minimise and prevent space debris, and is developing on-orbit servicing vehicles that will carry out operations such as repairing or refuelling directly in space.

Beyond circularity, regenerative design represents a further evolution. While circularity seeks to minimise negative impacts, regenerative approaches aim to generate net-positive ecological and social outcomes (Horn and Proksch, 2022). Space technologies can serve as powerful tools for advancing the UN Sustainable Development Goals (SDGs). Empirical evidence from 603 ESA-funded satellite applications shows that all projects contribute to at least one SDG, particularly in health, sustainable cities, and food security (Paravano et al., 2024), demonstrating that downstream space applications constitute a structured driver of sustainability-oriented innovation. To conclude, the law seems to lay the foundations for achieving SDGs and socio-economic goals, but additional efforts will be required to fully unlock the sector's long-term transformative potential.

5.2.6 International leadership

From a macroeconomic perspective, improved regulation in the space sector may catalyse international trade. All respondents agree that Italy already enjoys a strong international reputation and robust capabilities. According to IntF, the law represents "an effort to better orient and establish a more systematic approach, alongside increased private investment and stronger international development". IntH stresses that "Italy in the space economy is robust and capable". The new law provides the basis for increasing the country's credibility as a partner in multinational projects and raising its profile within organisations such as the ESA and the European Union Space Programme. This integration could attract capital inflows and foreign direct investments, facilitate technology transfer, and enhance Italy's participation in high-value global value chains. Minister Adolfo Urso explicitly stated that one of the impacts of the new law is to consolidate national leadership, given that Italy is among the first

countries in Europe to adopt a law on the space economy, thereby strengthening its technological sovereignty.

However, two weaknesses remain that may constrain the sector's development. The first pertains to financial capital and the vision of scaling up at the global level to compete with major players in the United States and China. IntD observes that Italy "possesses strong industrial leadership, but it is not yet matched by equivalent economic and financial leadership". The real challenge is scaling up, as IntG reports: "in 10 years, the position of the Italian space sector will depend greatly on the level of aggregation it manages to achieve at the large-scale industrial level". The second aspect is that "Italy, like Europe, lacks sufficient independent launch capability", as stressed by IntE, a crucial factor for achieving strategic autonomy.

In addition to the economic benefits of developing an international reputation, the space industry has been considered a field for developing political leadership. According to IntH: "for Italy's future on the international stage, the outlook is promising: investment levels are broadly comparable to those of France and Germany, and within Europe the country benefits from an ambitious and substantial national programme". Similar to Italy, the UAE has sought to establish a major global hub for space science and technology by investing in building capabilities and creating a scientific, legislative and financing environment that is stimulating and attractive for space projects (https://www.mediaoffice.ae). Further, Turkey is advancing its launch capabilities and missile defence systems as part of a broader effort to reinforce its national economy in its complex geopolitical environment. Its space policy aims to establish Turkey as a leading regional space power in the Middle East. Rubin (2024) reports how Egypt's president deliberately claimed that the creation of the space national programme serves to enhance Egypt's prestige by signalling its ambition to join the ranks of leading nations and to position itself as a modern, technologically advanced State.

5.2.7 Conclusions

In Fig. 1, we map the main actors and regulatory interventions involved in implementing the new law and provide a synthesis of the interactions examined in this section.

The analysis of our results provides the basis for answering our second research question (RQ2): we argue that the provisions of Law 89/2025 have the potential to sustain socio-economic development, provided that some critical open issues are adequately assessed. In particular, our results highlight the positive impact of the following key issues of the law: the key strategic role of ASI; the encouraged interaction among government agencies, private firms, universities, start-ups, and financial actors; the conditions for intersectoral synergies; the economic support to competition and innovation; the sustainability requirements; and the strengthened international role of Italy. However, the analysis also identifies the critical open challenges that must be addressed to create favourable conditions for development. These refer to the need to: adequately reinforce ASI's workforce; proactively govern the scaling up of the entire ecosystem to compete internationally with the big players; to encourage large-scale capital and the financial sector to enter the space industry; provide

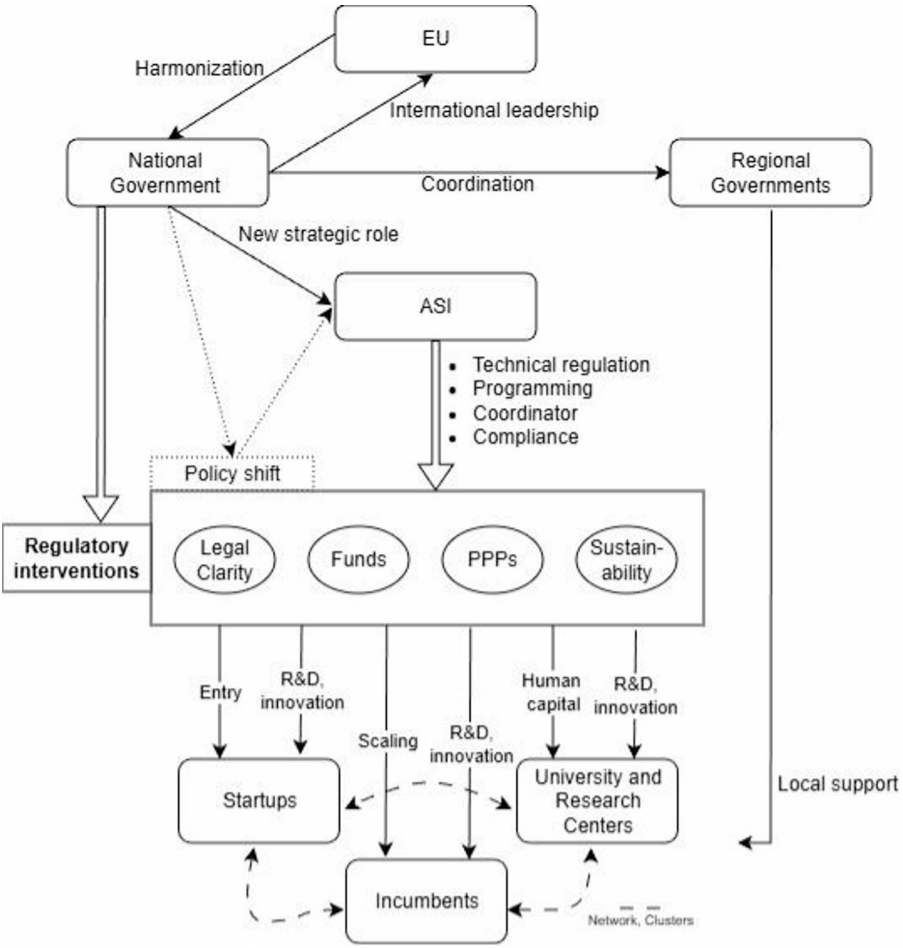

Fig. 1 Main actors and regulatory interventions involved in the implementation of the new Italian law

economic funding according to a structured long-term view; develop more recent frameworks of sustainability for reaching SDGs; continue to play a strategic political role in the definition of EU legislation.

6 Discussion

6.1 Opportunities and challenges

This paper contributes to the literature by bringing together expert perspectives collected through semi-structured interviews, providing qualitative evidence that informs the debate on how regulatory interventions may influence socio-economic development. We provide a critical analysis of the main features of the new law, discussing how they may create favourable conditions for emerging private firms,

research activities, public–private collaboration, and a more coherent strategic industrial vision.

The results highlight that with the enactment of Law 89/2025, the Italian regulatory capacity in the space economy could provide institutional credibility and could translate legal certainty into economic dynamism. By introducing risk-based licensing, scalable insurance requirements, and clear liability rules, the law aims to reduce transaction costs and uncertainty, thereby facilitating private sector participation. In this sense, regulatory innovation may create favourable conditions for industrial transformation by supporting research, funding private entrepreneurial initiatives, promoting PPPs, and pursuing SDGs. As seen in the US commercial space launch regime and Luxembourg's space resources framework, translating international obligations into predictable domestic procedures enhances institutional credibility and mobilises investment, talent, and international partnerships.

Our discussion aligns with recent empirical research. Among others, Janikowski (2025) shows that the impact of passing space resources legislation in the United States in 2015 led to an increase of USD $8.7 billion in the space sector. Analysing data from ASI, Florio et al. (2024) find positive socio-economic returns on public procurement and Earth observation policies, with downstream start-ups showing the highest innovation output, and with significant positive effects for knowledge production in both universities and research centres.

Nevertheless, the findings suggest that the new law also presents several challenges. Regulatory inertia and rigidity could introduce economic costs, as shown by the US Bureau of Industry and Security (2014) and the Center for Strategic and International Studies (2010), which document significant revenue losses and compliance burdens following the ITAR reclassification of satellites, which coincided with a marked decline in US global market share. Choi and Niculescu (2006) report similar frictions affecting Canadian firms, indicating that excessive regulatory rigidity can function as a non-tariff barrier to innovation and cross-border supply chains. The authorisation procedures of the new Law 89/2025 are open to the risk of bottlenecks and delays. High fixed compliance costs could represent a barrier to entry and investments: some results revealed that, since firms need to accelerate the process and receive approval, this could collide with the necessity of ASI to take consistent decisions and ensure compliance with the principles of the law. This is particularly relevant in a fast-growing sector like the space industry.

The evidence gathered through the interviews, together with observations emerging from industry discussions, shows that some firms complained of recent delays of more than one year in receiving a response to a tender application from the Italian authorities. These hurdles were caused by the requirements of the Public Procurement Code; this may be detrimental to large firms, but particularly to start-ups or small businesses that need agility and certainty. Moreover, establishing a law is only the beginning of a long, continuous process, where the real challenge lies in translating it into concrete measures through executive decrees. This part of the process is where details and threshold settings take on the greatest importance, opening the door to the risk of slowdowns. At the time of publication of this research, no official decrees have been issued, indicating that there is still a long way to go before achiev-

ing a full, complete, and clear regulatory framework. Delays in approving executive decrees can prolong uncertainty and delay investment and entry decisions.

Future challenges will be maintaining high regulatory quality across the following regulations, keeping bureaucratic hurdles low, and sustaining strong coordination between public and private actors. Many of these challenges also depend on the institutional capacity, in particular at ASI, to administer the new responsibilities effectively. Taken together, the findings indicate that many of these challenges may ultimately depend on the institutional capacity of ASI to effectively administer its new responsibilities. They also suggest that, without the full implementation of digital tools and simplification measures, bureaucratic complexity could remain a challenge.

Another risk concerns the design of industrial policy: while the law aims to support SMEs and start-ups, the interaction between the regulatory authority and targeted funding and procurement instruments may give rise to distortionary effects. In the absence of transparent and competitive allocation mechanisms, such instruments could risk encouraging rent-seeking behaviour and directing resources toward firms whose entry is primarily driven by public support rather than by underlying productivity. When designing targeted support tools, the risk to avoid is that SMEs and start-ups might enter the sector to access funding or contracts, but exit once support ends, leading to temporary, low-quality entry rather than sustainable firm formation. The concern expressed here is not whether the State will support the sector, but that support without strong competitive discipline can replace market selection with administrative selection, weakening long-run economic performance.

Another threat emerged regarding the coordination among different ministries and public bodies, which must be continuously and efficiently managed to avoid overlaps or policy fragmentation. Possible overlaps with an EU-level Space Act (for example, double registration or duplicative procedures) would raise administrative burdens and uncertainty for operators. Finally, the effectiveness of monitoring and evaluation, particularly at the early stages of implementation, hinges on the development of sufficient institutional and human-capital capacity to evaluate the operation and performance of the regulatory tools.

In conclusion, our analysis shows that the new regulation represents a significant opportunity to stimulate socio-economic dynamism in the space sector, but this can occur only if the implementation of the executive decrees becomes a strategic moment to ensure that the new law is both innovative and effective in overcoming its inherent risks.

6.2 Policy issues

The results of our analysis provide valuable insights into key policy issues. To avoid the risks discussed in Sect. 6.1 and ensure the effective and competitive implementation of the new law, we offer the following policy recommendations. Above all, we already discussed the importance of keeping the national framework aligned with the EU Space Act, thereby reducing regulatory fragmentation across Member States. This is particularly relevant in the implementation of executive decrees. It is crucial to maintain coordination with the EU Space Act to avoid discrepancies – for

example, the €100 million cap required for insurance coverage, which is lower in other countries. We note the need to set lower insurance requirements for low-risk missions, in line with other EU Member States.

We also note that during the development of the law, the Italian government established working groups that involved representatives of various research institutions and businesses from the outset. This aspect remains a key asset. Our practical suggestion is to periodically organise a technical working group with industry representatives and inventors, to ensure that also the implementation of the executive decrees meets the needs of all the stakeholders, as well as to assure that in this paradigm shift all the actors will take part in the future developments of policies, in line with the management of institutional change suggested by the institutional entrepreneurship theory.

Another policy issue related to EU and international standards refers to sustainability. The Italian new regulatory frameworks must evolve to incorporate measurable standards and incentives. Integrating lifecycle metrics into certification schemes represents a first step. While ISO 24,113 focuses narrowly on debris mitigation, broader standards such as ISO 14,044 (lifecycle assessment) can support circular evaluation across mission lifecycles (Jones and Jain 2023). Other initiatives, such as the Space Sustainability Rating (SSR) developed by the EPFL Space Center, provide an additional avenue for integrating circular and regenerative principles into the space sector. As a composite indicator, the SSR already incorporates elements related to on-orbit servicing, mission life extension, and standardisation. However, these aspects are currently embedded implicitly within the broader assessment framework. Strengthening their visibility by introducing dedicated, measurable indicators aligned with circular and regenerative design principles could incentivise operators to adopt such practices more systematically and transparently.

We argue that the government needs to accelerate the development and harmonisation of internationally shared standards. At the same time, regulatory frameworks should move beyond conventional sustainability approaches by explicitly integrating circular and regenerative models into the planning, development, and governance of space activities. Embedding these principles within forthcoming legislative decrees through guidelines, measurable requirements, and dedicated funding instruments, including targeted support for start-ups adopting such models, would not only enhance long-term sustainability but also enable a net-positive environmental contribution both in space and on Earth. For Italy, this represents a strategic opportunity to position domestic firms as first movers and global leaders in this emerging field. Such national regulatory action should be accompanied by a strong and consistent push at the international level, beginning within the European Union, to promote the formal recognition and adoption of circular and regenerative models as integral components of future space governance.

Another strategic policy suggestion, linked to international competition and attractiveness, concerns the development of specific legislation on space property rights and the exploitation of space resources. We believe this is the next necessary step in order to keep pace with other nations that have already established ownership rights over extracted resources under national authorisation, as in the UAE and Luxembourg.

A crucial recommendation is to maintain clear, streamlined implementing regulations to prevent excessive bureaucracy. The challenge is not to reduce regulatory oversight but to minimise administrative complexity. Simplification measures such as a one-stop-shop mechanism, risk-based authorisation procedures, statutory timelines, digitalised application systems, and transparent checklists could preserve safety and sustainability objectives while lowering entry barriers and compliance costs. This is a key challenge involving ASI. As reported in Sect. 5.2.1, the government has already increased the ASI workforce in recent years. Future space policy updates should continue to invest in ASI's human capital while reinforcing institutional coordination to avoid fragmented or overlapping procedures that could create uncertainty for investors and add unnecessary bureaucratic and administrative complexity.

The need to secure sufficient resources to continue financing and supporting the space sector also concerns investments planned for the 5-year National Plan and the Space Economy Fund, as well as Italian contributions to ESA. In such a competitive environment among nations, even if macroeconomic conditions are challenging, we suggest immediately defining a long-run programme of funds and investments in the space economy: this is necessary in order to signal that the development of the space sector is a long-run structural priority, such that it could be perceived as more attractive for firms and investors. It is also essential, from a political perspective, for Italy to maintain an active leading role in shaping and refining the EU Space Act.

In such a dynamic, fast-growing environment, it is plausible to expect both new firm entries and failures. Any future policy agenda should emphasise monitoring failures and implementing learning processes and procedures to gain knowledge from them. Firms' capacity to extract knowledge from prior failures constitutes a critical determinant of their subsequent performance (Bennett and Snyder 2017; Vittori et al. 2024). Empirical evidence from the satellite launch industry supports this proposition: Madsen and Desai (2010) demonstrate that the likelihood of a successful launch increases with the cumulative number of prior failures, indicating that experiential learning can enhance operational reliability over time. The problem is that firms capable of effectively learning from failure represent exceptions rather than the rule (Edmondson 2011). While failure is a key mechanism for performance improvement, firms that successfully translate failure into organisational learning are rare. The most famous entrepreneur in the global space industry, Elon Musk, repeatedly said that failure is a part of learning and innovation (Winley 2015; Satara 2018).

We suggest that policymakers create a formal unit to investigate both successful and failing firms. Successful firms can reveal the best practices to follow and implement. Of equal importance are failed firms, as learning from failures can be a key mechanism for performance improvement. Analogously to organisations that design knowledge management mechanisms which incorporate failure as a fundamental component of the learning process (Vittori et al. 2024), we contend that the government should intentionally develop a structured, failure-tolerant framework to foster accelerated learning and breakthrough innovation.

To conclude, from a policy perspective, we underline that, given the dynamic, interdependent, and coevolving systems of firms, institutions, and technologies, linear or one-size-fits-all policies (such as tax breaks or incubators) are not effective at stimulating the creation of new firms (Carter and Pezeshkan 2023). Accordingly, we

argue that policymakers need to monitor the effective alignment of their policy interventions with the specific timing, conditions, and interdependencies of the evolving components of the sectoral ecosystem. Policies need, then, to shift from generic start-up support toward adaptive, stage-specific ecosystem strategies that recognise feedback loops, co-evolution, and non-linear dynamics, a challenging approach that requires strategic efforts in future policy evaluation and redesign.

6.3 Theoretical contribution

We believe that our research also offers an original contribution to the theoretical literature on Sectoral Systems of Innovation (SSIs). Our discussion shows that the Italian space industry represents a clear example of an SSI (Malerba 2002, 2004). While the SSI approach remains highly valuable for understanding industry-specific dynamics, emphasising the role of sector-specific knowledge bases, technologies, institutions, demand structures, and actor configurations in shaping innovation, we argue that this framework does not fully capture the dynamics of innovation processes in highly interconnected and convergent economic environments. The contemporary economy increasingly displays characteristics that challenge the analytical assumptions underlying the traditional SSI approach. Digitalisation, platform economies, artificial intelligence, technological convergence, and ecosystem-based innovation processes progressively blur the boundaries between industries and sectors. Innovation no longer emerges predominantly within stable and isolated sectoral domains. Instead, it increasingly results from interactions among heterogeneous technologies, industries, and institutional environments. In this context, the traditional notion of a sector becomes progressively less stable as an analytical category.

Moreover, the growing importance of technological convergence implies that technologies originally developed within one sector increasingly generate applications, complementarities, and spillovers across multiple industries. Innovation, therefore, becomes multidirectional, recombinative, and systemic. In this context, innovation emerges through intersectoral convergence. Sectoral boundaries are increasingly fluid, and innovation frequently arises at the interfaces between industries, as documented in recent empirical studies (Stephan et al. 2019; Li et al. 2021; Sergio et al. 2023). Finally, while the traditional SSI perspective emphasises unidirectional spillovers, we argue that technologies move continuously across sectors and that spillovers become multidirectional through spin-off and spin-in dynamics.

This paper advances the SSI literature by arguing that the Italian space industry cannot be adequately conceptualised as a standalone SSI, but rather as a dynamic SSI embedded within a broader, networked innovation landscape. Innovation in the space economy increasingly arises through interactions with adjacent sectors, such as digital technologies, advanced manufacturing, telecommunications, and data-intensive services, where sectoral boundaries are fluid, and knowledge recombination occurs at their interfaces. Therefore, we contend that the existing theoretical framework should be extended from the SSI perspective to an "Intersectoral System of Innovation" (ISI) capable of capturing systemic innovation processes that emerge from the coordinated interaction of multiple technological and industrial domains.

We propose conceptualising innovation as a system-level outcome that transcends individual sectors, highlighting how cross-sectoral complementarities, shared capabilities, and interconnected governance structures jointly shape innovation dynamics. For example, many contemporary space technologies originate outside the traditional aerospace industry, including miniaturised electronics derived from consumer electronics, artificial intelligence tools developed within the software industry, cloud infrastructures developed by digital platform firms, and batteries and energy systems derived from the electric mobility sector. At the same time, space technologies generate extensive spillovers across the broader economy. Satellite systems support precision agriculture, logistics, autonomous mobility, climate monitoring, insurance analytics, and disaster management. By extending the SSI framework toward the concept of an ISI, we believe that our paper provides a more suitable analytical lens for studying complex, high-uncertainty industries and for assessing policy interventions whose effects propagate across multiple sectors rather than remaining confined to a single industry.

Our analysis also highlights another important peculiarity that arises in applying the SSI framework to the space sector: the distinctive role of the State as both market creator and market client. Unlike many other sectors, where public intervention is primarily regulatory or supportive, space activities are characterised by a dual public role: the State defines the legal and institutional conditions that enable markets to operate, while simultaneously acting as a direct client through procurement, missions, and strategic programmes.

This duality has profound implications for innovation dynamics within the SSI framework. As a market creator, the State shapes demand conditions, reduces uncertainty, and enables private investment by clarifying rules, standards, and liability regimes. The State also acts as a demand shaper. Mission-oriented procurement creates markets, mainly for national security and sovereignty reasons, related to both defence and data independence. In addition, because many space services are well-received by the general public (e.g. weather and climate data, disaster monitoring, planetary science, GNSS timing), private firms cannot fully appropriate the social value and private market demand is too thin; public procurement internalises these positive externalities and directly influences technological trajectories by specifying requirements, funding development, and absorbing early-stage risks.

Consequently, innovation incentives in the space sector are not driven solely by market competition, but by a complex interaction between public demand, regulatory design, and private capabilities. This configuration challenges conventional SSI assumptions that treat demand as largely exogenous and policy as external to market formation. In the space sector, instead, market structure, innovation direction, and entry conditions are co-produced through public–private interaction. Recognising this dual role of the State is essential for understanding how innovation is governed and how policy interventions propagate through the system. Integrating this dimension into the SSI framework allows for a more accurate interpretation of innovation processes in sectors where markets are institutionally constructed and sustained by public action. In conclusion, our analysis points to the need to extend and refine the SSI framework to better capture the institutional and intersectoral features observed in the space sector.

Going back to the SSI vs. the EE approach, as discussed in Sect. 2, we argue that in the space sector, the role of government is more comprehensively captured by the SSI than by the EE framework, because public institutions are not merely contextual enablers of entrepreneurial activity, but constitute core actors that actively shape market formation, demand conditions, and technological trajectories. Through regulation, authorisation regimes, procurement, and mission-oriented programmes, the government defines the feasibility of economic activities, reduces uncertainty, and directly influences the direction and pace of innovation. As a result, innovation dynamics in the space sector emerge from coordinated interactions between public and private actors, rather than from localised entrepreneurial conditions alone. By endogenising institutions, policy instruments, and demand-side mechanisms within sectoral dynamics, the SSI framework provides a more suitable analytical lens for capturing the central and constitutive role of government in structuring innovation and entrepreneurial activities in the space economy.

In comparison, within EE theories, the government is typically conceptualised as an enabling actor that shapes the entrepreneurial environment, rather than as a central market participant or demand-side driver. However, EE theory can complement the SSI approach by emphasising how place-based policy environments shape entrepreneurial behaviour and innovation outcomes. In fact, as we discussed in Sect. 4.3, the Italian space economy is clustered in specific regions that combine technical expertise with supportive institutional and cultural conditions. In the new space context, ecosystem-oriented policies can be effectively implemented at the subnational level and involve coordination among regional governments, space agencies, universities, and private actors. As a result, EE-oriented policy approaches help explain why similar sectoral opportunities generate entrepreneurial activity in some locations but not in others.

Following this line of reasoning, integrating SSI and EE can highlight the importance of policy sequencing: early-stage policies that provide legal clarity, signal public demand, and legitimise private participation can unlock entrepreneurial experimentation; subsequent ecosystem-oriented policies can then support scaling, learning, and diffusion. By acknowledging the complementary roles of SSI and EE, policymakers can better design interventions that support not only innovation within the space sector but also the sustainable emergence of new space markets.

7 Conclusions and future research

The space sector is undergoing significant industrial transformation and dynamics worldwide, which is reflected in the emergence of the “New Space Economy”. It extends beyond the emergence of private actors and growing revenues to include a redefinition of institutional roles, business models, and innovation dynamics. Rapid technological advances have not only enabled the entry of new space-focused firms but have also reshaped the underlying business paradigm of the industry and its policy framework. In this context, the need for updated regulation arises primarily from technological developments that have made space increasingly accessible to private economic actors. To cope with these changes, Italy approved new legislation, Law 89/2025.

Our paper discusses how Italy's new space law can represent a proactive institutional reform that aligns national policy with global trends in commercialisation, sustainability, and technological advancement. The analysis draws on the legislative framework, the existing literature, and semi-structured interviews with eight key stakeholders. Building on the evidence presented throughout the paper, we first claim (RQ1) that the enactment of the new law can contribute to the development of the space industry. In fact, the new law represents a shift in the policy paradigm, enhancing awareness of space-related commercial opportunities and supporting a broader cultural shift through public–private partnerships that strengthen collaboration between State institutions and the private sector. However, our results stress that this can occur if the executive decrees remain clear and will not become overly bureaucratic, with strong coordination with the EU Space Act implementation.

Second, we argue (RQ2) that the provisions of the new law create the conditions to sustain socio-economic development. Our data suggest that the new strategic role of ASI, the systemic view that is expected to encourage interaction between the government agencies, private firms, universities, start-ups and financial actors, the intersectoral synergies, the tailored funds dedicated to sustaining research and firms' entry, the requirements of sustainability, and the strengthened Italy's international role, represent the key features that have the potentials to contribute to generate positive impacts on socio-economic dynamics.

However, risks and challenges remain. Above all, we noted the crucial importance of implementing the law, defining executive decrees, and designing effective, long-term economic measures to support research, competition, and innovation. Related to these risks, we discussed some policy recommendations. To sum up, we focused on the following issues: the continuous coordination and harmonisation with the EU regulations; the expansion of the ASI workforce; the creation of a formal unit that investigates both successful and failing firms as a mechanism of learning; the definition of global shared sustainable standards; the guaranteed maintenance of public funds and investments in a long time horizon to gain robustness in the international leadership. We believe our results make a valuable contribution to the debate on the implementation of executive decrees and other space laws.

From a theoretical perspective, we contribute to SSI literature in three ways. First, we propose extending the conceptualisation of SSI to an "Intersectoral Systems of Innovation" lens to capture systemic innovation processes that emerge across multiple technological and industrial domains. Second, we discuss the dual role, as both market creator and market client, that the government institution can play in the SSI, and argue for integrating this dimension into the SSI framework to better analyse innovation processes in sectors where markets are institutionally constructed and sustained by public action. Third, we advocate integrating SSI and EE approaches to identify policy sequencing, where early-stage policies provide legal clarity, build public demand, and legitimise private participation, and then subsequent ecosystem-oriented policies can support scaling, learning, and diffusion at the local level.

This study does not pretend to be comprehensive and provides opportunities for further research. First, we report the need to study the enactment of the executive decrees related to the new law. Second, future studies could use our discussion to collect data (when available) and implement empirical analyses to test and confirm

our claims about the impact of the new law. Third, our case provides insights into a further theoretical conceptualisation of SSIs, which is left to future developments.

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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