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# Technology, security, and policy implications of future transatlantic partnerships in space: Lessons from Galileo☆

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ABSTRACT

Policy makers seek to identify an institutional framework that facilitates the commercialization of publicly funded R&D, while simultaneously addressing innovation market failure. In the space industry, the formation of such a framework is complicated by national security considerations and the fact that numerous sovereign nations are often included in the commercialization process. This paper analyses how multi-public partnerships with industry can promote commercially viable space programs, resolve market failures, and address transatlantic security concerns. The benefits and policy implications of the formation of such transatlantic multi-public–private partnerships (TMP$^3$) are illustrated based on a case study of the design of a major European public–private project in the space industry: the Galileo space-based navigation system.



## 1. Introduction

In recent years, there has been a substantial increase in the incidence of public–private research partnerships, which are designed to address market failures. The rise of this activity underscores the need for an institutional framework that facilitates the commercialization of publicly funded R&D, without creating long-term dependency on public funds. Although there is a substantial literature on such partnerships (see Hagedoorn et al., 2000; Siegel and Zervos, 2002; also Lorell et al., 2002, for partnerships in defence), there has been little analysis of multi-public–private partnerships (henceforth, MP$^3$) and especially, transatlantic multi-public–private partnerships (henceforth, TMP$^3$).

We fill this gap by outlining a framework relating to key objectives and public concerns for potential partners in multi-public–private partnerships. This framework incorporates security aspects, as well as more 'conventional' objectives and concerns. We illustrate the use of this framework by using Galileo as a case study to examine whether such a transatlantic partnership would have resulted in advantages over European-only MP$^3$ and under what conditions transatlantic partnerships are likely to form. The objectives and success of this partnership depend on the objectives of both the private and public sector in

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several nations and thus could identify factors that prevented Galileo from becoming a successful public–private partnership. More generally, we assess possible economic and security benefits from the formation of transatlantic partnerships for similar future programs, as well as the challenges that transatlantic multi-public–private partnerships (TMP$^3$) might encounter.

We also consider the policy implications of such transatlantic collaborations. These are critical, given the complex nature of the political and economic issues that emerge from this framework. In the case of space R&D, these issues are further complicated by security concerns and national and regional economic interests. Our objective in this paper is to assess how multi-public–private partnerships can address market failures, while simultaneously addressing the security and economic concerns of participating nations.

The remainder of this paper is organized as follows. The following section analyses the evolution of market failures and public–private partnerships in space. Section 3 contains a detailed description of the Galileo project, followed by lessons learned from the failing of the public–private partnership that was intended to develop, deploy and operate the program. A more general consideration of objectives and concerns in multi-public–private partnerships is presented in Section 4, based on the lessons learned. Section 5 discusses the case for future transatlantic technology policy coordination in space. The final section consists of conclusions and suggestions for additional research.

## 2. Market failures and public–private partnerships in space

As noted in Hagedoorn et al. (2000) and Siegel (2003), the theoretical rationale for the formation of public–private research partnerships is the ability of such partnerships to address innovation market failures. These market failures stem from difficulties in raising financial capital for early-stage technologies, situations where appropriability conditions are weak, and instances where there are large positive externalities associated with the development of a new technology.

The presence of political objectives, coupled with the absence of trade wars, allows the formation of partnerships between several countries. This results in collaborative programs that add the promotion of security and stability to the above list. Historically, the formation of partnerships in space programs dates back to the Cold War, when partnerships were amongst countries and their chief goals were political. Secondary objectives were advancing science and technology and avoiding duplication in R&D (see Sadeh, 2002: 284 for an evolutionary approach to space cooperation; also Carrodeguas and Gerard, 1999). In the majority of cases, partnerships were formed between government agencies, as space applications were seen as a case of multiple market failures, with substantial spinoffs for the economy in the form of new product innovations, improvements in meteorology, earth observation and telecommunications (see Hertzfeld, 1992; Bach et al., 1992), and last but not least, political and flag-carrier effects, such as the US 'Apollo' program.

The flagship of such projects, the International Space Station (ISS), marked the end of the Cold War and heralded the era of collaboration in space on a global scale. The ISS was a multi-public space partnership, where commercial benefits were a secondary consideration and would be controlled and distributed by the member-state agencies that participated in the construction and running of the ISS. Multi-public partnerships emerged as a costly response not only to political objectives, but also to economically oriented market failures associated with emerging space-based telecommunications and positioning systems that were provided by intergovernmental organizations like INTELSAT, which were perceived at the time as natural monopolies (see Neven et al., 1993; Snow, 1987).

Many scholars have asserted that the formation of international joint ventures (IJV) and strategic research partnerships (SRP) allows companies to 'test the water' for future mergers and acquisitions. Similarly, multi-public, program-specific partnerships are often viewed as a stepping stone for future multinational collaboration. The most notable multi-public-partnership (MPP) is the European Space Agency (ESA), which was created in the early 1970s. The creation of ESA followed a number of successful programs in satellites and launchers at European level through the merging of the two respective program-specific European multi-public partnerships, ELDO (European launcher development organization) and ESRO (European satellite research organization) (Krige and Russo, 2000). ESA is comprised of 17 European member states and undertakes a wide spectrum of programs. Some of these programs are mandatory, while others are optional for the member states, allowing the flexibility necessary for functionality and delicate balancing compromises of different objectives such as multi-public partnerships require (see Krige and Russo, 2000: Table 3). A key advantage of ESA is the avoidance of duplication in civil/scientific programs amongst the member states. Co-ordination of scientific programs amongst different space agencies is an obvious way of saving on duplication, given that, for example, the results of advances in astronomy are hard to appropriate.

In general, policymakers of member states in multi-public partnerships have several objectives in funding collaborative space projects. These include the impact of such projects on their country's technological base, job creation, and aggregate industrial performance. The most obvious compromise is preferential treatment for space firms in member states, with respect to procurement. In particular, ESA's industrial policy is heavily criticized in terms of the inefficiencies that the principle of 'juste retour' imposes on program costs.

Following this principle, member-state contributions to budgetary appropriations are intended to be matched by contract value to the respective industry of the same value. Even though this preferential policy in procurement is no different than other countries (e.g. the most prominent preferential policy is the US 'Buy American Act'-FAR, 2002), it is often seen by policymakers as highly inefficient, advancing fragmentation and inhibiting the integration of the European space industry (see House of Commons, 2000). In addition, juste retour also does not avoid the intense lobbying of individual countries to ensure that their