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Current barriers and factors of success in the diffusion of satellite services in Europe

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A B S T R A C T

Satellite services benefit civil society by helping tackle challenges such as climate change, the digital divide, etc. They have the potential to deliver concrete benefits to European society through innovative services supporting economic, societal and environmental policies. Such benefits can trigger increased public support for space in Europe. However, this potential has yet to be achieved. This paper argues that technological bias, the diversity of interests and initiatives among stakeholders and their individual actions do not always serve their collective objective to ensure wide diffusion of satellite services. It draws on theories of diffusion of innovation and on its authors' participatory work with the space and the user communities and at their interface in an effort to help diffuse satellite services within civil society. One of the major causes of insufficient service diffusion is the weakness of the interface between the space and user communities; some of factors that currently contribute to this state of affairs are the space community's over-reliance on publicly financed, technical demonstration projects as solutions to service diffusion; insufficient coordination by public authorities of innovation policies and programmes with other public policies and objectives; and an insufficient integration of satellite services within users' culture, traditional tools and services. The discussion allows for conclusions to be drawn on how the system of stakeholders could function better in order for satellite services to be successfully diffused in Europe.

1. Introduction

As emphasised by the European Space Council [1], space capacity is a strategic asset for Europe for both security and economic reasons. To maintain independent access to space and preserve leadership in space-related science and technology, Europe needs to secure substantial resources and political commitment from EU member states. The development of the Galileo and Global Monitoring for Environment and Security (GMES) programmes is intended to reinforce both resources and commitment, by creating synergies between the use of space for defence and for civil applications benefiting society. Indeed, satellite-based services have a significant potential to contribute to the development of the knowledge economy and to help society cope with the new challenges it faces, such as climate change. Moreover, downstream services have better commercial and economic prospects in comparison to the upstream segment of the space sector [2]. Therefore, one of the key goals of the 2007 European Space Policy is to develop the downstream service market based on earth observation, navigation and telecommunications. In doing so a key issue is "maintaining a firm link between establishing user requirements and securing a further development of the infrastructure and services in a cost-efficient manner". However, despite the ambitious goals of the European Space Policy and the massive investments dedicated to its two flagship programmes, satellite services' penetration of the market is very limited: demand is sluggish, there is little user pull for the development of such services [3], and commercial services are stagnant [4].

The purpose of this paper is to analyse the obstacles and factors of success in the diffusion of satellite services within European civil society. Because of the innovative nature of satellite services, their *diffusion* is a complex, iterative and interactive process of collective learning and accumulation of knowledge about satellite services among formal and informal social networks within civil society. Successful diffusion depends at once on a multitude of actors (stakeholders), their interactions and the collective dimension of these interactions, all seen as a knowledge infrastructure. The *satellite service knowledge infrastructure* is a system that shapes and organises the processes leading to final user acceptance of satellite

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services and competence in their use. However, the stakeholders involved in this system have different motivations, obey different internal logics and share different working cultures. J-A Héraud's appreciation of regional systems of knowledge applies to the satellite knowledge infrastructure: "If in a system every part should act mainly for the sake of the rest, as organs do in an organism, then nothing exists like a '[…] system' (although it can be the *a priori* vision of some […] policy makers)" [5].

In this context the question asked is: what are the leverages and mechanisms for mobilising internal, rational and irrational motivations driving individuals, organisations and networks to interact meaningfully as a system, allowing for communication channels to be formed and for innovative satellite services to be thus diffused and absorbed within communities of final users? In other words, what are the strategies for "mobilising knowledge and relations" towards a successful diffusion of satellite services among society [6]?

While drawing on theoretical models of innovation diffusion and systems, this paper is based mainly on the authors' two-year participatory observation of the process of the diffusion of satellite services within civil society, in the framework of Eurisy's User Programme. Eurisy is a non-profit association of most European national space agencies. Its User Programme is an on-going initiative, started in 2006. It aims to contribute to the diffusion of satellite services within civil society by raising awareness of their benefits, by setting up models for satellite service implementation (in collaboration with the final users), and by providing bottom-up feedback to relevant stakeholders. The paper is based on the first-hand experience of working with both the space community and the final user communities in an effort to support dialogue and exchanges between them.

2. Inherent characteristics of satellite services that hinder their diffusion

Satellite services rely on three core functions: navigation, imagery and communication. All three are known to the general public through examples such as in-car sat-nav systems, Google Earth and TV broadcasts. Their innovative character is no longer perceived as groundbreaking.

In fact, the innovative nature of satellite services lies not strictly in the way they work, but in the novel use of these three basic functions: in how they are employed by professional users for improving existing practices in social and economic activities (risk management, agriculture, fisheries, etc.). For example, while the use of GPS in vehicles for navigation is relatively common and well known today, using GPS for monitoring sea-level rise or for indicating the level of oil in a tank are less-known, more innovative applications.

Innovative uses that are relevant to final users can only be devised through collaborative work between the user and the service provider. There are two stages in the collaborative service development: the function must first be imagined together, through an in-depth analysis of the final user's practices and needs. Then, once the user and service provider have matched the identified user need with a relevant satellite solution, they can co-produce the service.[1] More often than not high added-value satellite solutions are only relevant if tailored, and can only be tailored through collaboration.

It follows that the benefits of satellite services are not readily visible or demonstrable to the user. Of course, technical demonstrations are frequent, but they have limited relevance to the user. Indeed, "most individuals do not evaluate an innovation on the basis of scientific studies of its consequences." [7] Relative advantages, such as economic profitability, cost, comfort, social prestige, saving time and effort and immediacy of reward, play a big part in the decision-making process. In addition to a rational decision-making process, other factors influence the user, notably "multi-rationality, non-optimising adaptive behaviour as in biology, highly uncertain and changing environments" [8]. Because of the long co-production times and the high degree of adaptation to specific user needs, as well as technical uncertainty about the availability of space infrastructure (the satellite data), transparent value-for-money propositions are difficult to present to users. The reward at the end of the co-production process is not always clear. The social prestige associated with the use of satellite services is limited because satellite services mostly have a support function and are not particularly visible to their users. An example is the activity of the Oeiras Energy Agency,[2] which consists in collecting and recycling cooking oil for energy production, using satellite services for greater efficiency. The use of satellite services is secondary to and less visible than the innovative nature of the initiative itself, i.e. recycling cooking oil.

All these factors imply a high degree of uncertainty for the final user, who is asked to believe and invest in a service that cannot easily be assessed. Furthermore, satellite services are mainly aimed at optimising *existing* practices, at doing things differently rather than doing new things. This means, first, that satellite services will be met with a high degree of resistance to change. Established practices, the familiarity of existing tools and institutional inertia will easily take precedence over the will to change, unless the final users understand the need for change and are given control of the process. Second, satellite services undergo stiff competition from other, more established technologies. Because it is difficult for the final user to assess the relative advantages of satellite services, they will often prefer more familiar, more transparent, better-established technologies, like aerial photography.

The obstacles related to the innovative nature of satellite services hint at the complexity of their diffusion, and to the fact that it depends more on people, organisations and their interactions than on technical capabilities. The diffusion of satellite services therefore appears to be a more complex process of "social change" where shared culture, identity, codes of behaviour and trust play an essential part [8, p. 35]. We will now analyse more closely how the stakeholders in the satellite service knowledge infrastructure shape the service diffusion process.

3. The satellite service knowledge infrastructure: a systemic view

A recent OECD report defines the space economy as:

> all public and private actors involved in developing and providing space-enabled products and services. It comprises of a long value-added chain, starting with research and development actors and manufacturers of space hardware (e.g. launch vehicles, satellites, ground stations) and ending with the

[1] Indeed, there are relatively few 'off-the-shelf' satellite solutions. A service provider such as Infoterra France, for instance, has mainly developed value - added services for agriculture (satellite remote-sensing information on soil fertiliser content for optimising its use). However, it has the ability to provide many other types of information needed by practitioners in their work. In the case of telecoms, whatever the use of the service — whether broadband access provision in difficult areas or alert message transmission for remote monitoring of photovoltaic plants — the basic service provided is only a telecom link.

[2] Experience presented by the Oeiras Energy Agency during Eurisy's workshop *Innovation at the service of regions and cities for implementing sustainable energy strategies, held in* The Hague, The Netherlands, on 22–23 June 2009.