

1. Space in the financial and economic crisis

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1.1. Introduction

The purpose of this article is to analyse the impact of the financial and economic crisis on the space sector from a political point of view. Indeed, it seems technically difficult and methodologically dangerous to make econometric predictions regarding future economic developments. This is particularly valid for the global economic situation, the best example being the regular revision and correction of the economic outlooks of the World Bank and International Monetary Fund (IMF). In the particular case of the space sector, this uncertainty is lessened by some features that are specific to the space economy (such as the relatively predictable manufacturing cycles in the upstream sector) and by the existence of several consulting firms specialised in providing space-specific economic forecasts.⁵⁷⁵ This contribution however, does not intend either to make a market forecast or to predict when and how the space sector will overcome the crisis. It will rather propose a political analysis based on the thorough observation of the space sector in the last two years, enabling the identification of some political implications and prospects offered by the crisis. Consequently, the focus will be on the institutional space sector rather than on commercial space activities. In addition, Europe will be placed at the centre of the analysis and worldwide trends and developments will always be considered as structural constraints or enablers for the European space sector. Two interrelated central ideas underlie the present article. On the one hand, the crisis can be seen as a test case for the strategic nature of space. On the other hand, it also represents an opportunity to strengthen this strategic aspect of space, in the sense that it could anchor space even further to the European socio-economic framework, in the long term. In order to develop these ideas, a brief overview of the crisis itself will first be given, identifying the factual elements directly relevant to the space sector. In a second step, an analysis of what has happened in the space economy in the last two years will be conducted. This will finally enable the third step that is to specifically highlight the political implications and future prospects for the space sector that have been induced by the crisis.

1.2. The financial and economic crisis

After a brief presentation of some basic facts and figures on the crisis, national and international responses and reactions to it will be sketched. Finally, national and regional differences in the extent and gravity of the crisis will be highlighted, focusing on the major space faring nations. The overall purpose of this first section is to give an overview of the global background, against which an analysis of the space sector's behaviour during the crisis can be made.

1.2.1. Basic facts and figures

The crisis began with the subprime mortgage collapse in the U.S. in August 2007 and reached its peak in September 2008, when the U.S. investment bank Lehman Brothers declared bankruptcy. What started as turmoil in the financial sector rapidly spread to the real economy in the second half of 2008 and in 2009, as investment and consumption dropped sharply, due to the diminished confidence of households. While commodity prices – in particular oil and gas prices – reached historical high levels in the first half of 2008, weakening global demand had a contracting effect on commodity prices in the second half of the year. This trend somewhat lightened the burden for advanced economies importing commodities, but it had adverse consequences for exporting emerging economies. Another negative consequence of the surge in food and oil prices was very high inflation rates. As a whole, the worldwide economic and financial situation at the end of 2008 was exceptionally uncertain and prone to major risks.⁵⁷⁶ While world output grew by 5.1% in 2006 and 5% in 2007,⁵⁷⁷ the figures for 2008 (+3%) and 2009 (−0.6%)⁵⁷⁸ mirrored the rapidly deteriorating situation. Global recession continued to spread in the first half of 2009, but the first signs of recovery could be observed by the middle of that year. However, the stabilisation pace remained uneven, slow and uncertain.⁵⁷⁹ By the middle of 2010, positive macroeconomic developments indicated a steady recovery, despite renewed financial turbulences in the beginning of the year. Overall, the IMF expects the world output to grow by 4.6% in 2010 and 4.3% in 2011.⁵⁸⁰

1.2.2. National and international reactions to the crisis

Two central features could be observed in the national and international reactions to the crisis. The first is that state intervention was widely used as a regulating tool, reflecting the growing criticism of the neoliberal economic model and responding

to pressure from the IMF. This trend started from the very beginning of the crisis, with six central banks injecting 180 billion U.S. dollars into the monetary markets in a concerted action in October 2008.⁵⁸¹ Almost all the large economies adopted national stimulus packages to reboost their internal demand. The U.S. Congress approved President Obama's 787 billion U.S. dollars economic stimulus package in February 2009 while the European Council on 11 and 12 December 2008 approved a European Economic Recovery Plan, equivalent to about 1.5% of the EU's GDP, which represents around 200 billion Euros. Similar measures were implemented in the United Kingdom, France, Japan, Russia and China. The second point is the increased international consultation to reform the global financial and banking system. Discussions mostly took place within specialised international institutions, such as the World Bank and the IMF, and in the framework of the G7 and G20 summits. While a series of globally shared principles to fight the crisis could be agreed upon (such as the rejection of protectionism), national dissensions over the extent and the content of a reformed international financial system have prevented any concrete steps until now. However, these massive public macroeconomic interventions accelerated the pace of recovery.⁵⁸²

1.2.3. The uneven impact of the crisis

A final element of the crisis that needs to be highlighted concerns the regional disparities in its impact. Indeed, not all areas of the world were hit with the same intensity by the crisis, and a distinction should be made in particular between developed economies which suffered the most and emerging nations which were hardly affected. Looking specifically at spacefaring nations, established players such as the U.S., Europe and Japan faced a drastic slowdown of their economies.⁵⁸³ While the U.S. experienced a moderate negative GDP growth in 2009 (-2.4%), Europe had to cope with a stronger contraction during the same period (-4.1% in the Euro area). The situation was even worse in Japan, as the recession had already started in 2008 (-1.2%) and worsened in 2009 (-5.2%). Russia remained relatively untouched by the crisis in the beginning (+5.6% GDP growth in 2008), but the country's economy experienced a significant setback in 2009 (-7.9%), mainly due to the fall in energy prices and the curtailed access to external funding. At the other end of the spectrum, the two fast emerging space powers India and China saw their GDP growth continuing during the crisis at almost the same pace (+5.7% for India and +9.1% for China in 2009).

To summarise, the financial crisis that started in the middle of 2007 spread to the real economy throughout 2008 and 2009, and recovery is still slow and

uncertain. While the crisis hit developed economies more harshly than emerging countries, the globally coordinated response helped to mitigate its effects. Although it is difficult to establish a direct correlation between the crisis and developments in the space sector, its manifestations provide the background against which analysis should be conducted.

1.3. Space in the crisis

Keeping the main features of the crisis in mind, a specific focus will be put on both the commercial and the institutional space sector during the crisis. However, in order to better understand the impact of the crisis on the space sector, it seems first necessary to define the space economy.

1.3.1. The space economy

For many years, space was not considered as an economic sector as such, but rather as a limited scientific and technological domain. Governments played a central role for decades, as national security concerns dominated space activities during the Cold War. In addition, the huge investments needed in space and the associated economic risks were obstacles for the development of private endeavours.⁵⁸⁴ As a consequence, noteworthy commercial space activities started only in the 1980's.⁵⁸⁵ The end of the Cold War however, paved the way for the expansion of the space economy, as a conjunction of favourable structural factors emerged. The first of these enabling trends was the new impetus given to worldwide financial liberalisation and privatisation, symbolised in the space sector by the transformation of the two main intergovernmental organisations providing worldwide satellite telecommunications services (INMARSAT and INTELSAT) into privately held, profit oriented organisations.⁵⁸⁶ This liberalising wave also touched the two other main space applications, navigation and Earth Observation (EO).⁵⁸⁷ A second factor explaining the rise of private space activities in the 1990's was the reduction of national space budgets, especially concerning military spending. Although of a limited duration, these budget cuts forced private firms to seek new markets.⁵⁸⁸ Finally, and perhaps most importantly, the emergence of new satellite applications with a high socio-political impact in all three areas (EO, navigation and telecommunications) offered large commercial opportunities for space activities.

The last point in particular, led to considering the space economy as an economic sector by itself, with high growth potential. Another related conse-

quence was that the space economy became both broader and more difficult to define.⁵⁸⁹ In light of these developments, the OECD launched a research project focusing on space in 2003. Its objectives were to identify the economic challenges and opportunities for the space sector, and more generally to gain a better understanding of the issues at stake. As a tangible result of this work, the OECD proposed a broad definition of the space economy:

*All public and private actors involved in developing and providing space-enabled products and services. It comprises 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 providers of space-enabled products (e.g. navigation equipment, satellite phones) and services (e.g. satellite-based meteorological services or direct-to-home video services) to final users.*⁵⁹⁰

This definition reflects both the developments in space in recent years (as it comprises not only the traditional space industry but also space services) and the multiplicity of actors involved in the space sector (public and private actors, space and non-space actors, demand and supply side).

Due to their structural specificities, space activities are not comparable to other market sectors. These specificities need to be briefly presented, as they were often exacerbated by the crisis. The first and most characterising feature of space is the strong involvement of governments. Indeed, most of the R&D work in space is public, space agencies remain the largest buyers of space services and products and governments also set up the framework conditions for private space activities.⁵⁹¹ The two main reasons for this are, on the one hand the strategic relevance of space (both in the narrow military and in the broader, socio-political sense) and, on the other, the high economic risks associated with space endeavours, which can not be usually faced by private companies alone. In addition to the central role of governments, the high costs of access to space and the long development cycles of relevant technologies constitute further determinants of space activities. Finally, only low economies of scale are possible in the upstream sector, leading to concentration, while the downstream sector is characterised by high economies of scale, enabling the development of large and viable markets.⁵⁹²

To summarise, two simple facts need to be pointed out to better understand the effects of the crisis on the space sector. The first is that because of rapid developments since the 1990's, space has become a significant sector of activity: the Space Foundation estimated the global size of the space economy in 2009 at 261.61 billion U.S. dollars.⁵⁹³ The second point is the close interrelation and mutual dependency between the different actors involved in space. Besides the obvious link between the demand and the supply side, strong relationships also

exist between the private and the public sector, as well as between the upstream and the downstream sector.

1.3.2. The commercial space sector in the crisis

Looking only at revenues in the last two years, the crisis seems to have had very little impact on the commercial space sector. Indeed, revenues in 2008 and 2009 increased in virtually all the sectors. In the upstream sector first, global satellite manufacturing revenues have grown steadily in the last couple of years despite some year-to-year variations. While a slight decrease could be observed between 2007 and 2008 (11.6 billion U.S. dollars and 10.5 billion U.S. dollars respectively), global manufacturing revenues grew again in 2009 to reach 13.5 billion U.S. dollars.⁵⁹⁴ Even the diminished results in 2008 should not be attributed to the crisis: as manufacturing cycles are long, satellites launched in 2008 were ordered many years before the crisis started.⁵⁹⁵ To reinforce this picture of a resilient sector of activity, the number of GEO commercial satellites ordered in 2009 reached 41, almost twice as many as in 2008.⁵⁹⁶ The launch sector also remained very dynamic in 2009, both in terms of the number of launches (68 in 2008 and 78 in 2009)⁵⁹⁷ and in terms of revenue (3.9 billion U.S. dollars in 2008 and 4.5 billion U.S. dollars in 2009).⁵⁹⁸ Finally, ground equipment revenue grew by 8% between 2008 and 2009. Despite this positive sign, this is a significantly lower rate than the 34% expansion recorded between 2007 and 2008.⁵⁹⁹ This is mainly due to the fact that the ground equipment market is structurally dependant on activities that were hard hit by the crisis, such as the transportation sector that uses GPS receivers. As for the downstream sector, overall satellite services revenues expanded by 11% in 2009, although at a lower rate than in 2007 (+17%) and 2008 (+16%).⁶⁰⁰ At first sight, the crisis itself doesn't seem to have a significant impact on the commercial space sector. This could be ascribed at least partially to the strong growth of innovative applications, such as High Definition TV (HDTV) and to the very resilient demand for satcom applications in certain regions of the world, such as the Middle East and India. Another trend that could be observed during the crisis was the tendency for space companies to consolidate their market positions through mergers, takeovers, alliances and restructuring. Although this is a structural feature of the space industry, the crisis may have contributed to accelerating its pace. Examples from the upstream sector include the takeover of Saab Space by RUAG in July 2008 and the acquisition of a majority stake at SSTL by EADS Astrium in January 2009.⁶⁰¹ This trend also expanded to the downstream sector, as was manifested by the merger between the two major satellite radio providers Sirius and XM in July 2008⁶⁰² and the joint venture between satellite broadband

providers EchoStar and ViaSat to launch a dedicated broadband satellite by 2012.⁶⁰³

One of the most striking features of the last two years however, has been the strong government support provided to the commercial space sector. While strong government involvement in space is a structural constant, the crisis reinforced this trend. The first factor mirroring this was the increased institutional demand for satellite procurement in 2009. Indeed, commercially procured satellites for government missions were the primary driver of growth in this sector. While the value of such satellites amounted to 5.3 billion U.S. dollars in 2008, it reached 9.8 billion U.S. dollars in 2009.⁶⁰⁴ Another way for governments to support the space industry during the crisis was the increased use of national export-credit agencies to finance industrial projects. As access to credit is one of the most crucial prerequisite for space entrepreneurs and as the crisis had a very negative impact on the availability of credit, space companies often turned to national export-credit agencies to finance their projects. In France for example, the national credit-export agency granted a loan guarantee to Gazprom Space Systems for the acquisition of two Yamal 400 satcoms to be built by Thales Alenia Space in September 2009. The U.S. Export-Import Bank implemented similar schemes for U.S. satellite manufacturers.⁶⁰⁵ Similarly, a study on the future of UK space policy, released in February 2010, recommended that the Export Credit Guarantee Department should back the country's space exports.⁶⁰⁶ As a whole, these trends seem to indicate that governments understood the strategic nature of space activities, as they backed the space sector in the crisis, both politically and financially.

1.3.3. The institutional space sector in the crisis

A first and important point to raise regarding the institutional space sector is that there is no direct correlation between the evolution of a country's GDP and the evolution of its public space expenditures.⁶⁰⁷ In Europe for example, public space budgets during the last twenty years accounted for a stable percentage of the GDP, around 0.6–0.7%.⁶⁰⁸ This fact was verified again during the crisis, as no space budget cuts could be observed despite the global recession. To the contrary, institutional space budgets continued to rise, although at a significantly different pace from country to country. Established spacefaring nations experienced moderate budget increases. The U.S. witnessed a 5% increase of its overall public spending on space between 2008 and 2009, reaching 48.794 billion U.S. dollars. The space expenditures of Japan increased by 2.17% (3.012 billion U.S. dollars in 2009) but in France the net increase was only 0.6% (2.712 billion U.S. dollars in 2009).⁶⁰⁹ In other instances, space budgets are expected to remain flat for the next

few years. ESA's budget spending for example will remain at the same levels in 2010 and 2011.⁶¹⁰ This will also be the case in Italy, although ASI's President announced that the crisis would not have any effect on the 2010 and 2011 budgets.⁶¹¹ By contrast, emerging spacefaring nations seemed even less affected by the crisis. Although it is difficult to assess the exact size of the Chinese space budget, the country pursued its ambitious space programmes throughout the crisis, unveiling its plans for a future space station, continuing its lunar exploration programme and further developing its space infrastructure. India announced in July 2009 that the 2010 ISRO budget would reach 1.04 billion U.S. dollars, which represents a 40% increase from 2009.⁶¹² The case of Russia finally, is particularly interesting: while the country was severely hit by the crisis (−5.2% GDP decrease in 2009), its space budget grew by almost 100% between 2008 and 2009, to reach 2.837 billion U.S. dollars.⁶¹³

As a whole, the positive figures of global space spending during the crisis seem to indicate a strong public willingness to commit resources to the space sector in the long run. Two additional elements reinforce this impression. The first is the growing number of countries engaging in space activities and/or setting up national space agencies. In recent years, countries as different as South Africa, Australia, Venezuela, South Korea, Turkey, Kazakhstan, Nigeria and Vietnam have started space projects or programmes. The fact that such a high number of nations, including developing countries, have decided to invest in space despite the crisis is a strong indication of the strategic nature of space. A second point concerns established spacefaring nations more specifically. Most of these countries (such as



Fig. 1: *The G20 Summit on global economic recovery and financial markets (2009)* (source: BBC.com).

the U.S., France or Russia) launched economic stimulus packages to fight the crisis and channelled some of these funds to the space sector.

Combining all the elements related to the attitude of governments towards the space sector during the crisis, such as space budget increases, parts of stimulus packages poured into the space sector, support for the industry through credit-export agencies and enhanced institutional orders, the strategic importance of space seems undoubtedly verified. At a first glance, the space sector seems to have passed the test of the crisis. By looking more closely however, it becomes obvious that most public responses during the crisis were short-term oriented (e.g. providing stimulus packages and facilitating access to credit through credit-export agencies) and mainly for the benefit of the upstream sector (e.g. the satellite manufacturers). The last point in particular, corresponds to a rather traditional understanding of the strategic character of space. According to this reasoning, safeguarding the space industrial base (both as a technological asset and as a job provider) and guaranteeing a certain degree of autonomy and independence in space asset manufacturing should constitute the core goals. While this is an important component of the strategic character of space, it doesn't seem sufficient by itself. Indeed, the crisis should also be seen as an opportunity to unleash the economic potential of space on a long-term perspective, with a particular focus on the downstream sector (space applications). The strategic nature of space also rests with the huge socio-economic potential of space applications. For this reason, it seems necessary to define more accurately the political implications of the crisis and especially what the truly strategic aspects of space activities are.

1.4. The political implications of the crisis for the space sector

A broader understanding of the strategic nature of space is laid down in all space-related European official documents. Furthermore, Europe tried during the crisis to translate this conceptual framework into concrete policy initiatives. It seems however that a real paradigm shift necessary to enjoy the full long term strategic advantages of space has yet to be implemented.

1.4.1. The strategic relevance of space

The definition of the strategic dimension of space in Europe was the result of a long and progressive policy process, which culminated in the adoption of the

European Space Policy in 2007. The starting point for this process was the increasing consciousness of decision-makers that new challenges and opportunities associated with the rise of innovative space applications had to be tackled. While Europe was quite successful in space in the commercial and scientific fields, it lacked a comprehensive space policy. The necessity to fully exploit the political, social and economic potential of space was thus recognised quite early, as demonstrated by the first communications on space issued by the European Commission (EC) in 1988, 1992 and 1996.⁶¹⁴ The 1992 Communication in particular, made that point evidently clear:

*In the earlier phase of Europe's space effort, the space agencies had an essential, almost exclusive role, since the main aim was to establish a technological and industrial capability (technology-push). Europe must now move progressively towards a demand-pull approach in order to integrate space activities into the broader socio-economic fabric of Europe. Space applications programmes should be oriented according to objectives defined outside the space sector [...]*⁶¹⁵

In sum, the strategic dimension of space for Europe consists in its effective contribution to a wide variety of policy areas. This goes beyond mere support to the “strategic industrial basis” of space activities (e.g. the upstream sector), as it also encompasses all the possibilities and potential offered by downstream services. This redefinition of the strategic nature of space in Europe has to be placed in the broader framework of a paradigm change after the end of the Cold War. While space was mostly dominated by research and science and by national security considerations during the Cold War, the emergence of innovative space applications coupled with the new perspectives offered by global political and economic liberalisation in the 1990's induced a perception change. Consequently, the political relevance of space grew, as states needed to adapt to this new environment. In general, it is not only political preoccupations that influence space programmes, such as during the Cold War, but it is also space activities that can shape policies to a certain extent. This dual and reciprocal link between space and politics constitutes the central feature of the post-Cold War period.

In this regard, the crisis could represent an opportunity to fully exploit the potential of this paradigm change. It could serve as a strong political impetus to anchor space to the broader European socio-economic framework in the long term, focusing on space applications. Indeed, space is more than a high-technology innovative domain that can be occasionally helpful to boost Europe out of a crisis. In fact, European decision-makers took several decisions towards this direction during the crisis.

1.4.2. Space in the framework of a European policy against the crisis

A series of recent official European documents acknowledge the economic potential of space along two major axes. First, space is seen as a potential contributor to the efforts to overcome the crisis (European Council of 11-12 December 2008, 6th Space Council of 29 May 2009). Second, the long-term perspective was put forward by laying down the role space can play within the Lisbon strategy⁶¹⁶ (5th Space Council of 26 September 2008, ESA Ministerial Council of 26 November 2008). The overall focus was put on the development of new markets based on space applications, mainly in the framework of the GMES and Galileo programmes.

First, the European Council of December 2008 was dedicated to setting the overall European response to the crisis. This led to the adoption of a European Economic Recovery Plan (EERP) and to a further call for launching a European innovation plan and for developing a European Research Area (ERA). Space was explicitly mentioned as a part of these initiatives.⁶¹⁷ Secondly, the 6th Space Council, which took place on 29 May 2009, focused on the concrete contribution of space to innovation, competitiveness and economic recovery.⁶¹⁸ It called again for the inclusion of space in the EERP and the Lead Market Initiative (LMI).⁶¹⁹ While these two documents focused on the concrete contribution of space to overcoming the crisis, two further important documents laid down the broader strategic framework for space activities.

The 5th Space Council, which took place on 26 September 2008, identified the contribution of space to the Lisbon strategy as one of the new priorities within the ESP. It stated that “space, as a high tech R&D domain and through the economic exploitation of its results, can contribute to reaching the Lisbon goals so as to fulfil the economic, educational, social and environmental ambitions of the EU [...] to achieve the objectives for growth and employment by providing new business opportunities and innovative solutions for various services”.⁶²⁰ The Council further highlighted that space applications in the fields of navigation, telecommunication and EO constitute substantial market opportunities, especially for Small and Medium Enterprises (SMEs), and finally it called for the inclusion of space in the Lead Market Initiative (LMI). The Resolutions adopted at the ESA Ministerial Council on 26 November 2008 were along the same lines. They highlighted the need for the European space sector to be competitive in global markets and they emphasised the central role of SMEs in this regard.⁶²¹ However, despite these important decisions, the need for a real paradigm change is still pressing.

1.4.3. The need for a real paradigm change

Two observations can be made regarding the strategic nature of space in Europe. First, the long-term benefits of space can only be fully exploited if its societal implications and economic benefits are fully and effectively taken into account within European macroeconomic policies. Second, there is still a discrepancy between the political intentions expressed in official documents and the absence of concrete measures to support them. This is why the often mentioned paradigm shift – from a technology-push towards a demand-pull approach – is yet to be translated into concrete actions. Three examples illustrate this point: the contribution of space to the EERP, to the European Plan for Innovation and to the LMI.

The inclusion of space in the EERP was supposed to occur through the initiative “factories of the future”, one of the three Public-Private Partnerships (PPP) included in the EERP and intended to support the manufacturing industry in the development of new and sustainable technologies. So far, two calls have been issued within FP7 under this title, in July 2009 and July 2010. However, space was not part of them, as the funds were devoted to nanoscience, nanotechnologies, materials and new production, and Information and Communication Technologies (ICT).⁶²² The inclusion of space in the European Plan for Innovation has also not yet materialised. The Plan is still in its policies design phase and it will not be presented before the fall of 2010. It included a vast public consultation on European innovation policies between September and December 2009, involving, among others, Member States’ Ministries, EU Associations, Private Companies, NGOs, Research Centres and Universities. Strikingly, no significant actor in the space sector contributed to this process.⁶²³ Finally, as for the LMI initiative, space was not initially selected as one of the 6 markets included in the programme. A mid-term progress report, which was published in September 2009, carefully analysed the first phase of the initiative and called for a revision of the criteria for selecting new lead market candidates.⁶²⁴ This development on the one hand suggests that the inclusion of space is not likely to occur immediately after the mid-term report, as it was initially envisaged, but on the other hand it also means that there is a window of opportunity for including space as an area to be exploited.

The strategic nature of space places it at the crossroads of several overlapping political issue-areas. To strengthen this strategic aspect of space, a strong European long-term financial and political commitment to it is necessary, which makes sense from both a structural/international and internal/European point of view. In the international perspective first, Europe has to be competitive in commercial markets, maintain strategic autonomy in key areas and remain a credible partner for international cooperation. At an internal level on the other

side, Europe has to anchor space in the long run to the socio-economic landscape, focusing on space applications. There are two key conditions that seem necessary in order to reach this goal: strong political will and consistent public support. As for the first point, there are encouraging signs: the strategic nature of space is better appreciated by decision-makers, the EU has ambitious plans to increase its space budget by a factor of 3 for the period 2014–2021⁶²⁵ and both ESA and the EU place increasing focus on applications. As for the second point, major efforts still need to be made, as it was evidenced by a recent Eurobarometer survey that showed a mixed picture regarding the support of European citizens for space activities.⁶²⁶

In conclusion, looking back at the past two years the space sector has resisted the crisis quite well. Increased public commitment was one of the key reasons for this outcome, both by supporting the commercial space sector and by continuously backing up the institutional space sector, both politically and financially. These facts seem to indicate that the space sector has passed the test of the crisis and that its strategic nature is gradually being recognised by decision-makers. However, the efforts made during the crisis to keep the space sector alive should not be considered as a one-shot initiative. The crisis should instead be considered as an opportunity to fully implement the paradigm change that emerged gradually two decades ago: that is to move from a technology-push approach towards a demand-driven perspective in order to fully exploit the long-term benefits of space applications.

⁵⁷⁵ The Paris-based Euroconsult and the U.S.-based Tauri group for example, regularly publish economic forecast reports and in-depth studies on future economic developments in space.

⁵⁷⁶ International Monetary Fund. “World Economic Outlook. Financial Stress, Downturns and Recovery”. October 2008: xvff.

⁵⁷⁷ Ibid: 2.

⁵⁷⁸ International Monetary Fund. “World Economic Outlook Update”. 8 July 2010: 2.

⁵⁷⁹ International Monetary Fund. “World Economic Outlook Update”. 8 July 2009: 1ff.

⁵⁸⁰ International Monetary Fund. “World Economic Outlook Update”. 8 July 2010: 2.

⁵⁸¹ Those were the central banks from the U.S., Great Britain, Canada, Sweden, Switzerland and the European Central Bank (ECB).

⁵⁸² International Monetary Fund. “World Economic Outlook Update”. 8 July 2009: 1.

⁵⁸³ For all the following figures: International Monetary Fund. “World Economic Outlook Update”. 8 July 2010: 2.

⁵⁸⁴ Steinbruner, John D. Preface of Pasco, Xavier. “A European Approach to Space Security”. Cambridge: American Academy of Arts and Science, 2009: viii.

⁵⁸⁵ OECD. Space 2030 Exploring the Future of Space Applications. Paris: OECD, 2004: 12.

⁵⁸⁶ Ibid: 35.

⁵⁸⁷ Pasco, Xavier. “A European Approach to Space Security”. Cambridge: American Academy of Arts and Science, 2009: 1.

⁵⁸⁸ OECD. Space 2030 Exploring the Future of Space Applications. Paris: OECD, 2004: 12.

⁵⁸⁹ For the specific definitional problems of space economy, see: OECD. The Space Economy at a Glance 2007. Paris: OECD, 2007: 16ff.

- ⁵⁹⁰ OECD. *The Space Economy at a Glance 2007*. Paris: OECD, 2007: 17.
- ⁵⁹¹ OECD. *Space 2030 Tackling Society's Challenges*. Paris: OECD, 2005: 11.
- ⁵⁹² *Ibid.*: 112.
- ⁵⁹³ Space Foundation. *The Space Report 2010*. Colorado Springs: Space Foundation, 2010: 30.
- ⁵⁹⁴ SIA/Futron. "State of the Satellite Industry Report". June 2010. 22 Sept. 2010. [http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport\(Final\).pdf](http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport(Final).pdf).
- ⁵⁹⁵ It should be noted that manufacturing revenues for a given year correspond to the value of the satellites launched during that year, not to the value of satellites ordered during the year.
- ⁵⁹⁶ SIA/Futron. "State of the Satellite Industry Report". June 2010. 22 Sept. 2010. [http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport\(Final\).pdf](http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport(Final).pdf).
- ⁵⁹⁷ Federal Aviation Administration. *Commercial Space Transportation: 2009 Year in Review*. Washington DC: FAA, Jan. 2010. 22 Sept. 2010. http://www.faa.gov/about/office_org/headquarters_offices/ast/media/year_in_review_2009.pdf.
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- ⁵⁹⁹ *Ibid.*
- ⁶⁰⁰ *Ibid.*
- ⁶⁰¹ Rathgeber, Wolfgang. "Space Policies Issues and Trends 2008/2009". 18 May 2009. ESPI Report 18. 29 Sept. 2010. <http://www.espi.or.at/images/stories/dokumente/studies/espi%20report%2018.pdf>: 65f.
- ⁶⁰² *Ibid.*: 18.
- ⁶⁰³ Pagkratis, Spyros. "Space Policies Issues and Trends 2009/2010". June 2010. ESPI Report 23. 29 Sept. 2010. http://www.espi.or.at/images/stories/dokumente/studies/espi%20report%2023_1.pdf: 24.
- ⁶⁰⁴ SIA/Futron. "State of the Satellite Industry Report". June 2010. 22 Sept. 2010. [http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport\(Final\).pdf](http://www.sia.org/news_events/pressreleases/2010StateofSatelliteIndustryReport(Final).pdf).
- ⁶⁰⁵ De Selding, Peter B. "National Export-Credit Agencies Stepping up Satellite Financing". *Space News* 14 Sept. 2009: 10.
- ⁶⁰⁶ De Selding, Peter B. "Panel Urges Britain To Boost Space Spending, Support Exports". *Space News* 15 Feb. 2010: 15.
- ⁶⁰⁷ This means that a GDP rise will not automatically lead to an increase in public space spending, the same logic being valid for a GDP decrease. However, it is obvious that a high GDP growth rate constitutes a positive framework condition for ambitious space programmes.
- ⁶⁰⁸ Peeters, Walter. "Forecasting the Consequences of the 'Crash of 2008' on Space Activities". *Yearbook on Space Policy 2008/2009: Setting New Trends*. Eds. Kai-Uwe Schrogl, Wolfgang Rathgeber, Blandina Baranes and Christophe Venet. Vienna: SpringerWienNewYork, 2010: 167.
- ⁶⁰⁹ The previous figures are based on Euroconsult data.
- ⁶¹⁰ Pagkratis, Spyros. "Space Policies Issues and Trends 2009/2010". June 2010. ESPI Report 23. 29 Sept. 2010. http://www.espi.or.at/images/stories/dokumente/studies/espi%20report%2023_1.pdf: 33.
- ⁶¹¹ De Selding, Peter B. "Italian Space Agency Expects Budget to Remain Flat for 2010". *Space News* 18 Jan. 2010: 6.
- ⁶¹² Pagkratis, Spyros. "Space Policies Issues and Trends 2009/2010". June 2010. ESPI Report 23. 29 Sept. 2010. http://www.espi.or.at/images/stories/dokumente/studies/espi%20report%2023_1.pdf: 52.
- ⁶¹³ Figure based on Euroconsult data.
- ⁶¹⁴ Commission of the European Communities. *Communication. The Community and Space: A Coherent Approach*. COM (88) 417 final of 26 July 1988. Commission of the European Communities. *Communication. The European Community and Space: Challenges, Opportunities and New Actions*. COM (92) 360 final of 23 Sept. 1992. Commission of the European Communities. *Communication. The European Union and Space: Fostering Applications, Markets and Industrial Competitiveness*. COM (96) 617 final of 4 Dec. 1996.

⁶¹⁵ Commission of the European Communities. Communication. The European Community and Space: Challenges, Opportunities and New Actions. COM (92) 360 final of 23 Sept. 1992.

⁶¹⁶ The Lisbon strategy is an ambitious agenda for reform launched by the European Council in 2000. Its overarching goal is to make Europe the most competitive and dynamic knowledge-based economy in the world. It was replaced by the “Strategy 2020” at the beginning of 2010.

⁶¹⁷ Council of the European Union. Brussels European Council. 11 and 12 December 2008. Presidency Conclusions. Doc. 17271/1/08 of 13 February 2009. Brussels: European Union.

⁶¹⁸ Council of the European Union. Council Resolution. The Contribution of Space to Innovation and Competitiveness in the Context of the European Economic Recovery Plan and Further Steps. Doc. 10500/09 of 29 May 2009. Brussels: European Union.

⁶¹⁹ The LMI was launched with a Communication from the European Commission from 9 January 2008. It aims at entering fast growing worldwide markets with a competitive advantage. Six promising emerging markets were identified in the first instance, excluding space.

⁶²⁰ Council of the European Union. Council Resolution Taking Forward the European Space Policy. Doc. 13569/08 of 29 September 2008. Brussels: European Union.

⁶²¹ ESA. Resolution on the Role of Space Delivering Europe’s Global Objective. Doc. ESA/C-M/CCVI/Res.1 (final) of 26 November 2008. Paris: ESA.

⁶²² Call title “Factories of the Future”- 2010. FP7-2010-NMP-ICT-FoF. Published on 30 July 2009. Call title “Factories of the Future”- 2011. FP7-2011-NMP-ICT-FoF. Published on 20 July 2010.

⁶²³ For an overview of the consultation process and its results, see the dedicated page on the DG Enterprise and Industry website: http://ec.europa.eu/enterprise/policies/innovation/future-policy/consultation/results_en.htm.

⁶²⁴ Commission of the European Communities. Commission Staff Working Document. Lead Market Initiative for Europe. Mid-term Progress Report. SEC (2009) 1198 final of 9 September 2009. Brussels: European Union.

⁶²⁵ Pagkratis, Spyros. “Space Policies Issues and Trends 2009/2010”. June 2010. ESPI Report 23. 29 Sept. 2010. http://www.espi.or.at/images/stories/dokumente/studies/espi%20report%2023_1.pdf: 34.

⁶²⁶ Commission of the European Communities. Flash Eurobarometer #272. Space Activities of the European Union. Analytical Report. October 2009. Brussels: European Union.