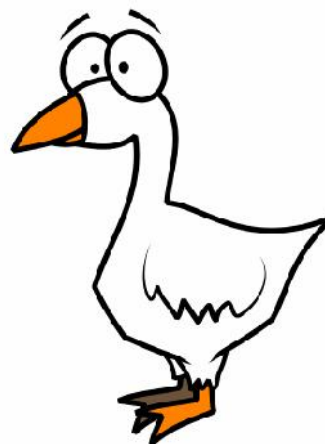
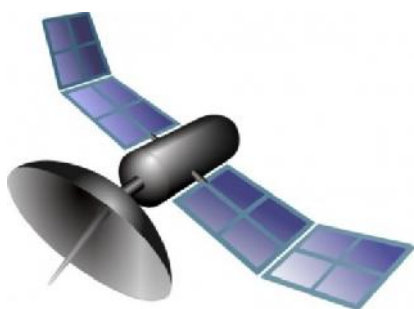


# ABOUT GMES AND DATA : GEESE AND GOLDEN EGGS

**A Study on the Economic Benefits of a Free and Open Data Policy for Sentinel Satellite Data**

**Final Report**



**by Geoff Sawyer and Marc de Vries**  
*Under an assignment from the European Space Agency*

EUROPEAN ASSOCIATION OF REMOTE SENSING COMPANIES  
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## FOREWORD

### *The context and challenge*

The Global Monitoring for Environment and Security (GMES) Programme<sup>1</sup>, with consequent investment by the European Union (EU) and Member States of the European Space Agency (ESA), holds the potential to deliver significant economic benefits to Europe's fledgling Earth Observation (EO) services industry and societal benefits to all European citizens. However, differing views of Member States as to the funding approach not only puts significant pressures on the overall budget, it also impacts the data policy and associated business model to be adopted: should governments seek to recover costs of production and processing of EO data by charging re-users, yielding direct returns, or should these costs be covered from the general budget, seeking longer term benefits. Put differently, GMES may well be Europe's goose capable of laying golden eggs. But how can we ensure a steady sustainable business model: do we take one egg (direct returns from sales of data) or do we allow the egg to hatch, hoping more golden-egg-laying geese will follow?

### *The business model paradigm is shifting*

Where in the last two decades of the previous century, public sector bodies (PSBs) were being encouraged to partly self-finance their operations, governments are now increasingly starting to recognise that charging for the re-use of public sector information (PSI) through a cost-recovery model does not necessarily lead to the best economic returns. In fact, a nucleus of evidence is building up that making PSI available at zero or marginal cost can generate significant benefits, enabling innovation, new business and job creation in the private sector, and increased efficiency in the public sector.

### *The need for sector-specific evidence*

Interestingly, this evidence is being generated in more 'traditional PSI domains' such as the meteorological and hydrographical sectors and the geographical domain, as well as in the fields of business registers, and statistical and legal information. However, despite its widely recognized potentially high returns, no such research has been carried out so far within the GMES sector. Obviously, facing the policy challenges and the crossroad concerning the data re-use funding model, such evidence would be of great value to policy makers and stakeholders, allowing them to take appropriate measures.

### *The value delivered for the GMES domain*

Accordingly, this study addresses this need. It describes the dilemmas faced and provides a theoretical economic analysis as well as a comprehensive overview of quantitative empirical research on the economic effects of re-use charging policies for PSI. Subsequently, it transposes those findings into the GMES domain, assessing the impacts it may have and establishing an objective framework of reference for fact-based decision making.

### *The authors*

The work on this study has been carried out by Geoff Sawyer and Marc de Vries. Geoff has a strong background in space technology (engineering) and is the Secretary General of EARSC with significant experience in the exploitation of EO geo-information services and influencing policies. Marc is a consultant, with a background in law and economics, who has been working in the field of re-use of PSI for over 15 years, for governments across Europe and with various European institutions.

Obviously, the views in this report represent those of the authors.

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<sup>1</sup> Note that the name of the programme GMES has recently been replaced by the name Copernicus.

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## EXECUTIVE SUMMARY

*In the 1980s and '90s privatisation became a popular policy and treasuries looking for all possible ways to raise funds found that they were sitting on a pile of golden eggs. Data and information collected by public bodies in the course of their duties could be sold to help subsidise their costs. In this way, treasuries could reduce public subventions and in effect raise money. Just as the owner of the goose that laid the golden eggs became greedy for more so did the public owners of data, becoming fixated on selling it to earn revenues.*

*Recent studies show that this policy, far from creating more golden eggs, is in effect, as in the fairy tale, destroying them. Public sector bodies (PSBs) that sell their data discourage innovation and creativity, inhibit the creation of new businesses and generally earn less for the government than if they were to give the data away for free. Indeed, those PSBs that do give their data away create more overall income for treasuries through increased business and employment taxes. The PSB goose really can lay golden eggs.*

*Our study is to examine this policy in the context of GMES. The European Commission has been working with the European Space Agency (ESA) to establish a system of satellites – the Sentinels – to provide Earth Observation (EO) imagery from around the world. This data will be used to provide information services in support of public policy notably for the environment and security. Hence the acronym GMES – Global Monitoring for Environment and Security.*

*For a long time it was assumed that the data delivered from GMES would be free to public policymakers but not for other users. Increasingly, a number of stakeholders, most notably ESA, have argued that it would be more effective to offer this data free of charge to all users. EARSC supports this policy as offering the best way to help the emergent EO services industry to develop and indeed to establish itself as a world leader.*

*Since many governments, especially at the European level, favour the move to free and open policies for all types of government-collected data, it would seem logical to apply this policy to GMES data. In this study we start to bring together the arguments and ideas from the work on PSI re-use and the issues and needs for exploiting GMES. No links have been made between the world of EO data and services and the wider world of PSI re-use. It is time to bring them together.*

*We start the study by looking at the theoretical perspective of how the re-use of PSI is best financed through general taxation from the State budget, as opposed to charging the users. This is because of the peculiar economic characteristics surrounding PSI (PSI-conomics), as it is fundamentally different from classic physical goods produced by companies.*

*We continue by examining the characteristics of the data and information that will be generated from GMES before contrasting this with other domains in which PSI is generated. Here we look at cadastral and cartographic information and data and meteorological services, which indeed are closest to the world of GMES. We find a number of areas where hard evidence is available on achieved benefits coming from a change of pricing policy: from cost recovery to marginal or zero cost.*

*Indeed, empirical research in various PSI domains seems to confirm the theoretical assumptions reflected in chapter 2. Briefly put, the benefits largely outweigh the costs (and lost incomes of the PSBs): private sector activities increase, leading to economic growth, more employment and better services, due to market dynamism. The additional tax returns make up for the extra costs and incomes foregone by the PSBs. The only issue is that these macro returns only kick in later, requiring transitory financing arrangements.*

*Our model for the transition and subsequent benefits is then applied to GMES but only after we have looked for evidence coming from the EO domain. The best example here is the US Landsat satellite system that over its 40 years of existence has changed charging policy several times; most recently in 2008, when it moved to a free and open policy. The increase in data use was dramatic with over 100 times more data downloaded in 2011 than in 2007, a result which corresponds with the results in several of the classical PSI domains mentioned above.*

*The lessons learned lead us to draw a number of conclusions and make several recommendations to policy makers on action to be taken. Collectively, these will improve the commercial environment and enable the EO services industry to grow; hence contributing to much-needed, economic growth in Europe.*

*We conclude by showing that evidence coming from the other domains does support the argument that free re-use of GMES data will offer better exploitation potential. Bringing together these two different policy areas, both being led from Brussels, strongly supports the stakeholders' views. A free and open data policy may finally be seen as "the goose that lays golden eggs".*

# 1 GMES AND OPEN DATA – STATING THE CASE AND INTRODUCTORY REMARKS

## 1.1 GMES: a growth enabler

### *Not a goose but laying the basis for future growth*

Global Monitoring for Environment and Security (GMES) is a publically funded programme with the goal to ensure that European policy makers have access to globally derived geo-information products necessary to inform policy decisions. At its heart are a number of Earth Observation (EO) satellites (Sentinels) that provide data which can be turned into information used to inform on environment and climate change, emergency management, natural resource management, security of the citizen and many other public tasks.

As the European Commission has noted: *“At a time when command and appropriate use of information has important geo-strategic implications, Europe needs to have available a capacity which allows it independently to evaluate its policy responses in a reliable and timely manner. A comprehensive Earth observing system, using space-borne and in situ techniques (land, air and sea) through well defined, operational services, is key to ensuring the implementation and monitoring of environmental and security policies in the context of sustainable development.”*<sup>2</sup>

But the information generated by the GMES system, and especially the EO data, will be valuable not just for the European public sector but also for many industries and public organisations outside of Europe that require spatial geo-information. Hence, a free and open data policy also has the potential to stimulate the European EO services industry and help it develop into a global leader.

### *Killing the goose*

Nevertheless, this view is not shared by everyone, with some proposing that the commercial sector be charged for data and information. A similar cost-recovery model policy was first advanced in the 1970s and '80s by treasuries as a means to recover costs incurred in the collection of information by some government bodies, e.g. meteorological agencies, cadastral authorities. As a result, this information has been sold at often rather high prices to a limited number of users.

Recently, this policy is under challenge and, in some countries, has been at least partially changed. Evidence is growing that by making the data freely available, greater economic benefit can be realised. Companies downloading the information are able to innovate, generating new products and services, hence leading to wealth creation. Those following the alternative cost-recovery model are in fact killing the goose that can lay golden eggs.

### *GMES and Earth Observation (EO)*

Throughout the report we refer to GMES and to EO. In this context we use the term GMES where it applies directly to the programme of that name. It may also be used to refer to the overall system that will result. Earth observation or EO is a more general term and consequently is used to refer to the wider activities associated with satellites, products and services that are not themselves covered by GMES.

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<sup>2</sup> SEC (2005) 1432, Global Monitoring for Environment and Security (GMES): From Concept to Reality; Communication from the Commission to the Council and European Parliament.



## 1.2 PSI re-use and Open Data basics

### *PSI Directive acknowledges PSI as a driver of economic growth*

Carrying out its public tasks, the public sector collects, creates, produces and disseminates a wide variety of information, such as legal and administrative information, business and economic data, or geographic and meteorological information. With the advent of the digital age in the 1990s, people started to recognize that quite often this public sector information (PSI) has a ‘second value’, where it constitutes a valuable raw material that can be re-used by third parties in added-value information products and services.

Against this background the PSI Directive was adopted in 2003, seeking to stimulate further the development of a European market for PSI-based services, to fortify competition in the internal market and to address divergence as to re-use rules between Member States. In essence, the Directive imposes obligations on Member States’ public sector bodies (PSBs) once they decide to allow re-use of their PSI and provides corresponding rights to re-users thereof. These obligations include transparency of conditions of re-use and tariffs and requirements to apply equal conditions to comparable types of re-use, including their own commercial re-use and a ban on exclusive agreements.

### *Second generation PSI re-use rule underway*

After a fairly slow start, the Directive – most prominently represented by the fast growing ‘Open Data community’ – became increasingly popular, and in December 2011, EU Commissioner Ms Neelie Kroes launched a proposal to update the Directive in order to align it with the revolution in technologies we have been witnessing. Briefly put, the new proposal tightens the obligations of PSBs, particularly on the issue of fair pricing and transparency. The European Parliament and the Council are now reviewing the proposal in a co-decision procedure. Assuming that the proposal will be adopted in the spring of 2013, Member States will have a transposition period of 18 months, meaning that the new rules will have to be complied with by 2015.<sup>3</sup>

## 1.3 What data will be available?

### *Characteristics of the GMES value chain*

The system that is being constructed under the GMES programme will generate several different types of data. The value chain for EO geo-information services at its simplest level is shown in Figure 1-1, where satellite imagery is downloaded by a ground station and made available to value-added processing organisations. The satellite data is processed into information products through a process of value-added (sometimes referred to as downstream processing), which normally involves assimilation with other datasets (other satellite imagery or ground-based in situ data), before being made available to users. In the case of GMES, the users are primarily in the public sector.

Therefore, in this value chain, we have essentially three different types of data: satellite imagery, in situ data, and processed information, collectively referred to as GMES data and information.

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<sup>3</sup> For those seeking more details on the 2003 PSI Directive and the 2011 proposal, [Annex 3](#) holds snapshots of both.

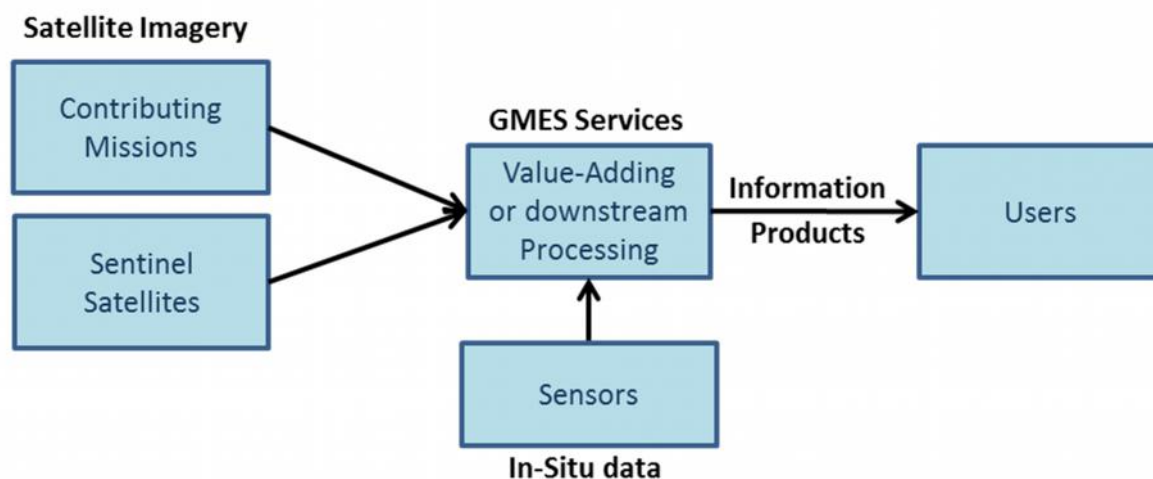


Figure 1-1: GMES value chain

In this chain, data from satellites or from in situ measurements are processed into information by a value-adding process. This information is specific to the GMES services mentioned earlier.

#### a) *Satellite imagery*

The satellite data to be used for GMES comes primarily from the Sentinel satellites being developed by ESA. They are satellites funded and operated by the public sector. However, data from other satellites (nominated as contributing missions) will also be used.

**Sentinels** provide medium and low resolution imagery (10m or greater), which in itself has a low commercial value. The satellites are designed to give regular, moderate resolution imagery of a large part of the Earth’s surface. The major use is for public tasks since the sensors measure parameters that have more interest for science and long-term climate monitoring. The data has characteristics suited to specific uses, i.e. atmosphere, ocean and land monitoring. Combining data in time series and with other observations can greatly increase its value.

GMES Sentinel data is fully paid for and owned by the public sector and hence is a core PSI.

**Contributing missions** will mainly provide high resolution optical or radar imagery (generally better than 5m)<sup>4</sup>. They are mainly owned and operated by private companies (commercial operators), acknowledging that the private investment has often been made alongside some government investment. The imagery is higher in resolution than that produced by the Sentinels (i.e. around 1m in the cases of Pleiades, Cosmo, TerraSar-X and around 5m in the case of RapidEye, DMCI). The data has characteristics best suited to emergency management and surveillance activities.

Contributing mission data is owned by the satellite owners and licensed to the public sector. As such the degree to which this data may be PSI will depend on shared rights determined by the terms of the licensing conditions.

#### b) *In situ data*

This is data collected by PSBs (agencies) generally in pursuit of their public task. It comes from ground-based, ocean-based and atmospheric sensors and will be used with the satellite imagery to improve accuracy and validate the final information products. In some cases, the in situ data may

<sup>4</sup> Note: we are generally using 5m as the boundary between low/medium resolution imagery and high resolution. We are not distinguishing between high and very high resolution as is the case in many studies as it does not bear relevance. The highest resolution GMES Sentinel data is 10m.

belong to specific end users (e.g. an NGO in the case of emergency situations) and may or may not be shared with others. Where the data is from a PSB then we presume it will be classified as PSI and hence should be made available for re-use.

#### *c) Processed information*

Processed information is that which shall be made available through the GMES services. Clearly it is derived from combinations of satellite imagery and in situ data. The GMES services will be paid for by the public sector out of an EU budget; it fits the criteria to qualify as PSI.

The parallel with PSI re-use is evident: EO data (coming from satellites) and the information (coming from processing the satellite data in combination with other data) being produced under the public task can also be used for other purposes, providing a wealth of material to be exploited in new domains. It will likely be a strong lever to help develop a European services industry, competitive on a global stage. Put differently: GMES will produce high-end PSI.

#### *Clearance of rights essential*

But what about the contributing missions? The mere act of (investing in) collecting and adding value to GMES data creates intellectual property rights (IPRs), in particular copyrights and database rights. Obviously, where appropriate, free-flow and re-use of GMES data will require clearance of these IPRs. Where these rights pertain to European PSBs (like ESA or the EC or even Member States' PSBs), re-use can simply be allowed by waiving or not exercising these rights. However, where the IPRs are held by private sector parties or individual countries, clearance of these rights will be needed to allow re-users to legitimately re-use the data, incorporating them in to services and products.

The EO data coming from contributing missions will be procured under licence, negotiated by the EC, leaving certain rights with the satellite operators, regardless of whether they are commercial companies or nation states. The extent of the residual rights depends entirely on what is negotiated with their owners, which depends in turn on the nature of payment – whether in cash or in kind. If in kind, this may be by negotiating reciprocal rights to a third party's mission. If in cash, as in a commercial transaction, the extent of the rights will depend on the amount paid. Ideally, the contract would give the EC rights that are equivalent to the GMES Sentinel data – which would mean free to everyone. Clearly, a commercial company will need a large contract to offer such a licence since they preclude significant third-party sales. Hence, the precise rights to be negotiated will depend on commercial evaluation and on the budget available.

### **1.4 The PSI re-use financing dilemma**

#### *PSI re-use = second use*

As mentioned, PSI re-use is capturing the hearts and minds of policy makers across Europe. Increasingly, they recognize that information produced within the context of the public task, often has a 'second' value: a re-use value. This re-use value is to be cashed in by re-users: mostly businesses and increasingly non-commercial users, Open Data activists in particular, who seek to avail themselves of this rich resource, creating new products and services.<sup>5</sup>

#### *Charging for re-use: two camps*

One of the central themes within the discussions taking place concerns the effects of charging for re-use by the PSBs holding the PSI.

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<sup>5</sup> Throughout this study numerous key terms are used. Grasping their exact meaning from the outset is essential. [Annex 2](#) therefore holds a list addressing these semantic issues.

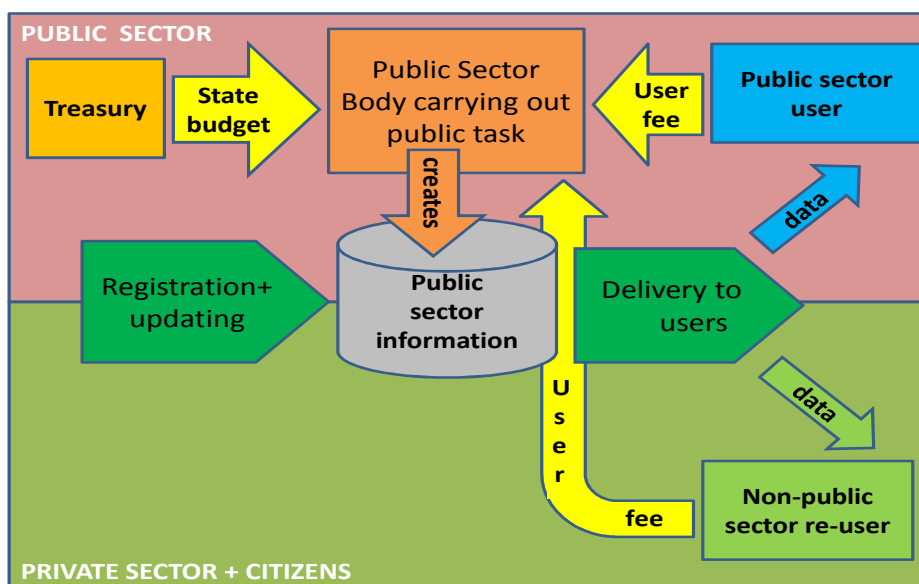


Figure 1-2: The two financing options: user fee or State budget financing through the treasury

Figure 1-2 captures this picture. Briefly, there are essentially two (non-exclusive) options available.<sup>6</sup>

*(1) the data holder charges the user*

In this option the data holder relies on charging users of the data. This means that the data holder determines a price, or a range of prices, for the various quantities and formats of data delivered. Such prices can differ between types of users, particularly if there are users from the public sector using the PSI within the context of the public task.<sup>7</sup> Parties outside the government seeking to re-use the data, however, are often charged, exceeding the marginal costs for distribution (= cost-recovery pricing). Regardless of the user (public or private), this financing model hooks on to output of the data holder, allocating the costs over those who need or want to avail themselves of the data (either under a public task obligation or for re-use in their business processes).

*(2) the data holder is paid from the State budget*

Here, the option is to facilitate direct financing from the State budget. As such there is no direct relation between the budget and the input and output of the data holder, but rather on a regular (yearly) assessment of cash required to run the operation. The costs are not passed on to the entities registering or updating registrations or to the users of the data, but are divided among all taxpayers. No charge is imposed for the use or re-use of the data – neither on public users nor on private sector re-users.

These two options correspond with two opposing views. On the one hand there is a growing crowd, often referred to as the ‘Open Data movement’, advocating that society will gain maximum benefit if companies are given free and open re-use rights to data. They argue that such re-use policy will lead to maximum economic benefit, as this will provide incentives at the least cost and the maximum opportunity to develop new markets, whereby the increased tax returns and efficiency will outweigh

<sup>6</sup> For some categories of PSI there is a third option: charging for the registration and/or updating. Many business registrations (also) rely on this income stream, charging new companies for registration and charging yearly fees for an extension of the registration. Accordingly, such PSBs face a trilemma rather than a dilemma.

<sup>7</sup> Increasingly, it is recognized that internal charging within the government does not make much sense. In the context of this study, we will not further discuss this option.

the losses incurred by dropping user charges. On the other hand, there are those who favour cost-recovery models whereby the PSB is allowed to charge for re-use of its PSI, turning it into an income-generating source, decreasing the general tax burden, passing costs on to those who use the data. They also question the sustainability of a scheme providing PSI at no cost or marginal prices when the costs of creating and maintaining quality PSI can be substantial (requiring additional public funding).

#### *Charging options represent an economic dilemma*

So in essence, the economic dilemma is how to finance operations: by charging users or by recovering the costs from the general State budget? The good thing about this dilemma is that, to a large extent, the decision can be largely based on economic laws and facts and figures, where the yardstick should be: will the economic effects (costs and benefits) of charging marginal or zero costs for re-use of data outweigh the economic effects (costs and benefits) of cost-recovery models.

#### *Current EU rules allow for cost recovery, but favour marginal cost pricing*

At present, although fostering marginal or zero cost pricing regimes for PSI re-use, the European regulatory framework – through article 6 of the PSI Directive – gives PSBs the right to charge for the re-use of their PSI, thereby generating an income that should not exceed the cost of collection, production, reproduction and dissemination, together with a reasonable return on investment. The more general competition law framework under the Treaty on the Functioning of the European Union (TFEU) appears not to limit this position further (with the exception that a PSB's charging conduct could be regarded as a clear abuse of a position of dominance).

#### *Relevance for EO data high*

Earth Observation (EO) data is potentially a highly rewarding PSI domain. Obviously, the dilemma also emerges in this domain, particularly in the context of on-going discussions between Member States in the GMES Programme. Differing views of Member States as to the funding approach not only puts significant pressure on the overall budget, but it also impacts the data policy and associated business model to be adopted. We shall deal with this further in chapter 4.

### **1.5 The evidence in other PSI domains is building up**

#### *Surge in PSI re-use research*

Research into economic effects of charging by PSBs for re-use of their data has recently enjoyed a surge in popularity. Where previously only a few authors were concerned with this issue, over the last few years a steady stream of reports and studies has sprung from the academic world, policy makers and re-users.

Where most of these studies conclude that there is a clear business case for zero or marginal charging, there is also a growing body of evidence which strongly suggests that taking away such barriers for re-use has beneficial impacts not only on the downstream market (i.e. on economic growth, employment and innovation), but also in the public sector itself, due to observed increases in efficiency and effectiveness.

### **1.6 However, the EO domain remains fairly *terra incognita***

#### *Evidence in the relevant domain is lacking*

Previous studies have not made the link between GMES and the case for free and open data and as a result there is little evidence in the EO domain to support the case. The strongest evidence comes from the US Landsat programme that has made the transition from a cost-recovery model in the 1980s and '90s to a free data policy that was only fully implemented in 2008. This change in policy provides some evidence, which we shall examine in chapter 4, but no real market data yet exists on which to base concrete, financial analysis.

This has not prevented several stakeholders from making the argument in support of a free and open data policy. The ESA Council first proposed this in 2010, and during 2011, EARSC published three position papers on the subject of GMES: (1) *Exploiting GMES Operational Services* (March 2011), (2) *The Threat to GMES* (July 2011) and (3) *GMES Data and Information Policy* (October 2011) providing the EO services industry perspective and examining the conditions whereby the private sector – downstream services industries – could deliver further returns, over and above the public sector economic benefits, on the public investments.

In other words, there is action on the ground suggesting that, in the field of GMES, there is a business case supporting low or zero cost re-use models. However, so far, no focused in-depth research has been carried out. This study seeks to make a first and important step in addressing this gap.

This being said, it is important to note that in this study we are not trying to bring evidence to justify the GMES programme on socio-economic grounds. This has been covered in previous work:

- PricewaterhouseCoopers report for ESA on the socio-economic benefits analysis of GMES published in 2006<sup>8</sup>.
- Booz & Co report for the EC on cost-benefit analysis for GMES published in September 2011<sup>9</sup>
- The socio-economic benefits of GMES<sup>10</sup> published by the European Space Policy Institute.
- In addition, the Ecorys report<sup>11</sup> on the competitiveness of the downstream sector (2008) – heavily relying on earlier studies made by Vega<sup>12, 13</sup> and Euroconsult<sup>14</sup> – came up with some data policy considerations.

This work collectively provides overwhelming evidence of the value that GMES can deliver for the public sector. The goal of our work goes beyond this to the additional value that may be created in the private sector. Furthermore, whilst our primary objective is to look at the potential value in the data / imagery coming from the GMES Sentinels, much of the logic will also apply to the information generated by the GMES Services.

## 1.7 Europe's returns could be high

### *Opportunity knocks?*

The GMES programme, born at Baveno in 1998 as a means to develop and sustain European capacity in the provision of satellite-derived information for the environment and security, now plans to launch its first dedicated satellites (the Sentinels) in 2013. The system is expected to be fully operational by 2016. With so much value captured in the massive amount of data to be collected, there is an urgent need for an appropriate data policy that supports not only the GMES objectives, but also looks at the potential economic side benefits (positive externalities) that will result from taking the right decisions, when addressing the policy dilemma referred to above.

Clearly, Europe's fledgling EO services industry has a leading role to play in the exploitation of the public investment through selling services built upon GMES data and information. Earth Observation is inherently global in nature and hence there is strong potential for exploitation through exports as

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<sup>8</sup> Socio-economic benefits of GMES, PricewaterhouseCoopers, October 2006.

<sup>9</sup> Cost-benefit analysis of GMES, Booz & Co, September 2011.

<sup>10</sup> The socio-economic benefits of GMES, Giannopapa, European Space Policy Institute, November 2011.

<sup>11</sup> Study on the Competitiveness of the GMES Downstream Sector, Entr.06.054; Ecorys, November 2008.

<sup>12</sup> The State and Health of the European and Canadian EO Service Industry; Vega and Booz Allen & Hamilton, 2004.

<sup>13</sup> The State and Health of the European and Canadian EO Services Industry in 2006; Vega, 2008.

<sup>14</sup> Assessment of the Downstream, Value-Adding Sectors of Space-Based Applications; Euroconsult 2007.

well as new customers in Europe. In line with the Lisbon treaty, information services can provide strong possibilities for growth and economic benefit. Giving the industry free and open access to GMES data and information should be the most effective way to realise this potential. So setting the appropriate policies, not just for GMES but in areas where geo-information provides for the implementation of policy decisions (for example agriculture), is key if the potential is to be realised.

#### *Timing is perfect*

This is an excellent moment to demonstrate the benefits that can be gained from a free and open data policy for GMES Sentinels. The question of GMES financing is on the table and will be decided in the next few months – most likely in early 2013. Many companies are looking forward to the satellite data becoming available after the first Sentinel is launched next year and can be encouraged to commit resources by a strong message. In addition, the EC is currently preparing its data policy proposals for approval in the next few months.

Furthermore, addressing this issue is in perfect harmony with the EC's recently launched action to amend the 2003 PSI Directive<sup>15</sup>, which, as a rule, will likely impose a maximum charging level (marginal costs for distribution only). This proposal for a new PSI Directive is now being discussed in the Council and Parliament, and results are expected in the fall of this year. (For those not quite familiar with the legal framework on PSI re-use, snapshots of the current PSI Directive and the proposal for a new directive are attached as [Annex 3.](#))

## **1.8 Aims, build up, process, outcome, contributors and dissemination**

#### *Clear objectives, clear target groups*

In this context and against this dynamic background, this study aims to provide evidence of the potential benefits of a free and open data policy, allowing policy makers at the European and national levels to take well-founded and sound decisions on re-use policies, based on transparent, objective and economic criteria.

Thus, the study:

- provides a theoretical economic analysis of the economic laws surrounding PSI re-use: 'PSI-economics' (chapter 2), and
- gives a comprehensive overview of existing evidence in other (non-GMES) PSI domains: quantitative empirical research on the economic effects of re-use charging policies for PSI (chapter 3), then, to the extent possible,
- transposes those findings into the GMES domain, assessing the impacts it may have and establishing an objective framework of reference for fact-based decision making (chapter 4), and finally,
- concludes with a set of coherent recommendations (chapter 5).

#### *Appropriate level of stakeholder input and quality control*

Maximizing the practical value of this study, we have sought constant interaction with stakeholders. This included presentations of the contours and first findings of the study during the EARSC Annual Meeting in Brussels on 6 July 2012. Subsequently, regular sharing of interim results has taken place in close collaboration with ESA: progress meetings were held in Brussels (2<sup>nd</sup> August 2012) and Rome (13<sup>th</sup> September 2012). Then an Expert Workshop was held in Brussels on 7<sup>th</sup> November 2012, hosted by the European Commission DG Enterprise, with experts invited from around Europe.

A list of all persons that contributed to the study is attached as [Annex 6.](#)

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<sup>15</sup> Directive 2003/98/EC of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information, OJ L 345, pp. 90–96.

## 2 THEORETICAL FRAMEWORK – THE LAWS OF PSICONOMICS

### 2.1 Introduction

In the previous chapter we have seen that there are basically two options to finance PSI re-use: (1) charging the users of the data and (2) using taxpayers' money from the State budget. In the following paragraphs we shall seek *economic* points of reference to decide on what to base the decision. Accordingly, these points of reference centre the underlying assumptions of economic theory: productive resources are scarce and have alternative uses, forcing economic actors (consumers, companies and governments) to choose between these alternatives in a rational manner to maximise benefits.

### 2.2 PSI characteristics

#### *Old school economics does not apply*

PSI is an information “good”, a non-physical, electronic “good” produced by the public sector and consumed both within and outside the public sector. These features cause ‘classic’ economic laws to work very differently, in comparison with a physical product produced and sold by a company. The differences in the economic ‘behaviour’ of PSI are caused by two fundamental characteristics: non-rivalry and non-excludability.

#### *PSI is non-rivalrous and non-excludable*

PSI is non-rivalrous, meaning that it can be consumed by one person without detracting from the consumption benefit enjoyed by any other consumer. In other words, use of PSI by one is not to the detriment of the others. Furthermore, information products are, in principle, non-excludable: it is difficult to include one user while excluding others. Where providers of information try to do so, they tend to rely on limiting access, exercising their intellectual property rights and charging. Obviously, this comes at a cost, since information, by its very nature, seeks to be disseminated. Preventing and controlling this dissemination will consume economic resources.

If a good is non-rivalrous and non-excludable, the private sector is unlikely to produce it in adequate amounts. Herein lies the rationalization for public provision of these goods, especially where they also have recognized social value and positive externalities. Public broadcasting, national defence, and lighthouses are perfect examples of such public goods.

#### *Implications for financing options*

Justification for charging of public goods is usually based on the so-called benefit principle: public services are charged for in a way that those who benefit (more) pay (more). This principle encourages those who benefit to appreciate that there are resource costs involved and it decreases the taxation burden on those who do not benefit (like levying charges for acquiring building permits and passports). It takes the detrimental effects into the equation: some users lose out as they do not want to pay the price. So in essence the dilemma is – as addressed in chapter 1 – what is more important: equity considerations, which require the beneficiary to pay, or efficiency considerations, where all those taxed pay and where the under-utilization of the service needs to be weighed against the distortions associated with general taxation. These characteristics have significant implications when considering the financing model.



## 2.3 Economic implications

### *The invisible hand does not work*

In economic theory the allocation role of prices requires that they be set equal to marginal cost to achieve economic efficiency: a producer of a good will continue to increase production as long as the increase in returns exceeds the costs for producing an extra unit. Accordingly, prices move to the level where they equal the marginal costs and maximize the efficiency.

Interestingly, a key feature of electronic information goods in the internet age is that for any level of production, the cost of providing it to an additional consumer – the marginal production costs – is (close to) zero. This implies that charging for them is never economically efficient, since some users are prevented from enjoying the good even though their consumption of the good would not generate any extra (marginal) cost. Accordingly, goods are not purchased and, as a result, they do not provide benefits to society.

### *Pricing lacks factual basis*

According to neoclassical economists, by allowing prices to move freely the supply of any given commodity will ultimately match demand. Accordingly, prices determine (a) what goods are to be produced and in what quantities, (b) how the goods are to be produced and (c) who will get the goods.

Following these assumptions, economic actors would respond to lowered demand by lowering prices and production (and vice versa) and thus increase efficiency. However, in real life, publicly produced public goods and services are not subject to such market forces. Thus, user charges cannot truly reflect demand, since the governmental offer cannot be refused.

Alternatively, if market-oriented pricing does not work, one can also rely on cost-benefit pricing. Cost-benefit pricing is based on the analysis whereby the equivalent money value of the benefits and costs to the community of a certain project are compared in order to ascertain whether it is economically worthwhile to pursue. However, one of the problems is that although the computation of many components of benefits and costs is intuitively obvious, there are others for which intuition fails to suggest methods of measurement. Likewise, assigning costs and benefits for the production of public goods is burdensome and largely arbitrary.

As a consequence, therefore, if the information for setting efficient charges is not available, the yardstick for taking well-founded decisions is not available, which makes it practically impossible to assess whether the 'right' decision has been taken.

### *Cost structure calls for mass production*

Producing information features a cost structure radically different from that for physical goods. First, information is costly to produce and cheap to reproduce, featuring high 'first-copy costs' but low 'second-copy costs', since the variable cost of the production and distribution of an extra unit, in particular in a digital and networked environment, does not increase, even if it concerns large amounts. So, generally speaking, the cost per extra unit sold is fairly stable irrespective of whether two copies or two billion copies are made.

Further, the (large) fixed costs of information production are regarded as so-called 'sunk costs'. Sunk costs are costs resulting from past decisions and cannot be recovered if production is halted. Accordingly, they can be ignored when making new decisions about production, since they no longer represent meaningful alternatives.

Applying these characteristics to the PSI re-use financing dilemma we can conclude that: (a) where the PSI has been produced already under the public task PSI, the associated costs are to be regarded as sunk costs, (b) second copies and distribution of PSI hardly lead to extra costs and (c) charging for PSI re-use lacks factual basis by definition. Accordingly, economists would argue that the greatest social benefit is achieved when such goods are priced at marginal cost because there is little or no incremental cost in disseminating information widely.

*Charging comes at a cost*

First, charging users entails transaction costs to the seller and to the buyer, since it requires recording and collecting, and recording and payment, respectively. Second, charging only works if the free flow of information is disabled, as otherwise buyers will pass on the information to subsequent buyers, underselling the original provider. Where providers of information try to do so, they tend to rely on limiting access and/or exercising intellectual property rights (copyrights and database rights in particular). As these barriers only work if rights are enforced, this requires monitoring and policing, creating an extra overhead. Third, setting up and running such charging arrangement represent opportunity costs where those involved might be able to use the resources consumed in another way, yielding other benefits. Simply put: charging is costly.

*Marginal cost and zero cost pricing makes sense*

Figure 2-1 visualizes the supply and demand curves and the cost structure in a monopolistic market for PSI goods. ‘Normal’ (non-governmental) monopolists would seek “point a” (quantity  $Q_m$ , against price  $P_m$ ) on the demand curve, maximizing profits, but causing a deadweight loss (equal to the size of the triangle abc and representing the allocative inefficiency that occurs since the equilibrium where demand meets supply is not matched). Governments, however, will likely seek “point d”

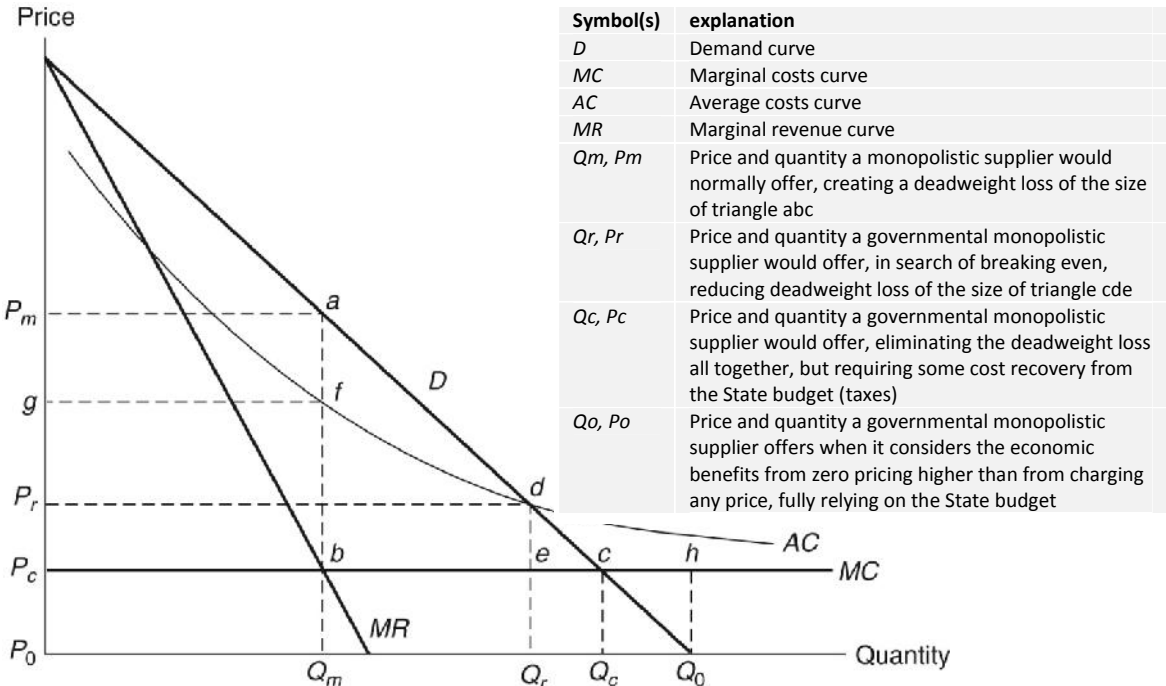


Figure 2-1: Supply and demand and cost structure in a monopolistic market for governmental information goods

(quantity  $Q_r$ , against price  $P_r$ , breaking even, reducing the deadweight loss to the size of triangle cde) or even “point c” (quantity  $Q_c$ , against price  $P_c$ , where the marginal costs are equal to the average costs, eliminating the deadweight loss all together, but no longer fully covering the average costs, requiring some tax money to subsidize the losses). Where the marginal transaction costs (sending

bills, monitoring payment, etc.) are relatively high, governments may decide to drop charging all together (Po), moving to zero costs charging and covering all costs from general taxes.

*Collateral damage is to be assessed*

Where the consequence of following the efficiency principle is in fact that public goods are priced at the level of marginal costs, which in a digital environment equals zero, obviously such price setting would heavily affect the position of competitors in the upstream market.

There are certain PSI domains in which we witness this, for instance in the field of geographic information, where Open Street Map and Google Maps offer alternatives for governmental topographic information. Arguably, if the PSB providing the PSI is under the legal obligation to under-price, this will have detrimental effects on companies competing with the PSB in the upstream market. Interestingly, however, upstream services such as Google Maps (also) come for free or at least are based on business models that do not rely on selling the content.

In any case, in the field of production and maintenance of EO data this should be a point of consideration, where there may be detrimental effects to upstream competitors. We noted earlier the dual player (public – private) particularity of the sector. The drive to increase private investment in space infrastructure has led European governments to seek commercial capital to be invested alongside public funds. These so called public-private partnerships (PPPs) mean that commercial returns are sought by the private sector irrespective of public involvement.

The systems concerned generally offer data which is different and complementary to that from GMES. Nevertheless, in the margins there is some overlap where free data may displace that from commercial sources hence conflicting with the interests of the downstream sector to have free and open access to GMES data. Careful attention must then be given to ensure that a PSI re-use data policy does not undermine the commercial investment made in the upstream data provision.

*Downstream effects of third-party re-use*

Increasingly, governments are deciding to ban internal charging (on the grounds described above), but appear to be more hesitant about not charging for re-use outside the public sector. Applying such user charges, governments tend to restrict distribution by relying on intellectual property rights. Since the data is (partly) disallowed from flowing freely downstream, or rather from networking, effects are limited.

Recent studies acknowledge that re-use, in particular for the low-end of the market, features enormous socio-economic benefits through their so-called long-term effects, representing the consumer surplus ready to be cashed in on. (In chapter 4 we shall look more at this evidence.)

The link with EO data is evident, where this data has significant potential to serve as a basis for private sector players – in particular those on the low-end market, able and willing to open up dormant consumer surplus – to use the data for new services and apps. Charging and (consequently) applying intellectual property rights will likely hamper such development and comes at a social cost where extra tax returns and employment are missed out on.

*Liberalized re-use regime effects on own exploitation are marginal*

Obviously, when a PSB lowers its charges to the level of marginal costs this will impact the revenue stream generated by its own exploitation. This particularly plays a role when a data holder is adding value to the data itself in the downstream market, in competition with private sector players. Quite often such a PSB, exploiting PSI in this way, has become reliant on this income and it ends up cross-subsidizing its commercial activities with its public task activities. In such cases, the PSB will try to

charge high prices for its raw data (where it is a monopoly), allowing it to cut prices in the added-value market (where it is competing with private actors). From an economic perspective, such a setup is inefficient.

Breaking this deadlock will require transitory funding since moving to lowered charges will affect the cash position of the PSB as returns will only arrive later. Furthermore, these will accrue mostly outside its accounts since they will be received directly by the tax authorities, through increased tax returns.

## **2.4 Wrap up**

From a purely theoretical economic perspective, where we take the macroeconomic and social welfare of society as a whole as the starting point, then financing of re-use of PSI from general taxation appears to be most beneficial, as it distributes benefits across society efficiently. Cost recovery does not: it raises extra costs and disallows the benefits from hatching and flowing freely across the value chain.

Obviously, the question is: does this work in practice? For that we need to look into empirical evidence supporting this theoretical analysis, particularly in those PSI domains close to EO data.

## 3 HUH, HUH, WHERE IS THE PROOF? – EMPIRICAL EVIDENCE FROM VARIOUS PSI DOMAINS

### 3.1 Introduction

In the previous chapter we have seen that from a purely theoretical perspective charging marginal or zero costs for PSI re-use appears to be macro-economically more efficient than cost-recovery models. However, does this work in practice? Empirical research into economic effects of charging for re-use of PSI has enjoyed a surge in popularity, in particular in the last four years, where a steady stream of reports and studies has sprung from the academic world, policy makers and re-users.<sup>16</sup>

#### *Quantitative market measurements and impact case studies*

In this chapter we will examine this empirical research, listing and highlighting key outcomes, with a view to transposing these findings into the EO data domain. We will start off with studies that have tried to quantify the European PSI market, i.e. the so-called PIRA, MEPSIR, MICUS and Vickery studies (paragraph 3.2). We will then move down to the meso and micro level covering sectoral studies and case studies, first providing a schematic overview (paragraph 3.3) and then providing concrete figures on economic effects resulting from PSBs moving from a cost recovery towards marginal cost, or even zero cost, PSI re-use charging model (paragraph 3.4). Some of these case studies are part of larger studies, like for instance the POPSIS study that covers 21 case studies (five of which we will be referring to). Paragraph 3.5 holds the wrap up.

#### *Focus on monetary data*

Looking into the cases, we will mainly focus on the monetary effects that accrue in the value chain: the costs and benefits. That being said, it is important to realize that some effects, benefits in particular, simply cannot be monitored and/or monetized. So, how can we make a reliable assessment of the value of improved data quality resulting from (more) users' feedback or increased cooperation and sharing of data between PSBs due to standardisation and enhanced interoperability? And what is the monetary equivalent of being able to see at the local level whether it will rain in the coming hours, allowing outdoor workers to plan their work more prudently and preventing people from catching the flu? So, although we shall (and can) not measure it, we should not forget that these 'socio-economic benefits' are there (and probably in immense volumes).

### 3.2 European comprehensive PSI value studies

Before moving to the case studies – detailing the effects of lowered re-use prices – we first provide a snapshot of the efforts to assess the overall value of PSI within Europe.

#### PIRA

Although the notion that there is significant value in PSI has been gaining weight during the last decade of the previous century, best mirrored by the 1998 EC Green Paper on PSI<sup>17</sup>, it was not until 2000 that the first serious attempt was made to somehow connect a figure to this value: the PIRA report.<sup>18</sup>

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<sup>16</sup> [Annex 7](#) holds an extensive overview of sources on economic aspects of PSI re-use.

<sup>17</sup> Green Paper on "Public Sector Information: a key resource for Europe" (COM(1998) 585), adopted by the Commission on the 20th of January 1999.

[http://ec.europa.eu/information\\_society/policy/psi/archives/news/index\\_en.htm](http://ec.europa.eu/information_society/policy/psi/archives/news/index_en.htm)

<sup>18</sup> Commission of the European Communities, 30 October 2000. Commercial exploitation of Europe's public sector information: Final Report for the European Commission Directorate General for the Information Society. Pira International. <ftp://ftp.cordis.lu/econtent/docs/2000-1558.pdf>

PIRA estimated that the European market for PSI in 2001 (15 Member States) amounted to an ‘investment value’ of €9.5bn and an ‘economic value’ (market size in money) of €68bn, whereas for the United States these values amounted to €19bn and a staggering €750bn, respectively. Accordingly, the main message of PIRA is that compared to the EU, the United States has only twice the investment value for PSI but earns more than *forty* times from it. Although the PIRA figures were disputed later, the report paved the way for the first PSI Directive, providing the European (economic) rationale to legislate this matter.

#### MEPSIR

In 2006, seeking to benchmark the impact of the implementation of the PSI Directive, the European Commission assigned the MEPSIR study<sup>19</sup> to a Northern Ireland-Dutch consortium of Helm and Zenc. This study undertook a thorough baseline measurement of PSI re-use across Europe (including Norway), covering all major PSI sectors (but excluding scientific/research information and cultural information). Although the MEPSIR study came up with much lower figures than the PIRA study – a market size of €27bn, it nevertheless confirmed the value potential inside PSI.<sup>20</sup> The MEPSIR study relied on a large number of robust measurements from all PSI domains in all Member States and it is generally regarded as the best estimate.

#### MICUS

In 2008, a follow up benchmark study was carried out by the German consultancy firm MICUS in three specific PSI domains, again under assignment from the EC. It reported that the PSI Directive has had its strongest impact in the geographical information sector, followed by the legal and administrative information market, whereas its impact in the meteorological information sector was limited. Unfortunately, due to low response figures it did not do a second base measurement, which would have allowed for a comparison with the MEPSIR figures.

#### Vickery

Then, in the autumn of 2011, upon request from the EC, Graham Vickery, former economist of the OECD, produced a report, again assessing the overall European market, based on the various figures presented in previous studies. Covering 27 EU Member States, the report assessed that (a) the market size of 2008 and of 2010 amount to €28bn and €32bn, respectively, (b) the market features an average growth rate of 7%, (c) total direct and indirect economic impact of PSI re-use lies between €70bn and €140bn and (d) the welfare gains from moving to marginal cost pricing reach up to €40bn.

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<sup>19</sup> [http://ec.europa.eu/information\\_society/policy/psi/docs/pdfs/mepsir/executive\\_summary.pdf](http://ec.europa.eu/information_society/policy/psi/docs/pdfs/mepsir/executive_summary.pdf)

<sup>20</sup> PIRA used a markedly different approach from MEPSIR. PIRA relied on two distinctively different values: an ‘investment value’ (public sector investments in the acquisition of PSI) of €9.5bn and an ‘economic value’ (part of national income attributable to industries and activities built on the exploitation of PSI) of €68bn. Its estimation of the investment value was based on a limited number of in-depth studies. Consequently, the individual values of PIRA might be more robust but the subsequent aggregated value less robust. The estimation of the economic value on the other hand was based on information derived from national accounts. This implies a rather broad definition of market size: all firms which are in one way or another related to PSI. The numbers in the MEPSIR study were solely based on the total added value by all first-order re-users (based on a much larger number of measurements than PIRA), as it considered the heart of the matter how much of the added value can be traced back to PSI (and not whether the information industry represents a significant part of a national economy (as is the case in the USA)). This (likely) explains why the PIRA base value (€68bn) is so much higher and the range so much wider (€28bn to €134bn).

The table below provides an overview of these studies and their main figures.

Year <sup>21</sup>	Name of study and author	PSI domain	Outline
2000	<i>Commercial Exploitation of Europe's Public Sector Information</i> , Pira International <sup>22</sup>	<ul style="list-style-type: none"> <li>- All PSI domains</li> <li>- 15 EU Member States</li> </ul>	<ul style="list-style-type: none"> <li>- For Europe (15 Member States) <ul style="list-style-type: none"> <li>o Investment value: €9.5bn</li> <li>o Economic value (=market size): €68bn</li> </ul> </li> <li>- For the United States: <ul style="list-style-type: none"> <li>o Investment value: €19bn</li> <li>o Economic value: €750bn</li> </ul> </li> </ul>
2006	<i>MEPSIR, Measuring European Public Sector Information Resources</i> , HELM and ZENC	<ul style="list-style-type: none"> <li>- All PSI domains</li> <li>- 27 EU Member States + Norway</li> </ul>	<ul style="list-style-type: none"> <li>- European market size: €27bn (27 EU Member States + Norway)</li> </ul>
2008	<i>Assessment of the Re-use of PSI in the Geographical Information, Meteorological Information and Legal Information Sectors</i> , MICUS <sup>23</sup>	<ul style="list-style-type: none"> <li>- Geographic information,</li> <li>- Meteorological information,</li> <li>- Legal information</li> <li>- 27 EU Member States</li> </ul>	The PSI Directive has had strongest impact in the geographical information sector, followed by the growing legal and administrative information market. Its impact has been limited in the meteorological information sector.
2011	<i>Review of Recent Studies on PSI Re-use and Related Market Developments</i> , Graham Vickery <sup>24</sup>	<ul style="list-style-type: none"> <li>- All PSI domains</li> <li>- 27 EU Member States</li> </ul>	<ul style="list-style-type: none"> <li>- Market size 2008 and 2010: €28bn and €32bn</li> <li>- Average growth rate in PSI-related markets: 7%</li> <li>- Total direct and indirect economic impact of PSI re-use: €70bn–€140bn</li> <li>- Welfare gains from moving to marginal cost pricing: €40bn</li> </ul>

Figure 3-1: Overview of PSI case studies

In summary, all the studies acknowledged the economic value captured in PSI and the significant growth rates over the years when opened up under liberal re-use regimes. In the next paragraph, we will take a closer look at these effects.

### 3.3 Overview case studies

#### *Case studies: evidence building up*

As indicated above, the PSI Directive was adopted on 31 December 2003, putting the burden on Member States to implement the provisions into national legislation by July 2005. In that process, many Member States started to understand and appreciate the potential of opening up their PSI, in particular the United Kingdom, where the so called Trading Funds were a sore subject to many re-users (and likely also policy makers). Interest in PSI re-use was further boosted by the 'Open Data movement', which started to gain political weight in 2010, bringing forth a second wave of studies of which POPSIS, Koski and Houghton are of particular interest. The table below provides a (large) selection of relevant studies, and briefly outlines the essence. For those interested in further details,

<sup>21</sup> Meaning: year of publication.

<sup>22</sup> [http://ec.europa.eu/information\\_society/policy/psi/docs/pdfs/pira\\_study/commercial\\_final\\_report.pdf](http://ec.europa.eu/information_society/policy/psi/docs/pdfs/pira_study/commercial_final_report.pdf)

<sup>23</sup> [http://www.epsiplatform.eu/media/files/micus\\_studie\\_psi\\_eu\\_long](http://www.epsiplatform.eu/media/files/micus_studie_psi_eu_long)

<sup>24</sup> <http://epsiplatform.eu/content/review-recent-psi-re-use-studies-published>

structured summaries of all these case studies have been brought together in [Annex 4](#). Furthermore, the bibliography in [Annex 7](#) provides a full overview of relevant material.

Year	Title and author + short name	PSI domain (+ short names)	Outline
2008	<i>'Models of Public Sector Information Provision via Trading Funds'</i> , Newbery, Bentley and Pollock, Cambridge University, <b>Trading Funds study</b> <sup>25</sup>	A set of UK 'basic registers': <ul style="list-style-type: none"> <li>- Met Office</li> <li>- Ordnance Survey</li> <li>- Hydrographic Office</li> <li>- Land Registry</li> <li>- Companies House</li> <li>- Driver Vehicle Licensing Agency</li> </ul>	Relying on prior experiences of agencies adopting marginal cost pricing, the study provides estimates for the costs and benefits of marginal cost pricing in relation to bulk, digital PSI from big UK public data holders.
2009	<i>'The Economics of Public Sector Information'</i> , Rufus Pollock, Cambridge University, <b>Pollock study</b> <sup>26</sup>	UK raw PSI in general	Relying on mathematical analysis the study assesses who should best finance PSI re-use and the regulatory structure needed.
2010	<i>'PSI in European Meteorology – an Unfulfilled Potential'</i> , Richard Pettifer, PRIMET, <b>Pettifer 1 study</b> <sup>27</sup>	Meteorological information in general	Proceeding on the basis that, in general, meteorological PSI is available on a cost-recovery basis in Europe and on marginal or zero cost bases in the US, the study assesses the detrimental effects for Europe.
2011	<i>'Pricing of Public Sector Information Study'</i> , Deloitte Belgium, <b>POPSIS study</b> <sup>28</sup>	21 case studies in the EU in all important PSI domains, including, the Dutch <b>KNMI case</b> (meteo), Norwegian <b>MET.NO case</b> (meteo), Danish <b>Deca case</b> (geographic), <b>Spanish cadastre case</b> (geographic), <b>Austrian cadastre case</b> (geographic)	Analysing 21 case studies, covering a wide range of PSBs and different PSI sectors, the study assesses different models of supply and charging for PSI and their effects on the downstream market, PSI re-users, end-users and impacts on the PSB itself.
2011	<i>'Does Marginal Cost Pricing of Public Sector Information Spur Firm Growth?' Heli Koski, The Research Institute of the Finnish Economy, <b>Koski study</b></i> <sup>29</sup>	Geographic information	Assessing the performance of 14,000 firms in the architectural, engineering and related technical consultancy sectors, located in 15 different countries, the study analyses the effect of maximum marginal cost pricing for geographical PSI on the firms' growth performance during the years 2000–2007.

<sup>25</sup> <http://www.berr.gov.uk/files/file45136.pdf>

<sup>26</sup> <http://www.econ.cam.ac.uk/dae/repec/cam/pdf/cwpe0920.pdf>

<sup>27</sup> <http://www.primet.org/file/EU%20PSI%20Working%20Groups/PSI%20in%20European%20Meteorology%20-%20an%20unfulfilled%20potential%20distribution%20copy.pdf>

<sup>28</sup> [http://ec.europa.eu/information\\_society/policy/psi/docs/pdfs/report/11\\_2012/models.pdf](http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/models.pdf)

<sup>29</sup> [http://www.etla.fi/files/2696\\_no\\_1260.pdf](http://www.etla.fi/files/2696_no_1260.pdf)



Year	Title and author + short name	PSI domain (+ short names)	Outline
2011	<i>Costs and Benefits of Data Provision – Report to the Australian National Data Service</i> , John Houghton, Victoria University, Australia, <b>Houghton study</b> <sup>30</sup>	Information from: - Australian Bureau of Statistics - Office of Spatial Data Management & Geoscience - National Water Commission & Bureau of Meteorology	Presenting three case studies, the study explores the costs and benefits that PSI-producing agencies and their users experience in making information freely available and the preliminary estimates of the wider economic impacts of open access to PSI.
2011	<i>‘Pricing of PSI in the Meteorological Sector blocks market development’</i> , Richard Pettifer, PRIMET, <b>Pettifer 2 study</b> <sup>31</sup>	Meteorological information in general	Considering three hypothetical SMEs, in Luxembourg, Poland and France that wish to provide weather-related services but are confronted with cost-recovery pricing, the study concludes that these SMEs can never compete successfully.

Figure 3-2: Overview of relevant PSI re-use case studies

In summary, we see a surge in interest in the economic effects brought about by more liberal PSI re-use regimes, mirrored by a wide array of studies at the national and sectoral levels, both inside and outside Europe. In the next paragraph, we will look at these effects in more detail and will refer to these case studies by using their short names.

### 3.4 Chain of economic effects of lowered PSI re-use charges

#### *The challenge: putting the findings in context*

Most of the studies referred to above work on the basis of an input–output relation, whereby the effects (output) of lowered charges for PSI (input) are assessed in isolation. What has not been done so far is to analyse the studies by interconnecting them and adding a sequence and timeframe to the effects, which will not only reveal the deadlock faced but also suggest the solutions at hand.

#### *The sequence of effects and their beneficiaries*

Our starting point (and that of most case studies) is a PSB lowering the charges for re-use of its PSI. This brings about a whole array of subsequent effects, which can be divided in three phases: (a) the *sowing* phase, (b) the *growing* phase and (c) the *harvesting* phase. Walking through, we will look at the subsequent effects taking place and substantiate them with the empirical research listed above.

#### *a) The sowing phase*

The sowing phase features two immediate effects: an uptake at the demand side by the re-users (following the price cut) and, in parallel, an income effect at the side of the PSB, where it loses revenues – it can no longer charge for its data – and sees its cost increasing, as mirrored in the illustration below.

<sup>30</sup> <http://ands.org.au/resource/houghton-cost-benefit-study.pdf>

<http://www.crcsi.com.au/Documents/ANZLIC-Economic-Study---Stage-2-Report.aspx>

<sup>31</sup> [http://www.primet.org/file/EU PSI Working Groups/Workshop Position paper final](http://www.primet.org/file/EU%20PSI%20Working%20Groups/Workshop%20Position%20paper%20final)

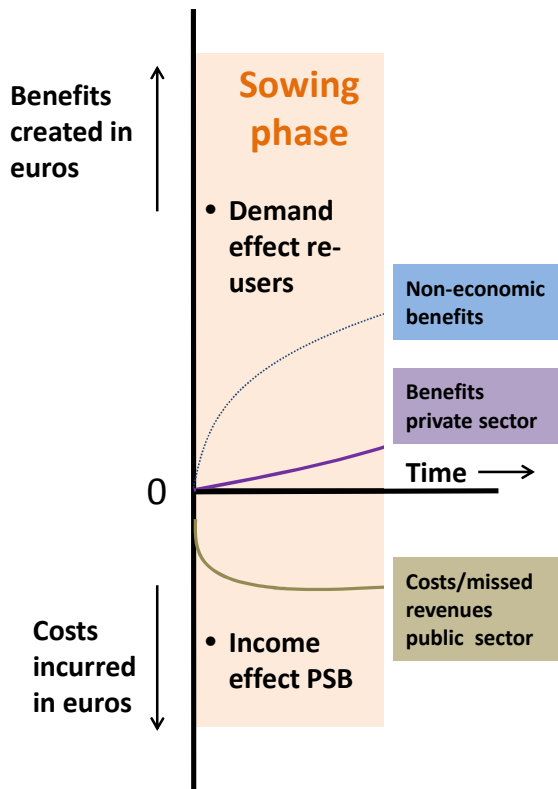


Figure 3-3: Effects in the sowing phase

#### i. Demand effect re-users

##### *Spectacular increases in demand*

All case studies report on, quite often really spectacular, increases in demand (both in terms of volume and numbers of users) following a decrease in re-use charges, as demonstrated in the table below.

Interestingly, lowered prices also attract new categories of users, SMEs in particular, apparently previously unable to afford the required PSI. Both POPSIS and Koski report on this:

*POPSIS: "Interestingly, some case studies demonstrate the use of variable pricing regimes such as 'pay per use' or 'percentage of turnover generated by PSI' without high fixed price elements. These regimes have led to increased re-use and facilitate new entrance of re-users, notably SMEs."*<sup>32</sup>

*Koski: "It seems credible that higher PSI prices create a barrier for SMEs using geographical information to develop new information products and services and to enter new market areas."*<sup>33</sup>

We will look at the consequences thereof in more detail in the growing phase, where they materialize in full.

<sup>32</sup> POPSIS, *ibid.* p. 32.

<sup>33</sup> Koski, *ibid.* p. 13.

Case study	PSI domain	Price cut re-use charges	Increase in demand
Austrian Cadastre (POPSIS + Koski)	Topographical data	Up to 97%	Factor 2 – 7 in number of downloads <sup>34</sup>
DECA (POPSIS)	Danish address data	almost 100%	Factor 100 in number of re-users
KNMI (POPSIS)	Dutch meteo data	80%	Factor 10 in number of re-users, 90% of them being SMEs
MET.NO (POPSIS)	Norwegian meteo data	100%	Factor 30 in numbers of unique weekly re-users, majority being SMEs
Spanish Cadastre (POPSIS + Koski)	Spanish topographical data	100%	<ul style="list-style-type: none"> <li>- Factor 80 – 100 in numbers of downloads</li> <li>- Factor 25 in numbers of re-users</li> </ul>
Houghton study	Australian: <ul style="list-style-type: none"> <li>- Topographical data</li> <li>- Statistical data</li> <li>- Hydrological data</li> </ul>	<ul style="list-style-type: none"> <li>- almost 100%</li> <li>- 100%</li> <li>- 100%</li> </ul>	<ul style="list-style-type: none"> <li>- 172%</li> <li>- Factor 3 in product downloads</li> <li>- Factor 100 in data requests</li> <li>- Factor 2 for extractions of re-use</li> </ul>

Figure 3-4: Overview of increases in demand following lowered PSI re-use charges

#### PSI features relatively elastic demand

These figures confirm previous research (Trading Funds Study and Pollock Study) that suggested a price elasticity of demand (PED) well above 1 (in absolute terms), meaning that in case a PSB lowers its prices (so not dropping the charging all together) the relative increase in quantity outweighs the relative discount, generating higher revenues than before.<sup>35</sup>

Pollock notes that evidence on price elasticity is limited, and its value will be determined by the nature of the product at issue. Nevertheless, he estimates that elasticity is generally greater than 1, and the range for the kinds of products that are the subject of this study is between 0.5 and 2.5. According to the Trading Funds Study, elasticity of demand varies depending on the PSI, but for the products associated with the PSI, average elasticity is estimated at between 1 and 2.

The POPSIS findings confirm this in the Austrian cadastre case and the Dutch KNMI case.

POPSIS: “[T]he Austrian Federal Office of Metrology and Surveying adopted a simplified and more market-oriented PSI pricing approach with drastic price cuts of up to 97% within strict budget constraints (there was no additional governmental funding). Due to the additional demand – notably from SMEs – triggered by lower prices, PSI sales revenues and the associated cost-recovery ratio could be kept stable or slightly increased. Without additional governmental funding, BEV could improve the situation for re-use business and secure a wider use of its public data.”<sup>36</sup>

POPSIS: “In 1999, at the peak of competition between the commercial activities of the KNMI and the private sector re-use activities, there were in essence two re-users of KNMI data. ... About ten years later, after full implementation of the new re-use policy, this picture had changed quite dramatically.

<sup>34</sup> Cartographic products with a factor 2 – 15, digital ortho-images with a factor 70, digital cadastral map and elevation model with factor 2.5, the digital landscape model with a factor 10.

<sup>35</sup> The formula for the coefficient of price elasticity of demand (PED) is  $(dQ/Q)/(dP/P)$ , whereby Q is the quantity, P is the price and d is the changes therein. Generally, if PED for a good is relatively elastic ( $-\infty < Ed < -1$ ), the percentage change in quantity demanded is greater than that in price. Hence, when the price is lowered, the total revenue increases.

<sup>36</sup> POPSIS, *ibid.*, p. 127.

*In 2010, the price level of a full KNMI dataset went down by 80%, from 0.1 M EUR to 0.02 M EUR (which included both license and distribution costs) and covered the facilitation of re-use costs only. At the same time, the number of re-users exploded, increasing to 50<sup>37</sup>.<sup>38</sup>*

## ii. Income effect PSB

Lowering of the charges directly impacts (negatively) the income of the PSB, as revenues no longer come in. In fact, as the new charging regime needs to be implemented, costs may further rise, in particular as boosted demand may require additional investment. This double-edged knife requires the PSB to rely on its own reserves and, in the absence thereof, requires alternative funding (from general taxation funds).

*Lost revenues appear to be limited in size*

Interestingly, however, looking at the lost revenues in proportion to the PSB's total budget, in most cases the 'damages' appear to be fairly limited. The table below – directly taken from the POPSIS study – indicates that the 'PSI re-use cost-recovery ratio'<sup>39</sup> of more than half of the PSBs is less than 5%. In other words, if charges were dropped all together many would hardly notice, or at least, they would not have to shut shop. Only for a few the loss of income would appear to be of a fundamental nature, in particular in the field of business registers.

Country	Public sector body	PSI domain	Budget (M EUR)	PSI sales revenues (M EUR)	Cost-recovery ratio
Italy	Infocamere	Business register	93.6	31	31.31%
Netherlands	KvK	Business register	243	6	19.50%
United Kingdom	Companies House	Business register	74.8	15.5	20.73%
Austria	BEV	Geographic information	85.0	22.5	26.5%
Germany	BKG	Geographic information	33.8	0.08	0.24%
Germany	SenStadt	Geographic information	9.1	0.945	10.38%
Denmark	DECA	Geographic information	31.6	0.26	0.82%
Spain	IGN-CENIG	Geographic information	52.0	2.1	4.12%
Spain	Spanish Cadastre	Geographic information	108.0	0	0.00%
France	French cadastre	Geographic information	162.5	0.9	0.55%
Italy	Italian cadastre	Geographic information	666.0	3.3	0.50%
Netherlands	Dutch cadastre	Geographic information	261.0	17.15	6.57%

<sup>37</sup> Among these fifty companies, five are companies that are so-called meteorological service providers (in 1999 there were just two). These companies have portfolios with direct meteorological forecasting products as basic meteorological datasets for customer processes (sea forecasting, wind energy and so on). General re-users deal with customer processes that are built on meteorological input datasets.

<sup>38</sup> POPSIS, *ibid.* pp. 273–274

<sup>39</sup> The cost-recovery ratio is defined as: (PSB's revenues from sale of raw PSI to re-users / total budget of the PSB) \* 100%

Country	Public sector body	PSI domain	Budget (M EUR)	PSI sales revenues (M EUR)	Cost-recovery ratio
United Kingdom	Ordnance Survey	Geographic information	127.0	21	16.54%
Germany	DWD	Meteorological information	214.9	2	0.93%
Netherlands	KNMI	Meteorological information	56.0	0.25	0.45%
Norway	Met.no	Meteorological information	58.0	0	0.00%
Slovenia	ARSO	Meteorological information	6.0	0.36	6.00%
Spain	CENDOJ	Legal information	9.0	1.5	16.67%
France	DILA	Legal information	135.0	0.9	0.67%
France	SIRCOM	Fuel prices information	1.1	0.179	15.91%
Germany	DeStatis	Statistical information	177.7	0.2	0.11%

Figure 3-5: Cost-recovery ratios 2010 of PSBs measured in the POPSIS study<sup>40</sup>

Equally, Houghton concludes that the greatest cost to agencies lies in the loss of revenue when information that was previously sold is provided at marginal cost. Moving to standard licences and formats may have some transitioning costs for agencies but is unlikely to have a material impact on costs once the standard systems are in place. Ultimately, the use of standard licences and formats should reduce agency costs by reducing the support required by re-users.

#### *b) The growing phase*

In the growing phase, more indirect effects start to kick in, both at the market end (for the re-users and more broadly on the downstream market) as well as for the PSB itself, in the form of increased efficiency, as the figure below illustrates.

<sup>40</sup> Although only six cases from the POPSIS study were explicitly mentioned above, the table demonstrates all 21 POPSIS's case studies, as the percentages are quite illustrative.

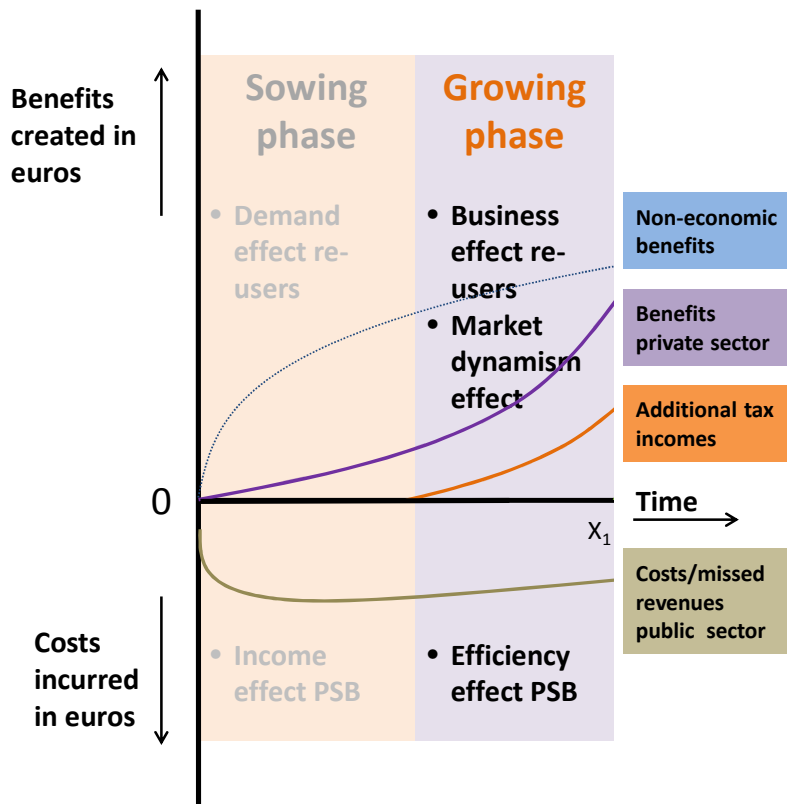


Figure 3-6: Effects in the growing phase

### iii. Business effect for re-users

The costs of purchasing PSI from the government will decrease, which is (partly) translated into lowered prices in the successive parts of the chain, leading to larger quantities sold, and as the price cuts do not affect profits (but are a result of lowered costs), profits of re-users rise. Furthermore, transaction costs diminish, in case re-use is made free all together.

Koski has looked extensively at profitability of companies following lowered re-use charges. Assessing the performance of 14,000 firms in the architectural, engineering and related technical consultancy sectors, located in 15 countries, she analyses the effect of maximum marginal cost pricing for geographical PSI on the firms' growth performance during the years 2000–2007.

*Koski: "The reported empirical findings clearly show that the PSI pricing scheme does matter for the firm growth particularly from the perspective of small and medium sized enterprises. The firm-level data concerning potential re-users of geographical information in business services sector from 15 countries during the years 2000–2007 suggests that the pricing of GI strongly relates to the firms' sales growth. Firms functioning in the countries in which public sector agencies provide fundamental geographical information either freely or at maximum marginal costs have grown, on average, 15 percent more per annum than the firms in the countries in which public sector GI is priced according to the cost-recovery principles. The difference-in-difference estimations further show that positive growth impact materializes already one year after switching to the marginal cost pricing scheme but a stronger boost to the firm growth takes place with a two year lag."*<sup>41</sup>

<sup>41</sup> Koski, *ibid.* p.13.

Three POPSIS cases also report increased turnover of re-users following a move to marginal costs charging models: in the Danish address case (DECA), the turnover of re-use market (first and second tier re-users) increased by 1,000%; in the Dutch meteo case (KNMI), the turnover of the downstream market increased by 400%; and in the Norwegian re-use meteo market case (MET.NO) there was a 200% growth, money-wise. Many case studies also demonstrate new parties entering the market, which is obviously the result of increased profitability (see Figure 3-6 above). We will look at these new entrants in more detail in the next section (market dynamism).

**iv. Market dynamism effect**

Attracted by low (or non-existent) PSI re-use charges, lowering market entry barriers, and increasing profits of existing re-users, new parties enter the market, resulting in more market dynamism: existing re-users need to innovate and upgrade their services. Conversely, parties no longer adding value and not able to keep pace, leave the market.

*SMEs entering the market spur dynamism*

Koski’s research demonstrates that the market dynamism and growth is spurred by the new comers rather than the existing body of re-users, bringing about a subsequent set of economic effects. This is confirmed by a wide range of case studies.

*Koski: “Interestingly, marginal cost pricing has not generated notable growth among the large firms; it has been SMEs that have benefited most from cheaper geographical information. It seems credible that higher PSI prices create a barrier for SMEs using geographical information to develop new information products and services and to enter new market areas. The switch to the marginal cost pricing may thus not only result in growing markets but also intensify competition and challenge the large incumbent companies. Cheaper public sector GI is thus likely to benefit consumers by producing more product variety and also cheaper prices.”<sup>42</sup>*

*Distinction between high- and low-end markets*

POPSIS addresses another important aspect of the market dynamism brought about. It notes that ‘the new kids on the block knocking on the door’ are fundamentally different from the ‘old’ re-users (the high-end market re-users), as Figure 3-7 demonstrates.<sup>43</sup>

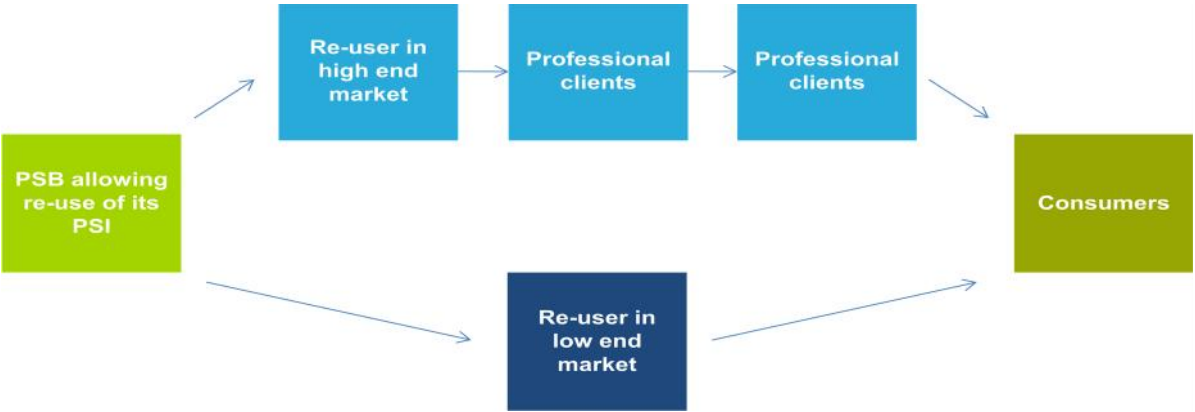


Figure 3-7: High-end and low-end re-use markets

The high-end market typically consists of re-users that provide their PSI-based services to professional clients. Substantial value is added by re-users serving the needs of specific professional clients. A typical example is a meteorological company that provides very detailed weather forecasts

<sup>42</sup> Koski, *ibid.* p.13.

<sup>43</sup> POPSIS, *ibid.* pp. 26–27.

to oil rigs, based on its own high-tech forecast models. The high-end market services are highly targeted, the number of clients is relatively low and yet the value of each transaction is high.

Conversely, in the low-end market, business models are based on reaching out to large volumes of (generally non-professional) consumers who use high traffic web services and maybe apps on mobile devices. Typically, these re-users merely mash up the PSI with other free content and integrate it into services, not adding much value, other than distributing it widely. The re-users' revenues come from third-party advertisements, not from its users.

Backing this up, in the Dutch KNMI case, the POPSIS study reports:

*“The lowered price level increased competition and sparked innovation: second-tier users of meteorological information were offered smart, new products. For instance, the greenhouse sector in the Netherlands was able to save about 10% on its energy costs due to its access to real-time detailed forecasting of rainfall services. This allowed the sector to maximize the length of time that the greenhouses can remain open to the air. This not only very beneficial for the crops but also for the environment, since it reduces carbon dioxide emission quite considerably.... New business models emerged: a new re-user entered the market and launched an innovative service under the name ‘Rainfall Radar’ (Buienradar). Anyone can use the service to determine whether it is going to rain in the current location in the next few hours. This service is provided completely free of charge. It generated around 300 million hits per year throughout Europe in 2010. As a result of this high traffic, it is paid for through advertising revenues. Finally, since all KNMI data products are license free, almost no restrictions in use or distribution are set. Some of the re-users have started activities as distributors.”<sup>44</sup>*

#### *Stifling effects of strong PSB presence in the market*

One may also ask what the consequences are when prices are not lowered. The two Pettifer studies provide evidence of the consequent damage being incurred in the meteo domain: not lowering its re-use charges and its own downstream market activities, the national Met Offices trifles with the market, where high charges block SMEs from entering.

In his first paper ‘Pricing of PSI in the Meteorological Sector blocks market development’, Pettifer considers three hypothetical SMEs, in Luxembourg, Poland and France that provide weather-related services relating to forecasting, highways and energy, and uses 2010 prices on a cost-recovery basis. The absolute minimum PSI meteorological data required to provide basic weather-related services, with a market value of €6,000 to €20,000 per contract, would cost a typical SME between €84,000 and €400,000. Pettifer’s conclusion therefore is that SMEs cannot operate successfully or compete with large firms when partial or full cost-recovery pricing principles are used: cost-recovery pricing principles are likely to create barriers to market entry because SMEs are probably unable to find the 20 contracts required to operate profitably.

In Pettifer’s second paper, ‘PSI in European Meteorology – an Unfulfilled Potential’, he assesses the damage from this current practice, by comparing the European market figures with those of the US. *“Recent estimates of the size of the 2006 market in value-added meteorological products of all types in the USA and Europe are of the order of \$1.4 billion per annum and \$372 million (€530 million) per annum respectively. ... It would appear therefore that [on the basis of GDP] only about 0.3% of the potential European market in this sector is currently being supplied whereas in the US the equivalent figure is around 0.7%. Moreover recent estimates suggest that in real terms, after allowing for growth in GDP, the US market has grown at an average rate of around 17% per annum over the past six or seven years while the European market has been growing at closer to 1.2% per annum in the same period. This type of difference can be seen in specific market sectors as well as in the overall*

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<sup>44</sup> POPSIS, *ibid.* p. 274.



market. ... There are other characteristics of the European meteorological market that bear examination and raise questions over the structure and operation of the sector. For example, although the real overall annual market growth in Europe has been languishing below 2% over the past five years, the small part of it (now about 28%) that falls to the private sector has been growing at around 25% per annum whereas the 75% that is in the hands of the dominant NMHS has actually declined by around 1.5% per annum. This large growth in the private sector component of the market (albeit from a very low base) is doubtless to some extent due to capture of business from the NMHS but the NMHS, despite their greater resources and strong brand positions, appear unable to develop the market and to grow the meteorological economy overall. It is interesting to note that much of this increase in the private sector component of the market has arisen since a few of the NHMS relaxed their PSI supply policies partly or completely towards the US model and made some key meteorological PSI available at the marginal cost of distribution. This suggests that if a major overall structural change in this direction, whether political or commercial, can be made it will encourage the growth of the private sector, stimulate genuine competition and foster the development of the total market.”<sup>45</sup>

#### v. Efficiency effects in the PSB

The last effect in the growing phase concerns the efficiency gains made by the PSB. Having implemented the new re-use policy, efficiency gains start to kick in where fewer resources are consumed to run operations, administrative staff are no longer needed and transaction costs savings are cashed in. Furthermore, the PSB’s remaining downstream market activities are seized or carved out, as the PSB cannot keep up with private sector competitors (no longer being able to rely on upstream advantages).

#### *Direct efficiency gains cover significant part of revenues lost*

Houghton compares the PSB’s revenue lost with the costs saved as a result thereof: (Efficiency gains PSB / Lost income PSB) \* 100%. Accordingly he arrives at a percentage of 32% (for the Australian Bureau of Statistics). He also reports on Western Australia’s Landgate agency, which estimates their transaction and support-related costs at around 17% of fundamental data revenue.<sup>46</sup>

POPSIS reports on several cases where efficiency gains are being perceived:

- The Dutch KNMI case demonstrates the move to a marginal costing charging regime had a significant impact on the efficiency of the organisation. In 1999, the commercial arm of the KNMI comprised 25 FTEs. This amounted to a cost of around €0.65m (in both direct and indirect costs) and a turnover of PSI sales of about the same amount, so breaking even. In 2010, the ‘re-use department’ of the KNMI ran at a total cost of around €0.25m a year by 1.5 FTE, whereby the number of re-users had gone up with a factor 10.
- The Danish address case (DECA) assessed that opening up address data against marginal cost led to a total savings of around €5m over a period of five years, by estimating the time saved from not having to deal with licensing and administrative issues anymore. That amount alone already outweighed the loss of PSB income. The re-use department is now run by 0.5 FTE against a cost of €0.2m.

#### c) The harvesting phase

As Figure 3-8 demonstrates, in the harvesting phase the investments really pay off: increased tax returns outweigh the costs incurred by the PSBs and market dynamism has led to economic growth,

<sup>45</sup> Pettifer, *ibid.* pp. 5–6.

<sup>46</sup> Houghton, *ibid.* pp. 19, 34.

resulting in more employment. And of course there are other non-economic benefits, all adding up to increased welfare.

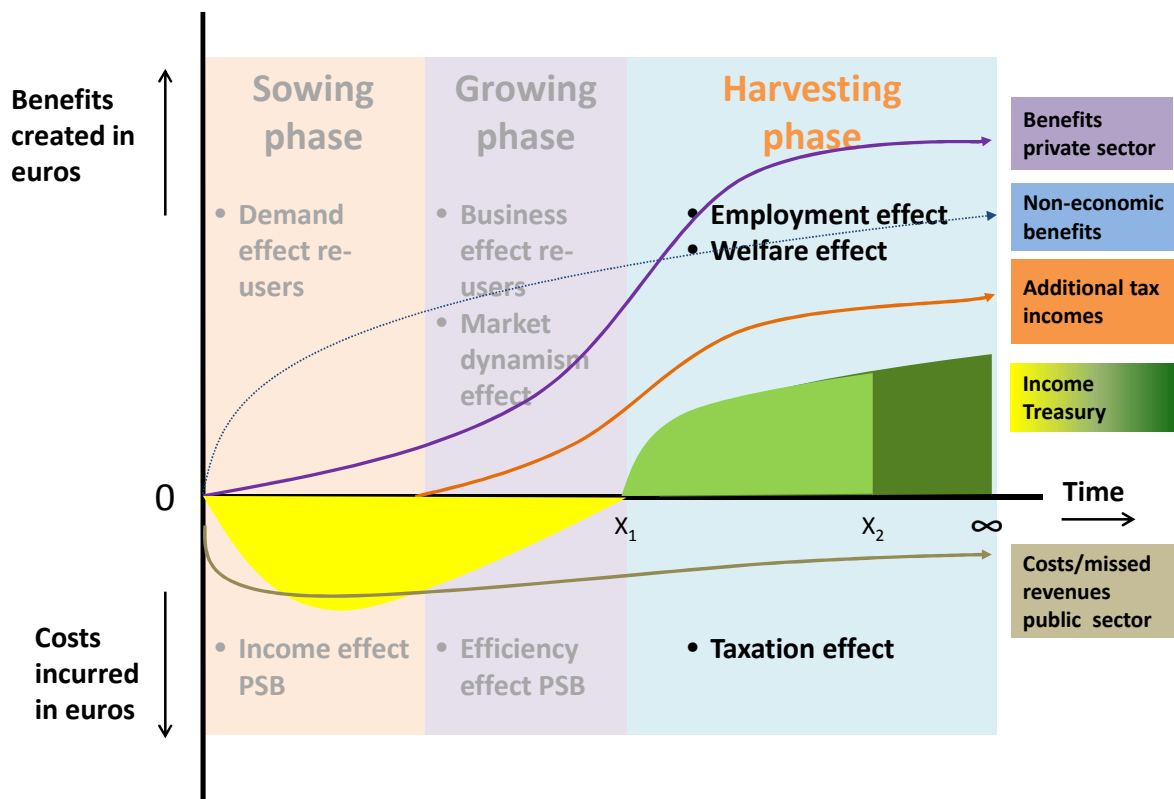


Figure 3-8: Effects in the harvesting phase

#### vi. Employment effect

Due to increased economic activities, new and old re-users (and their clients) require additional staff, which they can now afford to hire due to increased profitability. This positive effect on employment largely outweighs the possible redundancy at the PSB level.

Although the strong increase in usage and the numbers of re-users suggest that there must be positive effects on private sector employment, only two cases hold hard evidence. The Dutch KNMI case demonstrates that in the eleven years since 1999 following the policy change that entailed the shift to cost recovery of re-use facilitation costs only, there were significant developments. The number of re-users went up by 1,000%, turnover increased by 400% and employment was boosted by 300%. In the Danish DECA address data case, which also shifted to a re-use facilitation cost-recovery model, the number of re-users went up by at least 5,400%, turnover by 1,000% and employment by first and second tier re-users by 800%.

#### vii. Taxation effect

Although already taking off in phase 2, the treasury starts to benefit from the entire movement: (a) VAT returns increase, (b) profit taxation increases as the GDP goes up and (c) social security taxes increase where more people are employed. These returns start to outweigh the initial investments made, having to fund the budget gap of the PSB in phase 1 and part of phase 2.

Again, few cases hold hard figures on the taxation effects. In the KNMI case, the additional corporate tax gains amount to €35m over a period of eleven years, based on an 'investment' (= lost revenues +

re-use facilitation costs) of around €7m , thus giving a return on investment of 500%. The Danish DECA address case suggests a similar return on investment (corporate tax only) of 450%, where the GDP increase amounts to €14.25m over nine years against an investment of €3m. Obviously, at a macro level, and in absolute terms, these amounts are modest but become significant when scaled to a European level.

Pettifer, in his paper, ‘PSI in European Meteorology – an Unfulfilled Potential, points to the potential tax gains missed out on:

*“The failure to realize the potential in this market place is costing the national treasuries in the EU dearly in terms of lost revenue from taxation. If the European meteorological market were as well penetrated as that of the USA, then the actual market size would be around €1,390M per annum. According to Eurostat the overall taxation return for EU countries in 2005 was 39.6% of GDP. To a first approximation then we might expect that the gross overall tax revenue from this sector would increase by around €340M. If, to generate this, the NMHS were to lose all of their income from the sale of PSI, and all of their direct value added retail sales (which are assumed to be diverted to the private sector and are thus still within the total market size), then the net benefit to the EU central treasuries from this change in the trading structure of the market would be in the order of €290M per annum and would be, if the US is any guide, growing at about 17% per annum in real terms, rather than at about 1.2% per annum as they now are.”*

*Treasury implications*

Returning to Figure 3-8, the yellow and green planes represent the cash implications for the Treasury. During the sowing phase, the loss of income and investments needed to kick start and implement free re-use are not set off yet by taxation gains, which start to kick in only in the growing phase. At point  $x_1$  the positive cash flow outweighs the loss of income and accordingly, the cash needs accumulated in the previous period ( $0 - x_1$ ) start to diminish rapidly. At point  $x_2$  the net gains start to come in, where these cash needs accrued are outweighed by the positive effects (tax gains and PSB efficiency gains). As of this point, the investment decision towards a free or marginal costs charging model will yield a constant and structural return.

So the balance of Treasury =  $\int_{x_2}^0 f(\text{Additional tax incomes}) - f(\text{Costs} + \text{missed incomes public sector})$   
 where:

- $x_1$  = point where tax revenues start to outweigh the PSB’s total costs and income lost
- $x_2$  = point where total tax revenues collected outweigh the PSB’s total costs and income lost
- $x_2 - \infty$  = total taxation profits

So ultimately, the cases looked into promise high returns. However, where PSBs have become reliant on income from re-use, the turnaround may not be easy, particularly if the proportion of user fees is relatively high. In those cases the Treasury will need to finance the transition, making up for the initial losses. We will look into this matter in more detail in chapters 4 and 5.

**viii. Welfare effects**

Finally, it is likely that the societal gains will be much higher than just the financial ones we have been focusing on.<sup>47</sup> Many reports underline the positive externalities from opening up PSI (for re-use), which will likely result in wider economic impacts and benefits for society or the public at large. The benefits may look trivial – e.g. localized weather forecasts help people to stay dry – but they are

<sup>47</sup> See in particular Velde te, R.A. (2009), Public Sector Information: Why bother? in: Uhlir, P. (ed.). The socio-economic effects of Public Sector Information on Digital Networks. Towards a better understanding of different access and reuse policies. Washington DC: National Research Council (Ch.6. pp.25–28) and on the same note: <http://www.oecd.org/dataoecd/12/49/40064800.pdf>

obvious: less flu, more productivity, happier citizens, etc. Equally, we have only started to understand the potential network effects of opening up PSI, in terms of innovation and the development and introduction of new products, services and processes that, in turn, generate new economic activity, new business opportunities, better informed and potentially better government and business decisions. Making sure we do not forget, these effects are represented by the blue dotted line in Figure 3-8.

### **3.5 Wrap up**

Empirical research in various PSI domains seems to confirm the theoretical assumptions reflected in chapter 2. Briefly put, the benefits largely outweigh the costs (and lost incomes of the PSBs): public sector activities increase, leading to economic growth, more employment and better services, due to market dynamism. The additional tax returns make up for the extra costs and income loss of the PSBs. The only issue is that these macro returns only kick in later, requiring transitory financing arrangements.

## 4 WOULD IT WORK WITH US? – TRANSPOSITION IN THE GMES DOMAIN

### 4.1 Introduction

In the previous chapter we saw that there is a growing base of evidence that from a macroeconomic perspective, a free data re-use policy makes good sense. In paragraph 4.2 we will look at evidence coming from within the GMES domain (or more practically, the wider EO domain), allowing us to compare it with the empirical evidence gathered from within the other PSI domains and letting us make an estimate of the potential benefits of a free GMES data re-use policy in paragraph 4.3, which takes the form of an educated guess since the quantitative data are currently limited.

### 4.2 EO domain evidence

Although fairly limited there are a few cases that allow us to look at the economic effects of changes in EO data re-use policies, being: (a) Landsat, (b) ERS and Envisat, (c) examples of national EO data portals opening up for free re-use and (d) some anecdotal facts and figures from downstream companies relying on EO data.

#### *a. Landsat – the long transition from commercial to free*

The clearest example is the US satellite system, Landsat. It is the best case because during its 40 years of imaging, using a succession of satellites, it has been subject to several changes of data policy. Most recently, in 2008 it moved from a charging to a free-access data policy and the impacts of this last change are clearly visible from the increase in data downloads as shown in Figure 4-1.

It is also notable that the change comes after years of charges and many changes in policy. Since commercialisation was first tested in 1981, the operational responsibility for the satellites has changed hands three times and many different charging structures have been tried out. In the mid-1980s a new company was established to sell the data at a price that peaked at \$4400. This policy was deemed to have failed when, in the early 1990s, it was recognised that:

*“With military and government-funded re-searchers as major Landsat data users, Congress—and the public, via a spate of news-paper articles—realized it was “paying twice” for Landsat data, in that tax dollars had built the satellites and then by paying a government-subsidized company for its data. As a result, after many Congressional hearings the decade-long commercialization experiment was ended, and the Landsat program returned to the government fold.”<sup>48</sup>*

This led to a decade where the data was sold directly by the US Geological Survey (USGS) at a price of \$600 per scene until, in 2008, the US Government decided that data gathered by the Landsat system of satellites should be made available at no charge to users. Almost overnight the number of downloads of imagery exploded.<sup>49</sup> In a recent analysis of the impact of the data policy it was noted that:

*“Open access has resulted in the distribution of over 5.7 million images (through June 2011), representing the full range of Landsat instruments. More than 250,000 images are distributed each*

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<sup>48</sup> Chronicing the Landsat Legacy *Laura Rocchio, SSAI; The Earth Observer, Nov-Dec 2011*

<sup>49</sup> Landsat Data Distribution Policy, January 2008,  
[https://landsat.usgs.gov/documents/Landsat\\_Data\\_Policy.pdf](https://landsat.usgs.gov/documents/Landsat_Data_Policy.pdf)

month—an incredible statistic when considering that for the entire year of 2001 (when the previous record was set for data distribution) approximately 25,000 images were purchased.”<sup>50</sup>

In 2001, the year of highest downloads before 2008, nearly 20,000 scenes were taken at an average of 53 scenes per day. In 2011, over 2 million scenes were downloaded at an average of over 5,000 per day; a 100-fold increase. Clearly the interest in the data is very strong. See Figure 4-1 below.

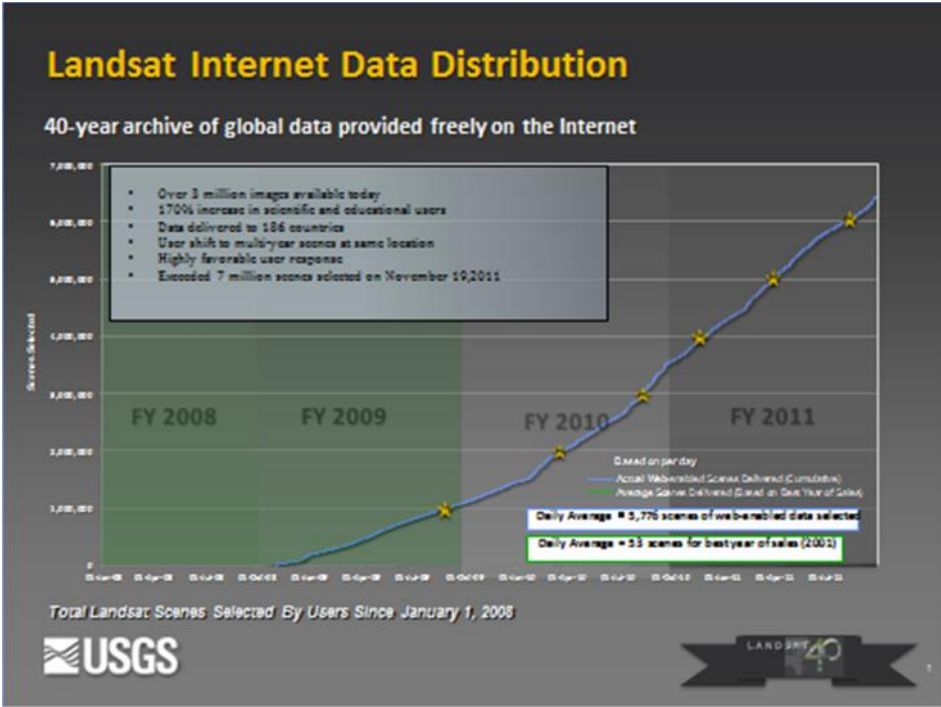


Figure 4-1: Landsat image downloads since 2008 (courtesy of USGS)

For a full history of the Landsat programme see [Wulder et al<sup>50</sup> and USGS<sup>54</sup>].

*Economic effects*

In paragraph 3.4 we saw a series of economic effects resulting from the opening up of PSI in the other domains. How do these compare to the Landsat case?

*i) Demand effect*

This dramatic increase in the use of the data corresponds with the findings in other domains seen in the sowing phase (see paragraph 3.4). As the charging policy is changed and data is made freely available, the interest increases by one or two orders of magnitude. There appears to be a definite read-across from other PSI domains to the EO domain.

*ii) Efficiency effect*

The efficiency effect is where the PSB no longer has the cost overhead of maintaining the resources needed to run the sales operation. In this respect, the USGS 2011 report says that “because the internet makes it possible for users to download images directly ... the bureau has realised savings including eliminating the billing and accounting system.”<sup>51</sup>

<sup>50</sup> Wulder, M.A., et al., Opening the archive: How free data has enabled the science and monitoring promise of Landsat, Remote Sensing of Environment (2012), doi:10.1016/j.rse.2012.01.010

<sup>51</sup> Landsat Fees, from the USGS website [http://remotesensing.usgs.gov/landsat\\_fees.php](http://remotesensing.usgs.gov/landsat_fees.php)

As in the other domains, the income realised by the USGS was very low and barely covered the cost of the sales system.

### *iii) Market dynamism effect*

The users of Landsat imagery especially in the private sector have always been very sensitive to the price demanded. Recall that in 1985, a single uncorrected Landsat scene cost \$4,400, in 2001 it would have been \$600 and today it is free. The 1986 annual report on Landsat sales reported that:

*“[T]he announcements in 1981, 1983 and 1985 that the prices would rise led to a roughly doubling of demand in the months preceding the increase and to a drop in sales to very low sales immediately following the increase<sup>52</sup>. [Furthermore,] in 1983 when prices tripled, government purchase revenues increased 5 fold whilst the value of private purchases fell by one third<sup>53</sup>.”*

Nevertheless, when the USGS made a survey of the users of the data in 2011, it found that *“on average, respondents were willing to pay \$760 per scene which is greater than the previously administratively set price.”<sup>54</sup>*

This apparently rather confusing and somewhat surprising result provides evidence of the sensitivity of entry barriers for commercial users. Since the majority of those downloading Landsat data are “public good users”, it follows that the largest drop is from the commercial sector. Charging creates too high an entry barrier and it is probably reasonable to conclude that the strongest impact falls on SMEs. Certainly, intuitively, this would be the case.

Furthermore, the USGS study<sup>54</sup> shows that it is the academic and federal government users that are willing to pay the highest prices. As these are the largest users, in the set-up where Landsat charges were made, most of the funds were simply circulating within government circles.

Cutting the charges spurs innovation and re-use and creates new markets for the information.

### *iv) Business effect.*

The strong surges in data downloads provide evidence that the data has value. Are there cases where users of the data can show improved business results? In the course of the study we spoke with two of the larger commercial users of Landsat data, the essence thereof is summarized below.

- MDA Federal is a private company and one of the largest users of Landsat data. They report that out of \$30m annual revenues, over \$10m are generated using Landsat data and that as a result of the policy change, they have recruited an additional 125 employees. Furthermore, whilst they used to have a business in correcting the data, this has been replaced by additional processing in the PSB. In other words, the PSB has moved forward in the value chain in a way that the industry approves of! It is also a great advantage for Landsat data that it is easy for users to download, partly helped by the enhanced degree of processing ensuring geo-location accuracy. This is an important point to return to because it is insufficient to just make data available free, it must also be easy to access. If it is not, all savings in data purchase go in to the time and effort needed to access the data.
- GDA Corporation is another company to report on the benefits derived from Landsat’s revised data policy. GDA Corp is a relatively young company, formed in 2002; it has about 10 employees. GDA offers a crop mapping service that is mainly used by federal and state

<sup>52</sup> Encouraging Private Investment in Space Activities; Report to the US Congress, 1991.

<sup>53</sup> USGS EROS data centre Annual report for Landsat sales 1987.

<sup>54</sup> The users, uses and value of Landsat and Other Moderate-Resolution Satellite Imagery in the United States; Miller et al. USGS 2011.

governments, particularly the US Department of Agriculture, Foreign Agriculture Service. Whilst unwilling to share revenue figures, GDA considers that the value of no-cost data is largely passed on to the customer through a cost saving of between \$1.5m and \$2m per annum.

According to USGS: “Access to readily available Landsat imagery has helped GDA to expand rapidly and serve agricultural, environmental, and resource management clients, some of whom were previously unaware of the tremendous value that Landsat data and its analysis can bring to their decision-making and ultimately their bottom line.”<sup>55</sup>

Hence, it would seem that the recent change in Landsat data re-use policy has acted as a strong enabler driving business that probably would not have existed without a free data policy. A recent paper<sup>56</sup> from the Landsat advisory group underlines the potential for public sector benefits. Ten application areas have been examined to give estimates of annual efficiency savings and are considered to produce savings of at least \$178m to \$235m per year for the Federal and State governments.

*b. EO data re-use in Europe*

Meanwhile, back in Europe, no situation compares with that for the US Landsat. Nevertheless, we take the opportunity to include relevant figures since these do show a picture of what was happening and have not been reported elsewhere. The closest comparison is with the SAR and MERIS sensors carried on ERS-1, ERS-2 and Envisat. These three satellites, launched and operated by ESA between 1990s and 2012, were subject to a policy of commercialisation from the outset. A regime was established that was similar to the US approach in the 1980s with one, and later two, companies awarded the rights to sell the data.

In 2000, before the launch of Envisat in 2002, 2 commercial “Distributing Entities” were established through competition. EMMA and SARCOM became responsible for the sales of ERS and Envisat data. The total for sales - number of scenes - is shown for each year in the Figure 4-2 below.

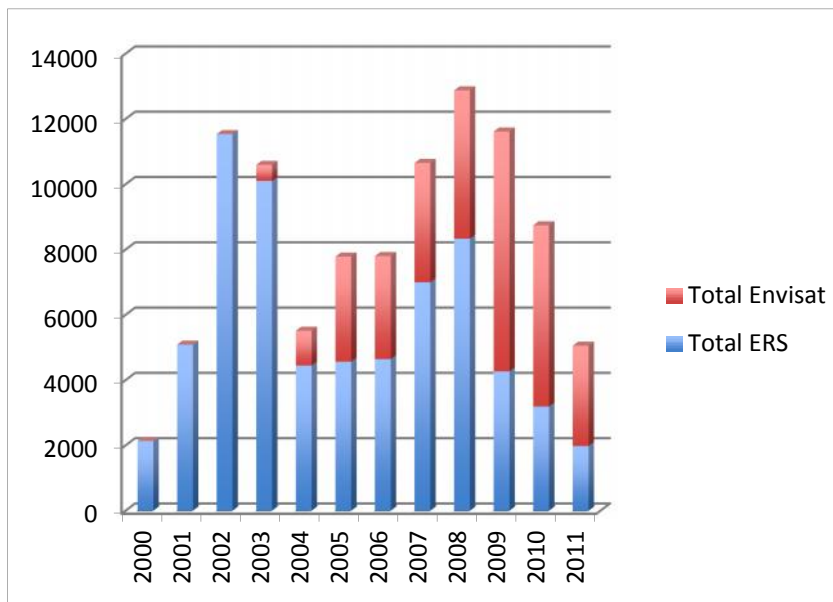


Figure 4-2: Total sales (number of scenes) of ERS and Envisat SAR data.

<sup>55</sup> Landsat adds tremendous value to decision-making and bottom line, USGS success story, [https://landsat.usgs.gov/Landsat\\_Stories.php](https://landsat.usgs.gov/Landsat_Stories.php)

<sup>56</sup> The Value Proposition for Ten Landsat Applications; Landsat Advisory Group, September 2012.



The peak in 2002 and 2003 is due to two exceptional bulk orders for ERS data. Further bulk orders pushed sales up in 2007 and 2008 leaving the core sales more or less flat until ERS-2 was decommissioned in mid-2011. Throughout the period, we see a steady rise in the sales of Envisat data. Envisat failed suddenly in April 2012.

Regarding pricing, in 2000 the distributors paid 150Euro per scene (for bulk orders) to ESA and this price was progressively reduced down to 12Euro in 2009. This pricing reflected both the reduced price for Landsat data as well as the reduced cost of distribution. Revenues to ESA peaked at around 500k in 2002/3 and fell to under 100k in 2011. In this case, there seems to be no clear trend as has been seen with Landsat.

However, in addition to commercial sales through the distributing entities, Envisat data was also distributed at a marginal cost to research users. As costs fell and the new Landsat data policy reduced prices, the cost of access to Envisat data was similarly reduced. This spurred interest and seems to have led to a consequent increase in demand as shown in Figure 4-3. Note that the figures are for projects using Envisat data and are not the number of scenes used. Hence these figures are not comparable with those for Landsat data.

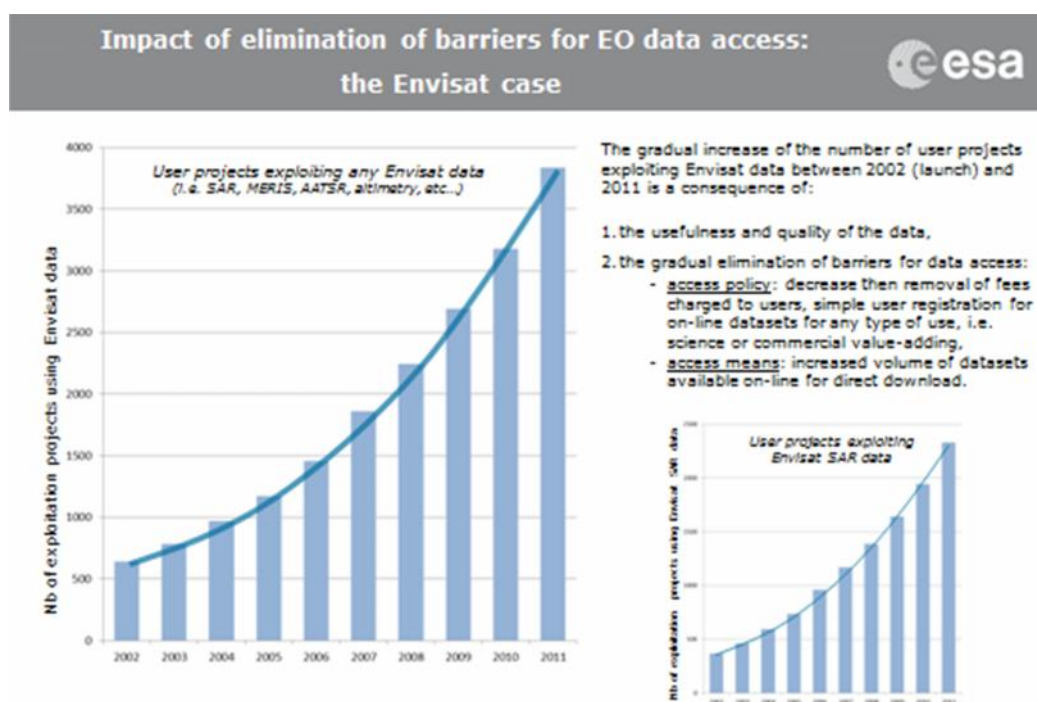


Figure 4-3: Elimination of barriers led to increase in data take-up for Envisat (courtesy of ESA)

Whilst less dramatic than is the case for Landsat, the uptake of Envisat data for user projects has increased by a factor of 7 to 8 driven by easier access – although it is not possible to separate the effects of technology change and data policy both of which played a role. Commercial sales have changed much less and we may well be seeing some of these moving to project based work where data costs were lower. Furthermore, there is no singular event, as in the case of the Landsat price policy change in 2008 that triggered a change in demand.

### c. National data portals

Further evidence is also building up at national level. At least two European Member States have recognised the benefits that can come from the re-use of EO data. We describe in [Annex 5](#), the cases

of Sweden and the Netherlands that have both created data portals containing sets of satellite data. In each case, satellite data was being purchased from private operators by one government department (but used by many more) before the decision was taken to make this same data freely available to any user, including other government departments.

Both portals contain image sets of national coverage and hence interest. Both are aimed at national users with the intention to stimulate local industry as well as public sector interest. Both require users to register a national address but in reality the checks are limited. Moreover, since both datasets have only national coverage, there is low interest for users coming from outside the country; this is not the case for GMES data, which will have global coverage.

Since the data was being purchased, the licencing conditions were re-negotiated with the suppliers, which involved some additional cost. Costs are covered by a consortium of public sector organisations, but in both cases with the participation of some industries. In the case of Sweden, the use of the data has increased dramatically by several 100-fold, where, over the longer time period, 2500 user accounts were reached in 2011.

In the Netherlands, where the policy change has been implemented just recently (March 2012), the interest is very clear with an average of five new accounts being created each week. This now adds up to around 250 accounts (with many more users behind that).

#### *d. Downstream business*

The value-adding (VA) sector in Europe has been estimated to have revenues of around €300m and a cumulative annual growth rate (CAGR) of 7% according to the last industry survey that was made in 2006<sup>57</sup>. New figures for the European market will be available after this report has been completed, but Euroconsult in their latest report<sup>58</sup> estimate a global figure of €1.4bn and a steady growth rate of 6–8% per annum. Projecting at this rate of growth from 2006 would lead us to estimate a European market for VA services of around €420m, i.e. approximately one-third of the global market.

How much of this market has been built based on the marginal-cost data from ESA? Not very much, according to the survey that EARSC carried out amongst its members on the occasion of a data policy workshop held during the AGM. The VA companies are more often using high resolution data from the commercial missions rather than the low or medium resolution data from the ESA missions (although it should be recognised that the recent Envisat failure has taken away an important data source for many).

However, there are some excellent examples of European companies making use of free data to build or support their commercial business. Two of these are described below.

- BMT-Argoss, a Dutch company, has built its business in metocean services around data coming from the US satellites: Landsat, Aquos and Terra, and from European satellites: Envisat, ERS and Jason, each of which makes imaging observations and provides the data free for online access. Many of the products and services offered are based on the free data access and the company has built a successful business on this basis, supplying products such as tidal heights and currents, wind and wave climate and bathymetry. Today this has resulted in a business with revenues close to €10m and over 120 employees in the Netherlands and UK. The CEO says that without free data, his business would look completely different.

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<sup>57</sup> The State and Health of the European and Canadian EO Service Industry; Vega, 2006.

<sup>58</sup> Satellite-Based Earth Observation, Market Prospects to 2012. Euroconsult, October 2012.

- The second interesting example is Enviros, a Czech subsidiary of a UK company. It offers services to investors in solar energy projects to provide an audit of the likely energy production and hence revenue potential for a site. Enviros makes use of a database put together originally by the Eumetsat SAF (the Satellite Applications Facility of the European Organisation for the Exploitation of Meteorological Satellites) for climate change research. A copy was purchased by the Joint Research Centre, the EC's in-house science service, a few years ago and re-processed into a database called PV-GIS (Photovoltaic Geographical Information System), providing information on solar illumination levels at the Earth's surface. The database was developed as a support tool for EU policy makers – so similar to GMES in many ways. The PV-GIS database was subsequently made available for external users on a free and open basis and has been picked up and used by a number of companies. In the period 2009 to 2011, Enviros has developed revenues of about €1.5m compared to annual turnover of €3.5m. Other companies have also used this database as the basis for business; for example, Geomodel (Slovakia) offer a range of consultancy services based on a derivative of PV-GIS and A2-C (Switzerland) offer a software tool called Evalo which is sold or licensed to companies as a promotional tool.

#### *Limited but growing evidence*

Although limited in size and evidential value, the cases appear to signal that freeing up EO data can lead to market development and business growth. It is certainly clear that the interest in the data is extremely high. As we saw above, the characteristics of GMES data, the market conditions and the policy setting are all highly favourable to reap fully the PSI re-use potential. This raises an obvious set of questions, such as: how high is this potential, what would it cost and when would it kick in. We shall examine this in more detail in the next paragraph.

### **4.3 Economic effects of free re-use of GMES data – an educated guess**

As seen in the previous paragraph, clearly, from a quantitative and statistical point of view, no reliable extrapolations can be made where solid figures are lacking, in particular within the GMES domain. Nevertheless, we can certainly try to come up with an educated guess as to **the basic developments**, as we are able to compare the effects coming from the cases described above in paragraph 4.2 with the more solid ones reported upon in chapter 3.

This being said, what are the basic developments?

#### *PSB 'losses' much lower*

First and foremost, and rather uniquely, the GMES re-use is not inhibited by any legacy. Thus, it can do things right, right from the start. Where other PSB domains suffer from being bogged down in the 'own-re-use, income-reliance trap' – preventing them from moving to free re-use models, as this would cause their immediate bankruptcy – GMES public data holders are not dependent on income from charging users (either from the public or private sector). Consequently, costs incurred or foregone incomes are relatively much lower, as they only comprise the costs for facilitating the re-use. Accordingly, the PSBs' accrued losses (represented by the plane in yellow) are much lower.

#### *SMEs decisive for market development*

Although less spectacular than in some other PSI domains (as in meteo), demand increases shown by the Landsat and the Dutch and Swedish NSO cases indicate an exponential surge in volumes as well as numbers of users.

Looking more closely at the character of the new users, it is very likely that, even to a higher extent than in other PSI domains, SMEs will be highly represented, as the EO services sector is dominated by SMEs. The last industry survey in 2006 showed less than 9% of companies in this domain have more than 60 employees. EARSC is about to conduct a new survey and has identified over 250 companies

believed to be active in the sector. Today, no more than five or six companies in Europe would have more than 250 employees or revenues over €50m, the cut-off definition for an SME under international rules, making it likely that at least 90% of the companies active in this domain qualify as SMEs<sup>59</sup>.

This is important as many studies have shown that it is through SMEs that the majority of new jobs are created. For example Kane 2010<sup>60</sup> shows that start-ups in the US are responsible for creating most net new jobs. Further, Koski<sup>61</sup> shows empirically that in certain countries and certain sectors (architecture and engineering firms) the availability of marginal cost geographic information (GI) increases growth by 15% per annum compared to countries which do not make their PSI available for re-use.

#### *Low entry barriers sparks innovation*

Technical universities throughout Europe establish a strong knowledge infrastructure, where many future entrepreneurs are currently conducting academic and applied research. On opening up GMES data, this nursery of talent will create an interesting cocktail of capable people and market opportunities. This will particularly apply to applications of GMES data where the free availability of data will attract high potentials, as the entry barriers are relatively low: brains, will power, a computer and data (almost) come for free, and mobile devices allow for low-cost distribution of digital information.

#### *High dynamism and value feature steep curves*

Put together, low entry barriers and high concentration of SMEs explain the movement of the purple curve, displaying the benefits of the private sector: demand will increase rapidly in the beginning, but will soon level out to a steady growth. Market dynamism effects will kick-in at the end of the growing phase where successful start-ups are maturing and new staff are being hired.

This is also reflected in the steep rise of the private sector benefits in the harvesting phase, where successful start-ups will flourish swiftly and are likely to be acquired by the big players on the basis of potential rather than current performance, boosting economic value and allowing for an attractive way out for the founders, often allowing them to become start-ups again after an earn-out period. This is mirrored by the 'second sowing phase' and the cyclic shape of the curves.

#### *Speed of effects*

Another important difference with the other PSI domains is the expected speed of effects. It seems likely that the phases are shorter, where the subsequent effects are strongly inter-related and follow each other quite swiftly. Again, this is a result of low entry barriers and people willing to take risks, relying on lessons learned from trial and error rather than neatly planned and tested campaigns. Where in other PSI domains time lags in effects have been reported amounting to one or two years (Pollock and Koski – see [Annex 4](#)), it seems reasonable to assume that for EO data this will be shorter, possibly (0.5 – 1 year). Accordingly, one can expect the first real economic benefits to materialize in the growing phase after a short time.

#### *Taxation effects start early but slowly*

Obviously, where the costs of the PSBs is limited to the re-use facilitation costs, not having to cover up for the lost revenues resulting from free data re-use, the positive taxation effects kick in much earlier, requiring almost no transitory funding. After a relatively slow growth, the returns for the

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<sup>59</sup> Whilst the large majority of EO service companies are SMEs in terms of employee and revenue numbers, they do not qualify as SME's under European rules as they are often owned by larger companies. However, the nature of the sector means that they operate with a large degree of independence.

<sup>60</sup> The Importance of Start-ups in Job Creation and Job Destruction, Tim Kane, Kauffman Foundation, July 2010

<sup>61</sup> Does marginal cost pricing of PSI spur firm growth?; Heli Koski, ETLA, September 2011.

treasury go up steeply (presented by the green plane) as VAT, profit taxes and social security taxes flow in.

Putting everything together, Figure 4-4 depicts the likely effects for the GMES domain. Obviously, it should be kept in mind that this is a guesstimate and, it would require more in-depth measurements – going beyond the objectives of this study – to acquire solid estimates on the economic effects likely to kick in following an unconditional and long-term adoption of a free data re-use policy in the GMES domain.

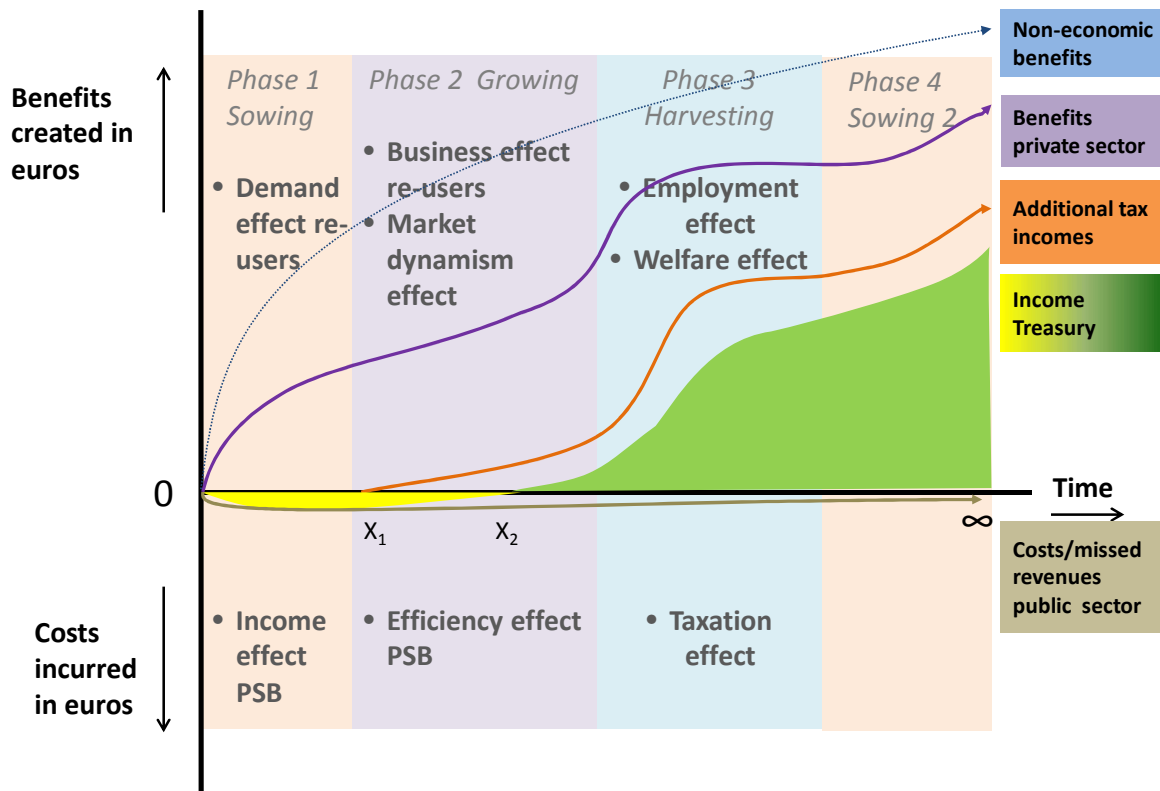


Figure 4-4: Chart of guesstimated benefits in the GMES domain

#### 4.4 Wrap up

Hard facts and voluminous figures on the economic effects of freeing re-use of EO data are missing. However, based on the few cases reported, there are good reasons to assume that the effects seen in other PSI domain, as described in this chapter, will emerge from the free provision of GMES data.

Indeed, there are good grounds to believe that the specific characteristics of the GMES domain (type of PSI, type of market), will turn data from the GMES into a show case for free re-use, as it is not hampered by any financing legacies and combines a powerful combination of a strong academic knowledge base, low entry barriers, a large potential of entrepreneurs and low-risk high-return market circumstances. The eggs laid by the GMES “goose” may indeed be golden.

Of course the next question is: how to realize this dormant potential? That is addressed in the last chapter, which holds our conclusions and recommendations.

## 5 THE CONSEQUENCES – THE WAY AHEAD, HOW TO MAKE IT WORK?

### 5.1 Introduction

Having examined the evidence from the other domains and compared this to the EO domain, there are a number of lessons and conclusions that can be drawn for GMES data. We therefore take a look at some of the implications of a free and open data policy, which feed in to the recommendations made in paragraph 5.3.

### 5.2 Further considerations

A free and open policy for GMES data and information will offer the best possibility to grow the market for EO services. Nevertheless, there are some possible implications.

#### *Risk to private operators*

For commercial data suppliers, there is no doubt that free data coming from the Sentinels will have an impact on their business models. As we have seen, the resolution of the imagery from the Sentinels is medium resolution (10m and above) whilst the commercial operators are mainly offering a better resolution (better than 5m). There is, however, some overlap with some suppliers and also a risk that some users will accept an information product with a slightly lower resolution if it is cheaper than one based on commercial imagery. Hence, these two aspects represent a threat to some operators.

This threat is somewhat counterbalanced. Firstly, the expectation is that access to the GMES data will lead to an increase in the total market for EO services. The use of Sentinel data should also stimulate the use of commercial data; greater awareness should ensure that the whole market increases in size, allowing the incumbent players to piggyback on this beneficial development. Secondly, some GMES services will require higher resolution data. In this respect, the commercial missions become contributing missions and data will be purchased to meet GMES needs. If the data license holders acquire full re-use rights they would be able to allow full re-use of this acquired PSI. More realistically if the budget is insufficient such that only partial re-use rights are obtained, the residual rights must be dealt with appropriately. Other measures may be foreseen to help limit the impact on more vulnerable operators.

#### *PSI for global or European re-use?*

Then there is the question of whether the GMES data and information should be made available globally or just for European users? Some countries, notably the US and Brazil, have taken the decision to allow anyone to simply register and have access to the data. Data and information sharing within GEOSS (Global Earth Observation System of Systems) will further encourage this trend. The EU, as a major international partner, wishes to take the lead by making data freely available on a global basis.

Where European taxpayers' money has been relied upon to produce the GMES data and where the financing from the State budget is aimed at creating economic and social benefits within Europe through advantageous access and re-use schemes, these (competitive) advantages would be watered down if non-European entities were allowed the same terms. Of course, such exercise of IPRs creates red tape and overheads, whereas, from a purely economic perspective – as we saw in chapter 2 – provision of data against marginal (or no) costs would make most sense. However, from an EU trade policy perspective, bargaining would lead to an agreement that is mutually and reciprocally

beneficial, allowing any world citizen to (freely) re-use satellite data, including those produced by non-EU countries.

Furthermore, it must be remembered that Europe and the US have pursued a policy of public-private partnership. As discussed above, commercial firms have invested alone or alongside national governments to develop and launch high resolution satellite systems. We recommend that a clear understanding should be developed regarding the specification of any future public systems so as not to undermine any of the commercial business models. Such an agreement needs to be recognised internationally as well or there could be more confusion in the commercial market, further inhibiting any future private investment.

Thus there is a clear and highly important role for the European Commission to promote the broad European interests coming from GMES. Firstly, using diplomatic negotiations to ensure that the value of the data being made available, paid for by the European taxpayer, is exploited to the maximum and to be certain that other countries using the data are fully cognisant of the value of the resource to which they are being given access. Secondly, to develop real economic value through supporting European industry to gain access to markets arising from the investments being made.

#### *Are the business models fixed?*

Whilst the public sector has a responsibility to ensure that the information is available, it is not always charged with producing the information itself. Much PSI generation is outsourced, and it is important not to confuse these two roles. We showed earlier that some boundaries change - in both directions. For TomTom, supplier of location and navigation products and services, the boundary for generating and distributing traffic information has moved from within the public sector into the private sector. For Landsat, the operations of the satellite and the geo-correction of imagery have moved from the private sector back into the public sector.

That the boundaries can move is healthy and should be reviewed on a regular basis to see if a better optimisation is possible. However, there should be some agreement regarding changes and for maximum commercial exploitation it is necessary that these changes are planned and transparent in order that investment is not discouraged. This necessitates a close and sustained dialogue between public and private representatives.

#### *International organisations*

As an EU programme, several international organisations have a role to play in an operational system for GMES. ESA and Eumetsat will operate the Sentinel satellites whilst ECMWF (European Centre for Medium-Range Weather Forecasts) will be a leading player in the atmosphere and climate services. All of these agencies are formed under international rather than EU treaties which has implications when it comes to implementing a coherent data policy.

In other information services, the European Environment Agency (EEA) may take the lead for the land monitoring task, EMSA has a principle role to play in some of the marine and security services, and the EU satellite centre could lead other security services.

### **5.3 Policy implications**

#### **Towards a clearly defined and harmonized European data re-use policy for GMES**

We have shown that the data and information coming from GMES Sentinels are collected and paid for by the public sector in the process of exercising its public task. Accordingly, it clearly qualifies as PSI, in fact as *re-useable PSI par excellence*. Therefore, it should be recognised as such by the EC in the context of the on-going review of the PSI Directive. This would then also be recognised in the GMES data and information policy to be in-line with the PSI Directive.

The PSI nature of other data and information gathered under GMES shall also need to be taken into account according to the different types:

- GMES Sentinel data as PSI fully paid for and owned by the public sector
- GMES contributing missions with residual rights according to the data licences agreed with each supplier

Several European agencies operating under international treaties (non-EU) are concerned in the GMES programme. They should follow the overall policy applied to the GMES data and information. The EC will need to clarify the roles of all GMES partners and monitor their application.

*Recommendation 1: The nature and potential of GMES data and information should be recognised within the review of the PSI Directive and within the GMES data policy to be adopted in the near future for the different data and information types.*

### **Towards clear demarcation of public task responsibilities and private sector market domain**

In other PSI domains the presence of PSBs selling in the open market has inhibited the business of commercial operations. The most marked example is meteorology. In the EO/GMES domain the PSBs have less history in the commercial market even though they sometimes compete with the private sector.

Successful exploitation requires the development of products and services that can be taken into other markets. The necessary competences must be developed and remain within industry. European PSBs should focus on the use of the products and work together with industry to ensure that the home market is a reference for exploitation in exports. The market for PSI re-use has been successful in the US where the roles of public bodies are more clearly defined. Meteorology provides the best example.

At the same time, many of the GMES services are generated in teams comprising a mix of both public and private entities. There are signs that public entities seek to maintain their roles despite services moving from research to operational status. This could be because the institutes concerned fear a lack of long-term, stable research funds and seek to secure their future through operational funds.

In all areas of GMES the roles and responsibilities of the public and private sectors need to be addressed. There should be well-defined boundaries between public and private tasks. If industry is to invest in product or market development it can only do so with clarity over the boundaries between public and private sector roles. Whilst public-private working together is good, this relationship must be built upon the appropriate relationships where both parties can see a stable future.

The key question is where the competences and key tools are to be developed and maintained. Where necessary skills exist in the public sector, these can best be used by industry if there is an agreement to a long-term commitment that they will be sustained. Otherwise the goal should be for PSBs acting as agents of government with services procured from the private sector. This would allow the PSB to allow re-use of the information whilst industry has the skills, competences and capacity to exploit the knowledge and data in other markets.

*Recommendation 2: Ensure clarity of the role of public sector bodies within GMES based on a long-term and stable arrangement.*



### **Towards an open and responsive governance model**

The governance of GMES is still an open issue. Industry currently has no formal voice in the governance of GMES. As new products and services are requested by the public sector, the way in which these are brought to market should be agreed by all parties. The public sector may wish to have a new service developed and run under a GMES brand. This may be the appropriate way to engage industry but companies may also prefer to invest themselves in order to gain a better position in the market (faster entry, return on investment, etc.).

A stable, transparent and clear governance of GMES is necessary to ensure the appropriate long-term conditions are provided to underpin investment decisions. Such a structure should also act to ensure that the needs of European public sector users are met by federating demand, ensuring quality of service and maintaining the necessary long-term relationships between other PSBs and industry.

*Recommendation 3: The dialogue between public and private sectors should be fortified to ensure that industry's voice is heard. As a key player, industry must have a voice in the governance of GMES.*

### **Towards mitigation of collateral damage to private business models**

The availability of free GMES Sentinel data will have an impact on the market for EO data coming from existing private operators even though these mainly provide data at higher resolutions than that of the Sentinels. Some substitution of data can be expected as some users will choose to accept a poorer product (i.e. lower resolution) but at lower cost (based on zero cost data). This will be offset by two mechanisms: the increase in the overall size of the EO market and direct sales for GMES products. Nevertheless, some care must be taken to ensure that commercial business models are not undermined as a result of the public activity. This must include an understood and agreed demarcation between the specification (notably resolution) for future public missions including those that are subject to international agreements (see recommendation 8).

*Recommendation 4: Ensure adequate measures are taken to protect the investments of private companies in commercial satellite systems.*

### **Towards maximizing synergies between GMES data and European R&D policies**

GMES provides an excellent opportunity to develop a world-leading European industry. The large volumes of data will open the possibility for new products and services. By lowering the entry barriers to new companies, a free data policy will stimulate innovation and creativity through the value chain. It is therefore essential that Europe continues to invest in research and development (R&D) both to ensure that this innovation and creativity can be applied to public-sector needs and to provide the industry with the means to address globally issues that lead to export success. With appropriate public sector support, there is no fundamental reason why Europe's industry cannot take a strong lead in this business area.

*Recommendation 5: Ensure adequate R&D funding is available for industry at both the national and European levels.*

### **Towards catalysing the full benefits of SME potential**

The EO services sector, which will be the primary motor for the exploitation of GMES, is dominated by SMEs complemented by a few large players. This makes for a very dynamic and exciting sector where entry barriers are very low and researchers or entrepreneurs can easily establish a new

product or service. At the same time, the few larger players provide channels that can help exploit new export opportunities and that also provide easy exit opportunities if the business idea becomes successful. If tackled correctly, the stimulus of a micro-environment of start-ups and young SMEs as a consequence of a specific public programme could become a showcase for good public policy.

*Recommendation 6: In a dialogue with industry, look for specific measures that can be taken to help develop and sustain start-ups and SMEs in the EO services sector.*

### **Towards common standards, driving economic growth in Europe and beyond**

A proven way to help European industry establish itself as a global leader is to establish a set of product standards that can become accepted world-wide. In addition, the use of these products in the European “home” market is an essential reference for selling elsewhere.

Standards exist for data formats and for processes, and *Inspire* provides a European framework for many geographic information products. But today no certification scheme or product standards exist for the products that are generated by the EO geo-information services industries. As the industry moves from being R&D-based to an operational one, some of the more commonly generated products could be defined in a standard way. Indeed, in certain commercial sectors, customers are starting to call for standards for certain operational products.

Since free data lowers the entry barriers for everyone, there is a risk of low quality products being made available; this can damage the market. Consequently, a scheme to help European companies develop a quality image and a professional industry should be encouraged.

*Recommendation 7: European policy makers should work with industry to establish a comprehensive and recognised set of standards for GMES products and services.*

### **Towards a reciprocal external data policy**

Should the GMES data and information only be free to European users or should the policy be extended globally? The issue provokes strongly differing opinions. Whichever policy is adopted, the goal should be to develop maximum economic benefit for the European taxpayer.

In the domain of navigation services, free access to GPS signals, excepting specialised services, e.g. security, has been the favoured policy from the outset. The result has been a rapidly expanding market for downstream services which has been exploited by industry throughout the world. Today, the market for geo-location services is estimated at around €90bn.

If a free and open data policy will help develop the market for EO services in Europe this is equally true in other parts of the world. GMES Sentinel data is global in nature and could be made available to global users hence promoting the image of Europe as a global leader. However, this could enable non-European companies to gain a competitive advantage unless European industry (and indeed public institutions) can also have free access to data coming from other national or regional satellite systems.

Hence, reciprocity is sought with other national satellite operators backed up by two measures:

1. A framework of international agreements that ensure reciprocal access to international datasets and that include a limitation on the performance of future satellites included in the policy.
2. Technical controls that can be applied if other nations abuse the free data policy.

*Recommendation 8: If the EC and ESA make GMES Sentinel data freely available to global users, full access to international datasets must be assured on a reciprocal basis for European users through international agreements and backed by technical security barriers to control access.*

### **Towards maximising the economic returns**

Industry is the motor by which economic returns can be realised. Many of the economic benefits flow into the public sector and industry needs to learn how to capture these and apply the knowledge into other markets; especially exporting outside of Europe.

To achieve this requires a special form of public-private partnership whereby the public sector and industry work together to develop, deliver and sustain new information services. Industry needs to be able to understand the mechanisms and drivers whereby geo-spatial information is turned into societal value. The public sector needs to understand the issues faced by the European industry in a global competition and to be ready to help overcome the international barriers to business. GMES provides an excellent opportunity to develop this partnership given the very strong public role in its gestation, development, operations and most importantly its exploitation.

*Recommendation 9: Industry and the public sector to work together to establish a new partnership to ensure that the fruits of GMES public investments lead to a world-beating European industry.*

## **5.4 Final observations**

This study has brought together the two different worlds of PSI re-use and GMES and it seems that each has something to learn from the other.

GMES has a long history of gestation. Since the Baveno Manifesto first described the needs of the EU, the idea has developed considerably but has yet to become reality. The first satellites are almost ready for launch but continued discussions over funding are still delaying the entry into service. This study will hopefully help to bring some additional support by showing how by applying the economic laws and legal principles surrounding PSI re-use the data and information that will be generated in the GMES domain to meet public needs can also lead to substantial socio-economic benefits in due course at low cost.

PSI re-use is a policy to free up public data collected by governments in the course of fulfilling their duties. The policy has recognised neither GMES nor EO data more widely as coming under its scope. The new Directive planned for 2013 could be an opportunity to change this.

GMES seems to be a perfect type of PSI where there is a clear subsequent second value: it serves the public needs in the framework of the public task and it allows for re-users, SMEs with potential to create innovative new products and new jobs. The evidence coming from other domains suggests that the lack of legacy organisations and the dynamics of the industry offer good prospects for new products and services to be developed. In fact, GMES data appears to represent one of the strongest business cases for a free re-use policy, where returns for the private sector (innovation and increased turnover), the public sector (more efficiency, higher tax returns and more effective policy making) and the European citizen (more employment, better services, better quality of life) are so eminent.

The evidence, albeit being short on quantitative data, when put into the context of evidence from other PSI domains, appears to be quite convincing and provides us with a number of lessons learned. These are translated into a number of policy recommendations of a fairly high level of aggregation.

Obviously, where more detailed and specific (market) knowledge would allow for more tailor-made decision making (in terms of scope, focus, phasing, also taking into account the supra EU dimension), there appears to be a strong business case for further economic research to beef up the quantitative basis. This would have the additional benefit of providing a sound base for measuring the success of the policy in the future.

Furthermore, the various policy recommendations that are made will need to be expanded and worked upon. Responsibility for implementing them, if they are accepted by the broad community and especially the political decision makers, will fall with various bodies and institutions. We look forward to working wherever necessary to refine, define and implement those policies that can help the industry in Europe develop into a first class supplier for the public sector and an excellent and successful exploitation of GMES data and information in other markets.

We now look forward to presenting the results of this study to political influencers and decision makers coming from both communities; PSI re-use and GMES. In so doing, we hope to re-enforce the messages concerning the benefits that GMES can provide to Europe, its industry and all its citizens!

## ANNEX 1 – ABOUT THE AUTHORS



*Geoff Sawyer, BSc (Electronics), MBA*

Geoff has held senior management positions in the space industry and numerous representative positions in the UK and Europe. Geoff was the radar systems engineer responsible for the ERS-1 synthetic aperture radar and after many steps was, until recently, EADS Vice President Corporate Strategist for Space. In addition to his extensive industrial experience, Geoff spent three years working for the European Commission where he was responsible for supporting the creation of the GMES initiative. Geoff is very well known in the space and earth observation sectors and brings his depth of knowledge and wealth of experience as *Secretary General of EARSC* to support the ambitions of the geo-information industry that EARSC represents.  
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*Marc de Vries, BSc EC, LL.M*

Marc has professional degrees in both law and economics (Utrecht 1991). He has been active in the field of PSI re-use for more than 15 years, both at the national and European levels. In 2001 he started his own business under the name 'Citadel Consulting'. Having served clients in the public and private sectors in the Netherlands and beyond (EC institutions in particular), Marc has a wide network of contacts and is frequently invited to speak at conferences as a subject matter expert. He has published various books and articles on PSI, highlighting the legal, economic and policy perspectives.  
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## ANNEX 2 – ABBREVIATIONS AND SEMANTICS

Throughout this study numerous key terms are used. Grasping their exact meaning from the outset is essential. Obviously, where possible, we rely on existing and accepted definitions from authoritative sources. The key terms (in alphabetical order):

Term	Meaning (and reference to source where possible)
Data	All data that is generated by a PSB directly from exercising its public task. Thus, any data (and its value) that is added outside the framework of the public task is excluded.
Earth Observation (EO)	The term is generally applied to non-defence surveillance of the Earth's surface using satellites and other sensors. It is used to describe the monitoring of the natural and built environment and to provide information leading to human intervention.
EO Data	Data coming directly from the satellites or other sensors.
Global Monitoring for Environment and Security (GMES)	A European programme to develop a system including satellites to collect information necessary for European policy makers to take informed decisions. The <a href="#">EO</a> data collected will be turned into information on environment and climate change, natural resource management and security of the citizens in particular mitigation of the impacts of natural disasters as well as many other policy areas.
EO Information	The product of subjecting EO Data to processing often in combination with data from other sources e.g. in-situ data.
PSI charging model: Cost recovery	“Setting a price equal to average long-run costs (including, for example, all fixed costs related to data production).” (‘The Economics of Public Sector Information’, Cambridge Report 2008)
PSI charging model: Marginal cost	“Setting a price equal to the marginal cost of supplying data (that is, simply the cost of actually transmitting the data to someone).” (‘The Economics of Public Sector Information’, Cambridge Report 2008)  The digital nature of many forms of PSI implies marginal costs of approximately zero.
PSI charging model: Partial cost recovery	Setting a price lower than average long-run costs and higher than the marginal cost of supplying data. Sub-category: Re-use facilitation cost recovery Setting a price equal to average long-run re-use facilitation costs.  Re-use facilitation costs correspond to all additional costs incurred by a PSB to enable and facilitate re-use of PSI. These costs notably include costs for data transfer to re-users (such as servers), anonymization, data re-formatting for re-users and re-user helpdesks. The collection and processing of the data within the public task is not included in the re-use facilitation costs.
PSI charging model: Profit maximization	“Setting a price to maximize profit given the demand faced by the PSB. Where the product being supplied does not face competition then this will naturally result in monopoly pricing.” (‘The Economics of Public Sector Information’, Cambridge Report 2008)
PSI charging model: Zero cost	“Setting a price equal to zero.” (‘The Economics of Public Sector Information’, Cambridge Report 2008)
Public sector body (PSB)	“A State, regional or local authorities, bodies governed by public law and associations formed by one or several such authorities or one or

	several such bodies governed by public law.” (Art. 2(1) Directive 2003/98/EC)
Public sector information (PSI)	"[E]xisting documents (holding content, whatever its medium and any part of such content) held by PSBs of the EU Member States." (Art. 1(1) j-o 2(3) Directive 2003/98/EC)
Public task	<p>Setting the scope of the public task (and its financing) is a political decision taken at the national level (not the European level). Nevertheless, to determine the public task, some thumb rules apply:</p> <p>PSI is produced under the public task if:</p> <ol style="list-style-type: none"> <li>the PSI is the result of the <i>legal regime</i> under which the PSB works. Example: all constitutions assign the task of producing court decisions to national courts; hence, their case law is produced under the public task and falls under the PSI Directive.</li> <li>the production, processing, or distribution of the PSI falls under the <i>core business</i> and responsibility of the PSB. Example: the sole reason for setting up the Dutch Chamber of Commerce was to maintain the Dutch business registers; hence, those registers are produced under the public task and fall under the PSI Directive.</li> <li>there is a strong <i>public interest</i> involved in the production, processing, or distribution of the PSI concerned, whereby society at large benefits (i.e. the benefits do not accrue to just a small group of people). Example: maintaining the quality of cadastral data is key as, otherwise, there would be even higher risks involved in buying property (i.e. the buyer might risk paying money to a person other than the real property owner). Therefore, producing cadastral information is done under the public task and falls under the PSI Directive.</li> <li>without the engagement of the government, the PSI would not be produced because of <i>market failure</i>, i.e. the market would not be able or willing to perform this task. Example: the private sector cannot afford to build and launch the weather satellites required to gather meteorological data. Therefore, national meteorological services undertake these activities, which are regarded as falling under the public task. Thus, the output falls under the PSI Directive.</li> </ol>
Re-use	<p>Any use of PSI outside the public task including use by the PSBs themselves (including the PSB that has produced the PSI under its public task).</p> <p>“Use by persons or legal entities of documents held by public sector bodies, for commercial or non-commercial purposes other than the initial purpose within the public task for which the documents were produced. Exchange of documents between public sector bodies purely in pursuit of their public tasks does not constitute re-use.” (Art. 2(4) Directive 2003/98/EC)</p>
Sentinels	A system of five satellites being developed by the European Space Agency, which will be used to provide <a href="#">EO</a> data for <a href="#">GMES</a> .

## ANNEX 3 – SNAPSHOTS OF THE ‘OLD’ AND ‘NEW’ PSI DIRECTIVE

### A. The 2003 PSI Directive

The [Directive](#) stems from [the Green Paper on PSI](#) (1998) and a subsequent [Communication](#) (2001). It was adopted on 17 November 2003 and published in the Official Journal L345/90 of 31 December 2003.

The Directive is addressed to all Member States and, under the principles of European law, imposes the obligation to implement the rules therein ultimately by 1 July 2005. Although only four Member States managed to meet the implementation deadline, all have now put the framework in place in their national legislations. The Directive has four main objectives: (1) to stimulate the further development of a European market for PSI-based services; (2) to enhance the cross-border use and application of PSI in business processes, including publishing; (3) to fortify competition in the internal market; and (4) to address divergence as to re-use rules between Member States (as this will impede meeting the stated objectives). The Directive allows Member States to implement measures going beyond its minimum standards, thus allowing for more extensive re-use (which we now see happening in quite a few Member States).

The Directive consists of 25 recitals, and 5 chapters subdivided into 14 provisions. In essence, it imposes obligations on Member States’ public sector bodies (PSBs) once they decide to allow re-use of their PSI (Article 3) and provides corresponding rights to re-users thereof. Classic internal market principles of fair competition and transparency are the main building blocks of the Directive. Article 2 holds definitions of the key concepts such as ‘documents’, ‘PSBs’ and ‘re-users’. Furthermore, it connects to existing terms in other legal frameworks, such as ‘personal data’ and ‘services of general economic interest’. Its area of application (Article 1) is mainly set by the term ‘public task’, under which documents need to be supplied to be potentially subject to the re-use rules, and by some exemptions related to the other interests connected to the PSI (e.g. absence of access rights or presence of third-party intellectual property rights) or types of business of PSI holders (e.g. public broadcasters, or educational, research and cultural establishments).

Once PSBs allow for re-use of their PSI, the Directive imposes obligations on how to deal with requests for re-use and redress (Article 4), and the practicalities of making documents available, for example, formats (Article 5) and accessibility (Article 9). Transparency of conditions of re-use and tariffs are addressed in Articles 7, 8 and 6, the latter establishing an upper limit for charging, based on costs incurred to produce the information, together with a reasonable return on investment. However, lower charges (or no charges at all) can be applied and upon request, PSBs have to indicate the calculation base for the charges. Where licences are imposed, they should never restrict competition. This principle is elaborated upon in Article 10, which obliges PSBs to apply equal conditions to comparable types of re-use, including their own commercial re-use activities (to avoid cross-subsidies), and Article 11, which bans exclusive PSI re-use deals between PSBs and re-users (with an exception for those necessary for the provision of a service in the public interest). Finally, the Directive also provides for regular reviews of its application to be conducted. As foreseen in Article 13, the first one was carried out in 2009, whereby the EC decided not to make any amendments but rather to monitor the sound application of the Directive and to initiate a subsequent review in 2011.



## B. The 2011 Proposal for a new PSI Directive

Following the 2011 review, in December 2011, EC Commissioner Ms Neelie Kroes launched the Digital Agenda for Europe and the Europe 2020 strategy that aims for smart, sustainable and inclusive growth. The proposal for a new PSI Directive forms an essential part hereof.

The line of reasoning is that since 2003 — when the first PSI Directive was adopted — the amount of data in the world, including public data, has exploded and we are witnessing a continuous revolution in technologies. Accordingly, the rules adopted in 2003 can no longer keep pace with the rapid changes. Therefore, the proposal seeks to provide the market with an optimal legal framework to stimulate the digital content market for PSI-based products and services, including its cross-border dimension, and to prevent distortions of competition on the EU market for the re-use of PSI, by eliminating persistent and emerging differences between Member States in their exploitation of PSI, which hamper realisation of the full economic potential of this resource.

The main relevant changes concern:

### *Access = re-use*

Under the 2003 Directive, the decision of whether or not to authorise re-use remains with the Member States or the public sector body concerned. The new proposal holds a clear obligation for Member States to make all generally available documents re-usable.

### *Accessibility on an INSPIRED basis*

To facilitate re-use, public sector bodies should make documents available through machine-readable formats and together with their metadata, where possible and appropriate, in a format that ensures interoperability. For example, by processing PSI in a way consistent with the principles governing requirements under the INSPIRE Directive.

### *Charging against marginal costs as a rule*

Where charges are made for the re-use of documents, they should in principle be limited to the marginal costs incurred for their reproduction and dissemination, unless exceptionally justified according to objective, transparent and verifiable criteria. This exception could apply to those public sector bodies that would go out of business when implementing the marginal charges regime, as they cover a substantial part of their operating costs from the exploitation of their PSI. The burden of proving that charges are cost-oriented and within relevant limits should lie with the PSB.

### *PSI re-use watch dog brought in*






Redress is being made easier as Member States will need to appoint an independent authority that is vested with specific regulatory powers regarding the re-use of public sector information and to whom re-users can turn in case of denial of requests for re-use. Its decisions are to be binding upon the public sector body concerned.

### *Enhanced EC monitoring and guidance*



Finally, the EC intends to ensure that the Member States will report on the extent of the re-use of PSI, the conditions under which it is made available and the work of the independent authority. Furthermore, it may give guidance to Member States as to implementation of the Directive in a consistent manner, particularly on charging and calculation of costs, on recommended licensing conditions and on formats, after consulting interested parties.



## ANNEX 4 – STRUCTURED SUMMARIES OF CASE STUDIES








### Trading funds study



 <b>Models of Public Sector Information Provision via Trading Funds</b>    	
<i>Introduction</i>	This summary is based on the study ' <i>Models of Public Sector Information Provision via Trading Funds</i> ' by <b>Newbery, Bently and Pollock</b> , commissioned by the United Kingdom's Department for Business, Enterprise and Regulatory Reform and HM Treasury. The study uses mathematical analysis.
<i>Context</i>	<ul style="list-style-type: none"> <li>– The study provides estimates for the costs and benefits of marginal cost pricing in relation to bulk, digital PSI data from the Met Office, Ordnance Survey, the UK Hydrographic Office, the Land Registry, Companies House and the Driver Vehicle Licensing Agency (DVLA).</li> <li>– The study uses prior experiences of agencies adopting marginal cost pricing.</li> </ul>
<i>Key findings</i>	<ul style="list-style-type: none"> <li>– Elasticity of demand varies depending on the PSI, but for the products associated with the PSI, average elasticity was estimated at between 1 and 2.</li> <li>– The average time delay for the effects to take place is 1.5 years.</li> <li>– Overall welfare increases when marginal cost pricing models are used:               <ul style="list-style-type: none"> <li>○ <b>By Companies House</b> for CD ROM and bulk data and image products: estimated net welfare gain is around €2.3m.</li> <li>○ <b>By the Met Office</b> for wholesale products net welfare gain of €1.3m, with investment returns of approximately 500%.</li> <li>○ <b>By Ordnance Survey</b> for large-scale topographic and transport network products: estimated net welfare gain is around €194m. Estimated £85m cost to government would be reduced by increased tax income and introduction of a subsidy to spread costs across departments.</li> <li>○ By the <b>Hydrological Office</b> for digital UK charts, digital publications and licensing products: estimated net welfare gain is around €429,000.</li> <li>○ By the <b>Land Registry</b> for property price data and polygon geographic information system data: estimated net welfare gain is €1.5m. Due to the limited amount of information, no figures were estimated for bulk data downloads, but significant overall welfare gains were estimated.</li> <li>○ By the <b>DVLA</b> for anonymised, bulk data and mileage data: estimated net welfare gain is around €4.6m. The relative inelasticity of demand for registrations may permit financing from increased registration fees.</li> </ul> </li> <li>– Registration-based entities may be able to make up revenue losses through changes to registration charging policy. Non-registration-based entities would require additional government funding.</li> <li>– The establishment of an adequate regulatory regime is of crucial importance.</li> </ul>
<i>PSI domain</i>	Company register, land registry, meteorological, hydrological, vehicle and Ordnance Survey data.
<i>Years of data</i>	Evidence for mathematical analysis taken from sources from 1996 onwards.
<i>Year published</i>	2008
<i>Source</i>	<a href="http://www.berr.gov.uk/files/file45136.pdf">http://www.berr.gov.uk/files/file45136.pdf</a>

Pollock study

	<h2>The Economics of Public Sector Information</h2>	
<p><i>Introduction</i></p>	<p>This summary is based on the study ‘<i>The Economics of Public Sector Information</i>’ by <b>Rufus Pollock</b>. It uses mathematical analysis to assess who should finance PSI re-use and the regulatory structure needed.</p>	
<p><i>Context</i></p>	<ul style="list-style-type: none"> <li>– The study focuses on digital, non-personal and upstream PSI. The types of data considered are large and coherent datasets rather than individual pieces of data. It proceeds on the basis that marginal costs are zero when the information is digital. Transaction and transition costs are not included in the welfare analysis.</li> <li>– Elasticity of demand estimates are drawn from national experiences of improving re-use conditions.</li> <li>– When assessing welfare, the study takes account of the fact that PSI is often sold to intermediaries rather than direct consumers and the positive effect of new products and services.</li> </ul>	
<p><i>Key findings</i></p>	<ul style="list-style-type: none"> <li>– The evidence on price elasticity is limited, and its value will be determined by the nature of the product at issue. Nevertheless, the study estimates that elasticity is generally greater than 1, and the range for the kinds of products that are the subject of this study is between 0.5 and 2.5.</li> <li>– Given that the estimated elasticity of demand for digital, upstream data is greater than 1, marginal cost pricing is found to be preferable.</li> <li>– Good reasons for pricing at marginal cost or below include the following: <ul style="list-style-type: none"> <li>o Average costs distort the market because there is usually a high mark-up to cover costs.</li> <li>o Demand for digital PSI is likely to be high, and growing and average costs may hinder innovation.</li> <li>o Competition increases as public sector monopoly on data is removed.</li> <li>o Governments are already providing large contributions to fixed costs; the public should enjoy the benefits of that contribution.</li> </ul> </li> <li>– For those legally required to update registers (‘updaters’), rather than ‘users’ of PSI, an above marginal costs pricing model is preferable: elasticity of demand is less than 1 and there are no systematic distortions of ‘updaters’ willingness to pay.</li> <li>– To prevent market abuses and regular funding changes, public bodies in control of PSI should be regulated transparently and independently.</li> </ul>	
<p><i>PSI domain</i></p>	<p>Digital, non-personal and upstream PSI.</p>	
<p><i>Years of measurements</i></p>	<p>Mathematical analysis is based on evidence from a wide range of previous (peer) studies.</p>	
<p><i>Year of publication</i></p>	<p>2009</p>	
<p><i>Source</i></p>	<p><a href="http://www.econ.cam.ac.uk/dae/repec/cam/pdf/cwpe0920.pdf">http://www.econ.cam.ac.uk/dae/repec/cam/pdf/cwpe0920.pdf</a></p>	



	<h2 style="text-align: center;">PSI in European Meteorology – an Unfulfilled Potential</h2> 
<p><i>Introduction</i></p>	<p>This summary is based on the study ‘<i>PSI in European Meteorology – an Unfulfilled Potential</i>’ by <b>Richard Pettifer</b>, Chairman of the Association of Private Meteorological Services (PRIMET).</p>
<p><i>Context</i></p>	<ul style="list-style-type: none"> <li>– The study assesses the way in which meteorological PSI is exploited in Europe, and compares the estimated market and growth in the US and EU.</li> <li>– It proceeds on the basis that, in general, meteorological PSI is available on a cost-recovery basis in Europe and on marginal or zero cost bases in the US.</li> </ul>
<p><i>Key findings</i></p>	<ul style="list-style-type: none"> <li>– Cost-recovery pricing in Europe may be distorting the market:             <ul style="list-style-type: none"> <li>○ National Meteorological and Hydrological Services (NMHS) are monopoly wholesalers to their competitors on the value-added products market;</li> <li>○ NMHS may restrict re-use and adopt complex licensing systems; and</li> <li>○ cost-recovery pricing may raise data costs to such an extent that commercial re-use is not economically feasible.</li> </ul> </li> <li>– If PSBs must maximise their PSI sales revenue, they may have to employ complex licensing regimes that are expensive to manage.</li> <li>– Where NMHS provide free (often low quality) value-added products, opportunities for low-end commercial re-use are low, particularly for SMEs.</li> <li>– The European market in value-added meteorological products is estimated around €530m per year; the end-user market for weather related services is estimated around €2 x 10<sup>11</sup> per year. Therefore, only 0.3% of the European market is being supplied, compared to estimates of 0.7% in the US.</li> <li>– Since 2006, overall market growth in Europe has been less than 2%, with:             <ul style="list-style-type: none"> <li>○ the 28% private sector share growing at around 25% per year; and</li> <li>○ the 75% NMHS share declining by around 1.5% per year.</li> </ul> </li> <li>– If meteorological PSI was provided on a marginal cost basis throughout Europe and the market became as well penetrated as that in the US, then the actual market size would be around €1,390 x 10<sup>6</sup> per year; net revenue to EU central treasuries would increase by around € 290 x 10<sup>6</sup> per year.</li> <li>– Moving forward, the study suggests that:             <ul style="list-style-type: none"> <li>○ At the least, there should be complete, clear and public accounting between the commercial arms of NMHS and its parent agency, and that, at best, there should be complete technical and economic separation.</li> <li>○ States should be involved with regulating both the quality of PSI and its re-use on the market, particularly due to the safety implications.</li> </ul> </li> </ul>
<p><i>PSI domain</i></p>	<p>Meteorological information</p>
<p><i>Years of measurements</i></p>	<p>Relies on data from various studies published from 2002</p>
<p><i>Year of publication</i></p>	<p>2011</p>
<p><i>Source</i></p>	<p><a href="http://www.primet.org/documents-mainmenu-29/424-psi-in-european-meteorology-an-unfulfilled-potential">http://www.primet.org/documents-mainmenu-29/424-psi-in-european-meteorology-an-unfulfilled-potential</a></p>

	<h2 style="text-align: center;">Pricing of Public Sector Information Study</h2> <div style="text-align: right;">         </div>
<i>Introduction</i>	<p>The '<i>Pricing of Public Sector Information Study</i>' (POPSIS study) was prepared by <b>Deloitte and others</b> under an assignment from the European Commission. It assesses models of supply and charging for PSI and implications of price changes.</p>
<i>Context</i>	<p>This study assesses different models of supply and charging for PSI and their effects through the analysis of 21 case studies. The cases cover a wide range of PSBs and different PSI sectors (meteorological data, geographical data, business registries and others) across Europe. It examines the charging practices, ranging from zero and marginal cost models to partial and full cost-recovery regimes. The analysis focuses on the effects of PSI charging models on the downstream market, PSI re-users, end-users and impacts on the PSB itself.</p>
<i>Key findings</i>	<ul style="list-style-type: none"> <li>– The case studies show a clear trend towards lowering charges and/or facilitating re-use (16 out of the 21 cases).</li> <li>– Where cost-recovery regimes are applied, the calculation basis for setting PSI re-use charges is weak, oriented towards filling budgetary gaps.</li> <li>– PSI re-use revenues of PSBs range from relatively small to extremely small when compared to the total budget of the PSB concerned. In half of the cases, these revenues constitute less than 1% of the PSB's entire budget.</li> <li>– Based on their own raw data, the number of PSBs that exploit added-value products is limited (seven out of 21 cases) and appears to be decreasing.</li> <li>– In those cases where PSBs moved to marginal and zero cost charging or cost recovery that is limited to re-use facilitation costs only:             <ul style="list-style-type: none"> <li>○ The number of re-users increased by between 1,000% and 10,000%, attracting new types of re-users, in particular SMEs.</li> <li>○ Demand volumes expand strongly (up to 7,000%), where costs hardly increase. Once re-use facilitation processes are properly organized, they become sub-routines within the PSB.</li> <li>○ In some cases, PSI sales revenues can remain stable or even increase after drastic price cuts due to the growing demand.</li> <li>○ Zero cost pricing has the additional advantage that transaction costs decrease significantly. This decrease applies not only to administrative costs, such as invoicing, but also to costs related to the monitoring of compliance with licensing arrangements.</li> <li>○ Intensified ties PSB-re-users create better data quality and efficiency.</li> </ul> </li> </ul>
<i>PSI domain</i>	General PSI
<i>Years of measurements</i>	2006–2011
<i>Year of publication</i>	2011
<i>Source</i>	<a href="http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/models.pdf">http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/models.pdf</a>



	<h2 style="text-align: center;">Does Marginal Cost Pricing of Public Sector Information Spur Firm Growth?</h2> 
<i>Introduction</i>	This summary is based on the study ' <i>Does Marginal Cost Pricing of Public Sector Information Spur Firm Growth?</i> ' by <b>Dr. H. Koski of ETLA</b> – The Research Institute of the Finnish Economy.
<i>Context</i>	<ul style="list-style-type: none"> <li>– The study assessed 14,000 firms in the architectural, engineering and related technical consultancy sectors, located in 15 countries<sup>62</sup>, some operating maximum marginal cost pricing models, others cost-recovery pricing models.</li> <li>– Industries in these sectors make significant use of geographical information, and may also supply services requiring geographical information, e.g. digital mapping, navigation and map data solutions.</li> <li>– The study analysed the effect of maximum marginal cost pricing for geographical PSI on the firms' growth performance, measured by reference to the firms' real sales growth over a particular time period, taking into account the effect of the availability of geographical PSI (e.g. the use of web portals), the price of such data, and whether it was gathered and managed by a nationally responsible department or body.</li> <li>– Changes in national PSI policy included: <ul style="list-style-type: none"> <li>○ The reduction of prices of digital cadastral maps by up to 97% (Austria).</li> <li>○ A free web portal for essential cadastral geographic data (Spain).</li> <li>○ A free web portal for spatial data (Australia).</li> </ul> </li> </ul>
<i>Key findings</i>	<ul style="list-style-type: none"> <li>– The average annual growth rate was about 15% higher amongst firms located in countries with maximum marginal cost pricing for geographical PSI compared to those operating on a full or partial cost-recovery basis.</li> <li>– Changing to marginal cost pricing had the greatest impact on SMEs, as: <ul style="list-style-type: none"> <li>○ it substantially contributed to the sales growth of SMEs, but did not have a significant impact on the sales growth of larger firms; and</li> <li>○ SMEs increased sales growth by 7% on average after one year and 19% on average after two years.</li> </ul> </li> </ul>
<i>PSI domain</i>	Geographic information in the architectural, engineering and related technical consultancy sectors.
<i>Years of measurements</i>	2000–2007 where possible; 2003–2007 otherwise.
<i>Year of publication</i>	2011
<i>Source</i>	<a href="http://www.etla.fi/files/2696_no_1260.pdf">http://www.etla.fi/files/2696_no_1260.pdf</a>

<sup>62</sup> Australia, Austria, Czech Republic, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, the United Kingdom and the United States of America.

## Spanish cadaster case



 <h1>The Spanish Cadaster</h1> 	
<i>Introduction</i>	<p>This case was spotlighted in a Finnish study (<i>Does Marginal Cost Pricing of Public Sector Information Spur Firm Growth?</i> by <b>Heli Koski, ETLA</b>) that assessed 14,000 firms in the architectural, engineering and related technical consultancy sectors, located in 15 countries, analysing the effect of maximum marginal cost pricing for geographical PSI on the firms' growth performance. Further information on this case has been drawn from the European Commission's <b>2011 POPSIS study</b> (<i>Pricing of Public Sector Information</i>).</p>
<i>Context</i>	<ul style="list-style-type: none"> <li>– Since 2003, the Spanish <i>Oficina del Catastro</i> (the Spanish Cadastre/Land Registry) has put increasing amounts of geographical data online and, from 2010, has facilitated electronic land registry certification.</li> <li>– From June 2004, free access to cadastral maps by non-commercial users was provided through the online portal <i>IDEE</i> (in English, the 'Spatial Data Infrastructure Portal'). In April 2011 free access was also extended to commercial re-users, and a new model allowed mass downloads.</li> <li>– The Spanish Cadastre runs regular training sessions for users of the portal, to increase awareness and obtain feedback.</li> </ul>
<i>Key findings</i>	<ul style="list-style-type: none"> <li>– From 2004–05, cartography data consultations increased by about 700%. In 2010, the increase compared to 2004 was over 25-fold.</li> <li>– From a cost-benefit analysis, estimates for savings to the Spanish taxpayer from the online access and digital certification range from €8m to €15m per year (RSO/CapGemini estimate from 2009, KPMG estimate from 2010).</li> <li>– Since obtaining free access in 2011: <ul style="list-style-type: none"> <li>○ the number of private companies downloading data increased 15-fold;</li> <li>○ alphanumeric data download volume per week increased 20-fold;</li> <li>○ total digital map downloads increased by a factor of 80, (275 to 2,101); and</li> <li>○ total downloads increased by 100-fold, from 342 to over 3,300.</li> </ul> </li> <li>– 'Traditional' re-users have included estate agents, government departments, businesses commercialising PSI products and services, organisations and citizens using PSI for non-commercial purposes.</li> <li>– There has also been an increase in re-use by 'non-traditional' entities. One example is SMEs selling swimming pool products targeting only those households with a swimming pool.</li> </ul>
<i>PSI domain</i>	Geographic information
<i>Years of measurements</i>	From 2004
<i>Year of publication</i>	2011
<i>Sources</i>	<p><a href="http://www.etla.fi/files/2696_no_1260.pdf">http://www.etla.fi/files/2696_no_1260.pdf</a>  <a href="http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf">http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf</a></p>

## Austrian geographic data case



	<h1>Austrian Geographic Data</h1>	
<p><i>Introduction</i></p>	<p>This case was spotlighted in a Finnish study (<i>Does Marginal Cost Pricing of Public Sector Information Spur Firm Growth?</i> by <b>Heli Koski, ETLA</b>) that assessed 14,000 firms in the architectural, engineering and related technical consultancy sectors, located in 15 countries, analysing the effect of maximum marginal cost pricing for geographical PSI on the firms' growth performance and the European Commission's <b>2011 POPSIS study</b> (<i>Pricing of Public Sector Information</i>) prepared by Deloitte and others.</p>	
<p><i>Context</i></p>	<ul style="list-style-type: none"> <li>– In 2006 the Austrian Federal Office of Metrology and Surveying (<i>Bundesamt für Eich- und Vermessungswesen (BEV)</i>) made changes to its provision of geographic data by:               <ul style="list-style-type: none"> <li>○ moving from a pricing structure based on analogue products to one based on digital products; and</li> <li>○ changing its cost-recovery pricing to marginal cost pricing model.</li> </ul> </li> <li>– The prices of various key data sources, e.g. digital cadastral maps, were reduced by up to 97%, without additional government funding.</li> <li>– The pricing regime has been subject to regular reviews and alterations (in 2008 and 2010), based on PSI market value, prices of foreign public sector bodies for comparable datasets, re-use business conditions, federal government budget constraints, costs of production and re-use facilitation.</li> </ul>	
<p><i>Key findings</i></p>	<ul style="list-style-type: none"> <li>– The changes are likely to have aided:               <ul style="list-style-type: none"> <li>○ The substantial increase in number of datasets sold:                   <ul style="list-style-type: none"> <li>- In 2007, sales of cartographic products increased by 200%–1,500%, digital orthophotos by 7,000%, digital cadastral maps by 250%, digital elevation mode maps by 250%, digital landscape models by 1,000%, and external-use licences by 100%.</li> <li>- This increased demand came mostly from Austrian SMEs.</li> </ul> </li> <li>○ The 46% increase in total revenue from sales of geographic data.</li> <li>○ The rise in data sought by new user groups, e.g. geo-marketing, location-based services and health services firms.</li> <li>○ The increase in demand for data from international customers.</li> </ul> </li> <li>– In 2011, purchase orders had stabilised after an initial strong growth period. But, customer numbers and external licence numbers continue to rise.</li> </ul>	
<p><i>PSI domain</i></p>	<p>Geographic information</p>	
<p><i>Years of measurements</i></p>	<p>From 2006</p>	
<p><i>Year of publication</i></p>	<p>2011</p>	
<p><i>Sources</i></p>	<p><a href="http://www.etla.fi/files/2696_no_1260.pdf">http://www.etla.fi/files/2696_no_1260.pdf</a>  <a href="http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf">http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf</a></p>	





## Danish address data case (DECA)

	<h3>Danish address data</h3> 
<i>Introduction</i>	This case was spotlighted in the ' <i>Pricing of Public Sector Information Study</i> ' (POPSIS study) prepared by <b>Deloitte and others</b> for the European Commission. It assessed models of supply and charging for PSI and implications of price changes.
<i>Context</i>	<ul style="list-style-type: none"> <li>– In 2002 the political decision was taken to establish a central database of all Danish addresses. This policy change was driven by public task ambitions and by distinguishing between the public sector investment and subsequent exploitation of the facility created, allocating the costs to those that benefit, thus freeing PSBs to rely on cost recovery above re-use facilitation cost level.</li> <li>– An open network of distributors was established; the network can acquire the address data against re-use facilitation costs, without any re-use limitations</li> </ul>
<i>Key findings</i>	<ul style="list-style-type: none"> <li>– A centrally run system of address data is not only of vital importance for the proper execution of the public task (such as emergency services, taxation departments and the monitoring and control of safety regulations), it also represents an unprecedented source for the private sector to develop and distribute digital products and services where location is a key element.</li> <li>– By including the potential returns (in the form of increased economic activities by the private sector) in the equation when setting up and financing the database, the maximization of re-use potential (by the private sector) became a purpose in itself, preventing the PSB from becoming reliant on its own re-use incomes and allowing it to maximize the multiplier effects downstream.</li> <li>– The policy change ultimately significantly contributed to:               <ul style="list-style-type: none"> <li>○ a value creation downstream of approximately €57m;</li> <li>○ an increase in FTEs employed by re-users by 800–1,000%;</li> <li>○ an increase in turnover of re-users of around 1,000%;</li> <li>○ a PSB savings of around €5m, against an investment of around €3m;</li> <li>○ an increase in corporate tax gains of around €14m; and</li> <li>○ a return of PSB investment of around 470%.</li> </ul> </li> <li>– The case illustrates that increased tax returns on the boosted turnover of first- and second-tier re-users downstream in the value chain largely exceed the investments made by the public sector: the establishment of a central database of addresses supported by a re-use policy, which only charges minimal re-use facilitation costs and consequently boosts economic activities further down the value chain, has financed the more effective performance of the public task. The PSB has managed to create a self-propelling multiplier that is available to re-users.</li> </ul>
<i>PSI domain</i>	Geographic data
<i>Years of measurements</i>	2002–2011
<i>Year of publication</i>	2011
<i>Source</i>	<a href="http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/su_mmary.pdf">http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/su_mmary.pdf</a>



## Norwegian Meteorological Office case

	<h3>The Norwegian Met Office</h3> 
<p><i>Introduction</i></p>	<p>This case was spotlighted in the ‘<i>Pricing of Public Sector Information Study</i>’ (POPSIS study) prepared by <b>Deloitte and others</b> for the European Commission. It assessed models of supply and charging for PSI and implications of price changes.</p>
<p><i>Context</i></p>	<ul style="list-style-type: none"> <li>– In 2007 the Norwegian National Meteorological Institute (Met.no) made all weather data held by it, including certain datasets from other national met offices, freely available for access and re-use. <ul style="list-style-type: none"> <li>○ The shift to a zero cost pricing model was mostly financed by government compensation of €125,000, with the remaining small amount of transition costs covered by Met.no’s own resources.</li> <li>○ Data is downloaded on a Creative Commons basis.</li> <li>○ Only re-users seeking guaranteed data, for example, full-time availability, must pay a fee (currently €5,750 per year).</li> </ul> </li> <li>– In 2008 Met.no launched a free online portal (yr.no) which provides graphic displays of Norwegian and European weather forecasts.</li> <li>– Met.no still has a commercial arm but this policy is currently under review.</li> </ul>
<p><i>Key findings</i></p>	<ul style="list-style-type: none"> <li>– The free and open access to this PSI is likely to have aided: <ul style="list-style-type: none"> <li>○ the average 30-fold increase in the number of re-users, from around 100 to 3,000 unique re-users per week;</li> <li>○ the 200% increase in re-user turnover; and</li> <li>○ the entry of re-users into high end international data provision markets, normally dominated by national met offices.</li> </ul> </li> <li>– Since 2007 the composition of the re-user mix has changed, with: <ul style="list-style-type: none"> <li>○ a 40% increase in the number of re-users from outside of Norway; and</li> <li>○ new categories of re-users, including SMEs, that integrate the data into other media content or use it to develop ‘apps’.</li> </ul> </li> <li>– Increased interaction with re-users/taxpayers have led to: <ul style="list-style-type: none"> <li>○ improvements in data quality through re-user feedback (Met.no receives over 5,000 e-mails each year from citizens);</li> <li>○ increased professionalism in service delivery;</li> <li>○ improved internal process efficiency; and</li> <li>○ excellent public relations (Met.no has received awards for being the most respected public agency for five consecutive years).</li> </ul> </li> <li>– Tax returns on PSI re-use have increased by at least 100% and exceed revenue loss and the slight uncovered re-use facilitation costs.</li> </ul>
<p><i>PSI domain</i></p>	<p>Meteorological data</p>
<p><i>Years of measurements</i></p>	<p>2007–2010</p>
<p><i>Year of publication</i></p>	<p>2011</p>
<p><i>Source</i></p>	<p><a href="http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf">http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf</a></p>



## Dutch meteorological data case

	<h3>Dutch Meteorological Data</h3> 
<p><i>Introduction</i></p>	<p>This case was spotlighted in the <i>‘Pricing of Public Sector Information Study’</i> (POPSIS study) prepared by <b>Deloitte and others</b> for the European Commission. It assessed models of supply and charging for PSI and implications of price changes.</p>
<p><i>Context</i></p>	<ul style="list-style-type: none"> <li>– In 1999 the Royal Netherlands Meteorological Institute (<i>het Koninklijk Meteorologisch Instituut</i> (KNMI)) decided to cease all its commercial activities and encourage PSI re-use. Accordingly:           <ul style="list-style-type: none"> <li>○ it approaches PSI provision for re-use as a public task;</li> <li>○ it switched from a full cost-recovery pricing model to recovery of re-use facilitation costs only; consequently, the re-use system is self-financing;</li> <li>○ the price of the full KNMI dataset has decreased by 80%;</li> <li>○ its commercial arm was reorganised to facilitate privatisation; this was financed by public funding;</li> <li>○ it does not enrich PSI beyond what is necessary to allow re-use by public and private re-users alike or produce ‘value-added’ products; and</li> <li>○ data provision for academic purposes is on a marginal cost basis, provided that the results of the research are made publically available.</li> </ul> </li> </ul>
<p><i>Key findings</i></p>	<ul style="list-style-type: none"> <li>– Easier access to PSI has led to the creation of a competitive and innovative private weather market.</li> <li>– The 1999 policy changes likely aided:           <ul style="list-style-type: none"> <li>○ the 400% increase in turnover for private sector re-users;</li> <li>○ the 250% increase in high-end users;</li> <li>○ a rise in the employment activity of re-users of 300%;</li> <li>○ an increase of over €35m on corporate tax returns;</li> <li>○ the rise of new business models, offering free services to the public paid through advertising and innovative applications; and</li> <li>○ improvements in data quality, professionalism in service delivery, and internal process efficiency gains of €3.5m through intensified use and feedback from re-users.</li> </ul> </li> </ul>
<p><i>PSI domain</i></p>	<p>Meteorological data</p>
<p><i>Years of measurements</i></p>	<p>1999–2010</p>
<p><i>Year of publication</i></p>	<p>2011</p>
<p><i>Source</i></p>	<p><a href="http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf">http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/11_2012/summary.pdf</a></p>



## Australian spatial data case



	<h3>Australian spatial data</h3> 
<p><i>Introduction</i></p>	<p>This case was spotlighted in an Australian study, <i>'Costs and Benefits of Data Provision – Report to the Australian National Data Service'</i> by <b>John Houghton from Victoria University</b>, that explores the economic impact of free PSI access and the costs and benefits. Further information on the case has been drawn from the 2010 <i>'ANZLIC – The Spatial Information Council Economic Assessment of Spatial Data Pricing and Access'</i> by <b>PwC</b>.</p>
<p><i>Context</i></p>	<ul style="list-style-type: none"> <li>– From 2002, spatial data has been made available as follows:               <ul style="list-style-type: none"> <li>○ online spatial data – free of charge;</li> <li>○ packaged spatial data – marginal cost of transfer; and</li> <li>○ customised spatial data – price not exceeding the cost of transfer.</li> </ul> </li> <li>– No restrictions on commercial use or value-added activities imposed.</li> <li>– From 2009 data is under a Creative Commons licensing framework.</li> </ul>
<p><i>Key findings (Currency: Australian dollars)</i></p>	<ul style="list-style-type: none"> <li>– For the year 2009-10, free access to Geoscience Australia's topographical data was estimated to have increased welfare by \$4.7m per annum: data production costs were around \$13.3m with the benefit for government and private users being around \$10m and \$8m per annum, respectively.</li> <li>– Given the Australian Government's annual expenditure on fundamental spatial data of around \$70m, free access to such spatial PSI is estimated to improve welfare by around \$25m per annum.</li> <li>– For the period 2001-02 to 2005-06:               <ul style="list-style-type: none"> <li>○ Free access led to an estimated annual consumer surplus increase of around \$60m.</li> <li>○ There was a good elasticity of demand, with downloads increasing by up to 172% per annum.</li> <li>○ Average social returns on expenditure were estimated at \$15m per annum.</li> <li>○ Free re-use led to departmental transaction cost savings between 17% and 33% of respective revenues; conversely, transaction-related cost savings for PSI re-users were at around \$1.7m per annum.</li> </ul> </li> </ul>
<p><i>PSI domain</i></p>	<p>Geospatial data</p>
<p><i>Years of measurements</i></p>	<p>2001-02 to 2005-06; 2009-2010</p>
<p><i>Year of publication</i></p>	<p>2011</p>
<p><i>Sources</i></p>	<p><a href="http://ands.org.au/resource/houghton-cost-benefit-study.pdf">http://ands.org.au/resource/houghton-cost-benefit-study.pdf</a>  <a href="http://www.crcsi.com.au/Documents/ANZLIC-Economic-Study---Stage-2-Report.aspx">http://www.crcsi.com.au/Documents/ANZLIC-Economic-Study---Stage-2-Report.aspx</a></p>

## Australian statistical data case

	<h3>Australian statistical data</h3> 
<i>Introduction</i>	<p>This case was spotlighted in an Australian study, <i>'Costs and Benefits of Data Provision – Report to the Australian National Data Service'</i> by <b>John Houghton from Victoria University</b>, that explores the economic impact of free PSI access and the costs and benefits.</p>
<i>Context</i>	<ul style="list-style-type: none"> <li>– From 2005, all publications and data produced by the Australian Bureau of Statistics (ABS) have been freely available online.</li> <li>– Between 2005 and 2008, data was made available on a restricted licence basis; since 2008 all data has been under a Creative Commons (CC) licensing framework.</li> </ul>
<i>Key findings (Currency: Australian dollars)</i>	<ul style="list-style-type: none"> <li>– The cost for the ABS to make statistical data freely available using CC licensing is estimated at around \$3.5m per year.               <ul style="list-style-type: none"> <li>○ Savings from staff costs for subscription operations, customer support services and processing transaction fees are around \$945,000 per year.</li> <li>○ Lost ABS revenue from sales and consultancy are around \$4.5m per year.</li> <li>○ The CC licensing framework has led to estimated internal gains of \$56,667 per year: the framework has low, absorbable, running costs and revenue forgone has been roughly equal to internal savings.</li> </ul> </li> <li>– However, total user savings are estimated at around \$5m per year. This figure takes account of savings on data and licence costs, transactional costs, bank costs and time.</li> <li>– There was a 34% increase in website traffic in the first year of free statistical data. Product downloads more than trebled between 2003 and 2010.</li> <li>– Welfare gains have been estimated at around \$4m per year.               <ul style="list-style-type: none"> <li>○ This figure is based on the consumer surplus in relation to three-year average intensity of use for 2003-04, 2005-06 and 2006-07 to 2008-09.</li> <li>○ Due to a lack of information on additional government funding to ABS, this figure does not account for deadweight loss. However, this is estimated to be small since the government is a major user of ABS data.</li> </ul> </li> </ul>
<i>PSI domain</i>	Statistical data
<i>Years of measurements</i>	2003–2010
<i>Year of publication</i>	2011
<i>Source</i>	<a href="http://ands.org.au/resource/houghton-cost-benefit-study.pdf">http://ands.org.au/resource/houghton-cost-benefit-study.pdf</a>

## Australian hydrological data case

	<h3>Australian hydrological data</h3> 
<p><i>Introduction</i></p>	<p>This case was spotlighted in an Australian study, <i>'Costs and Benefits of Data Provision – Report to the Australian National Data Service'</i> by <b>John Houghton from Victoria University</b>, that explores the economic impact of free PSI access and the costs and benefits.</p>
<p><i>Context</i></p>	<ul style="list-style-type: none"> <li>– From 2008 the Australian Bureau of Meteorology (BOM) has published an annual National Water Account (NWA) that reports on:             <ul style="list-style-type: none"> <li>○ total water resources;</li> <li>○ volume of water available for abstraction;</li> <li>○ rights to abstract water; and</li> <li>○ actual abstraction of water for economic, social, cultural and environmental purposes.</li> </ul> </li> <li>– Such information was previously difficult to access; in accordance with regulatory duties it is now provided to BOM by over 200 organisations holding water data.</li> <li>– The NWA contains information in standardised forms, is freely available online and is made available within a Creative Commons (CC) licensing framework.             <ul style="list-style-type: none"> <li>○ Following BOM encouragement, in 2011 all but nine data providers had not yet committed to applying CC licensing to the data supplied to BOM.</li> </ul> </li> </ul>
<p><i>Key findings</i> (Currency: Australian dollars)</p>	<ul style="list-style-type: none"> <li>– Water data is used extensively when made readily and freely available online:             <ul style="list-style-type: none"> <li>○ Prior to the introduction of the Victorian Water Resources Data Warehouse (VWRDW), an average 400 information requests were made per year; since 2004 the VWRDW has had an average 443,000 data requests per year.</li> <li>○ From 2005 to 2010 data extractions for re-use have doubled, from 68,908 to 102,536.</li> </ul> </li> <li>– Open access to information may have been a factor facilitating the emerging market in water entitlements and allocations that had a value of \$2.8bn in 2009-10.</li> <li>– Since 2007-08, the equity of the Australian water market has doubled in value (from around \$1.5m to \$3m); improved information on water entitlements, allocations, trade volumes and trade prices is suggested as a factor in this.</li> </ul>
<p><i>PSI domain</i></p>	<p>Hydrological data</p>
<p><i>Years of measurements</i></p>	<p>2005–2011</p>
<p><i>Year of publication</i></p>	<p>2011</p>
<p><i>Source</i></p>	<p><a href="http://ands.org.au/resource/houghton-cost-benefit-study.pdf">http://ands.org.au/resource/houghton-cost-benefit-study.pdf</a></p>

	<h2 style="text-align: center;">Pricing of PSI in the Meteorological Sector blocks market development</h2> 
<i>Introduction</i>	This summary is based on the Position Paper ' <i>Pricing of PSI in the Meteorological Sector blocks market development</i> ' by <b>Richard Pettifer</b> , Chairman of the Association of Private Meteorological Services (PRIMET).
<i>Context</i>	<ul style="list-style-type: none"> <li>– The study notes at the outset that meteorological data is PSI well suited to being exploited for commercial purposes: it is well known, accessible and produced in an international format that facilitates quality control, easy exchange, comprehension and use. Commercial exploitation of meteorological PSI requires data from a number of states or geographical regions.</li> <li>– The study considers three hypothetical SMEs in Luxembourg, Poland and France that provide weather-related services relating to forecasting, highways and energy, and uses 2010 prices on a cost-recovery basis.</li> </ul>
<i>Key findings</i>	<ul style="list-style-type: none"> <li>– SMEs cannot operate successfully or compete with large firms when partial or full cost-recovery pricing principles are used: cost-recovery pricing principles are likely to create barriers to market entry because SMEs are likely to be unable to find the 20 contracts required to operate profitably.</li> <li>– The absolute minimum PSI meteorological data required to provide basic weather-related services, with a market value of €6,000 to €20,000 per contract, would cost a typical SME between €84,000 and €400,000.</li> <li>– The loss of revenue from providing meteorological PSI on a marginal cost rather than a cost-recovery basis is significantly less than the estimated additional tax revenue on resulting weather-related services.</li> <li>– If meteorological PSI was provided on a marginal cost basis so that the market became as well penetrated at that in the US, the estimated gross overall tax revenue from this weather-related sector would increase by around €340m.</li> <li>– Market growth in the weather-related services sector is 15.8% greater in the US, where meteorological pricing is based on marginal cost principles, than in Europe, where cost-recovery principles are generally used.</li> </ul>
<i>PSI domain</i>	Meteorological information
<i>Years of measurements</i>	2002–2010
<i>Year of publication</i>	2011
<i>Source</i>	<a href="http://www.primet.org/file/EU_PSI_Working_Groups/Workshop_Position_paper_final">http://www.primet.org/file/EU PSI Working Groups/Workshop Position paper final</a>

## ANNEX 5 – NATIONAL DATA PORTALS

### National data portals

Several countries have set up data portals to give all national users access to country-wide satellite imagery. These are based on the principle that one government department (often the Ministry of Agriculture) has been buying data and that, for a relatively small additional cost, it can be made available to all users through a wider user licence. This arrangement can benefit other government departments wanting to use the same data as well as industry. Access through a single portal makes it easier for all users to find the data that they need.

### The Dutch National Space Organisation case

#### *Introduction*

This is a wrap up of the interview with representatives from the Dutch National Space Organisation and the Ministry of Economic Affairs, Innovation and Agriculture held on 10 September 2012 in The Hague.

#### *The arrangement put in place*

In March 2012, the Ministry of Economic Affairs, Innovation and Agriculture (the Ministry), responsible for the Dutch National Space Organisation (the NSO), structurally financed the free re-use of GMES data for a period of three years (2012, 2013, 2014), by acquiring a licence from Astrium for radar data covering the Dutch territory. The basic idea is that Dutch users, in particular those from the private sector, can get acquainted with the use of this dataset, allowing them to prepare for the GMES data provision in 2014, thus giving them a head start when launched. The components of the dataset acquired is a look-a-like of the GMES dataset likely to be adopted (although it currently also holds two meter pictures). The total funding amounts to €4m for the entire period and was furnished by the Ministry, by rearranging funds within its own budget (rather than by claiming extra money from the Dutch Treasury, which would have been very burdensome in these times).

Only users based in the Netherlands are allowed to re-use the data. To that end they have to register with NSO and there is a 'light' check on the registration details. The data processing and making available is all done by Astrium, NSO stays clear of that. Also the user enters into a licensing agreement with Astrium, not with NSO. So far, around 250 accounts have been created (probably with a multitude of users per account). The amount is steadily growing (currently about five new accounts per week). Interestingly, Astrium also chipped in the two meter resolutions for free.

#### *How did NSO manage?*

The movement was created bottom-up – the NSO had been contemplating this possibility for a long time. To that end it had already initiated a study, looking at how the private sector was making its money and assessing the effects that such movement would have. Interestingly, the study found that at that time, the private sector was relying heavily on subsidized income streams, rather than on income generated from turnover. Obviously, setting up, allocating and monitoring these subsidy streams created a lot of overhead both for the government and the private sector. Further, the costs to acquire the data were (and are) quite substantial, creating a significant entry barrier for the private sector, SMEs in particular. However, a subsidized space program had been established in the 1980s, creating a fairly robust knowledge infrastructure. And of course, the Dutch Government had been investing in this field for many years through ESA contributions. (The total amount of Dutch governmental cash out is around €100m per year). Put differently, investments had been made, the



basic infrastructure was there, the market opportunities are there, but there was a gap between knowledge and market exploitation thereof. This created the business case.

It all came together when the former Ministry of Economic Affairs and that of Agriculture and Fishery merged into a new Ministry (the Ministry of Economic Affairs, Innovation and Agriculture). Suddenly the public sector and private sector user interests were bundled. The NSO, together with supporters within the Ministry, managed to set up the business case and pitch the idea appropriately, also connecting it to the 'Top Sectors' policy adopted by the Ministry, which defined a number of focal areas of strategic importance for the Dutch economy. Thus, the NSO managed to convince the decision makers that continuity is key, particularly for the market parties, thus validating a claim for structural funding for a period of three years. Setting up the business case, the NSO also mobilized 20–25 private sector users, requesting them to match the investment. Ultimately, private sector users committed €20m as own investments, to be spent over time once the data was made available. This was an important winning argument towards the decision makers. The NSO's case was further strengthened by aligning leading researchers who backed the business case. So clearly this was a bottom-up movement that would not have succeeded without the continuous efforts to make it work, in combination with smart tactics and a bit of luck.

#### *Further actions needed*

What is needed now is the visibility of the services that are emerging, based on the data. To that end the NSO is also pushing the usage by stimulating public sector users publicly procuring services that could be based on GMES to put that requirement in the tender specifications, thus turning the public sector into a launching customer. Furthermore, the NSO expects that the combination with in situ data will result in many new services.

#### **The Swedish data portal case**

The Swedish data portal was launched in June 2008 after a parliamentary decision in 2007. Five government agencies (the Environmental Protection Agency, the National Land Survey, the Swedish Meteorological and Hydrological Institute, the Swedish Forest Agency and the Swedish National Space Board) made a combined initiative to suggest the establishment of a satellite image database, and in 2007 a specific budget was granted for its development and for data procurement. The government also granted a specific budget for data procurement in 2008.

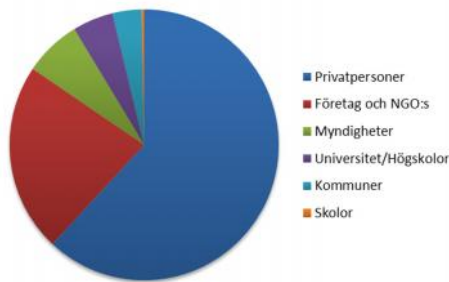
The portal is run by Lantmäteriet – the Swedish mapping, cadastral and land registration authority – with Metria providing the technical support. Lantmäteriet's running costs are normally covered by charging user fees. However, for the EO Portal, a consortium currently comprising the Environmental Protection Agency, the Swedish National Space Board, the Swedish Forest Agency, the Swedish University of Agricultural Sciences and four forest companies is meeting the costs.

The database contains satellite imagery for different types of users. It includes historical datasets from 1970, 1980, 2000 and 2005 of complete country coverage at between 10m and 30m. System corrected and ortho-rectified imagery are available for professional users while the general public might be more interested in image mosaics to see how the landscape has changed over time.

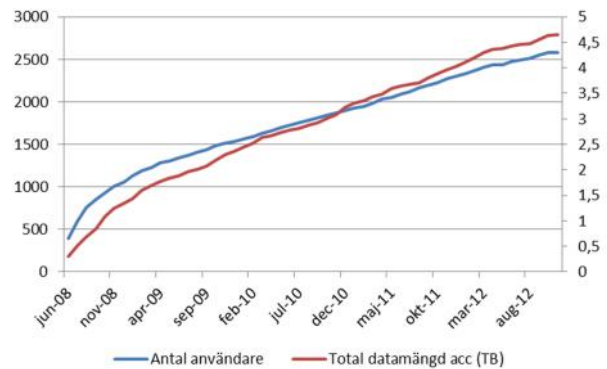
From 2007, full country coverage will be made each year. The goal is to make these datasets easily accessible by anyone. By early 2009, there were over 1250 unique users with 10 new users registering each week. In 2010, this had reached 2000 registered users, and 2500 in 2011.

The history of downloads shows a sharp increase in data usage. In 2008-09 there were 6500 scenes taken, as compared to around 300 scenes in the years before the portal was established. In 2010, this

increased to 21,000 scenes and there was a further small increase in 2011 to an estimated 25,000 scenes. Around 80% of the products being downloaded are ortho-corrected.



Foretag och NGO's = company and NGO's  
Mindigheter = agencies



In blue = total number of users (left)  
In red = total downloads (right)

### A re-user perspective: Metria (Sweden)

Metria is one of the leading EO service companies in Sweden, having benefited from the free data access policy. The company situation is rather unique: it was an operating entity of the Lantmäteriet until 2011 when it became a separate company. Prior to the Portal, Metria was the only organisation that had access to the imagery bought by the Swedish public sector. This placed it in a privileged position as it could use data from these archives for other projects. Once the Portal was established and anyone had access to the imagery, Metria found that this helped them win business through increased transparency. Customers (and competitors) now knew the transfer pricing policy, which previously was not visible.

Overall, service providers in Sweden are estimated to have gained annual revenues of more than €1m (with Metria gaining around €700,000) as a result of the Portal and the free access policy. The main uses of the data have been in forestry, environmental monitoring and urban planning.

### Norwegian Case

Norway has also implemented a centralised approach where a bulk data purchase from the Canadian radarsat has complemented data coming from Envisat before it died. These data were made available for government departments to use, mostly for coastal patrols, ice and oil spills. Commercial customers are required to purchase any data needed for their purposes. Most recently, the Norwegian receiving station has been active in supplying oil spill detections to the European Marine Safety Agency as an initial operation under the foreseen GMES services.

## ANNEX 6 – LIST OF CONTRIBUTORS

We kindly thank all those that have contributed to the study, in particular:

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EARSC Workshop (6<sup>th</sup> July 2012)

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