COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 20.5.2009
SEC(2009) 639

COMMISSION STAFF WORKING DOCUMENT

accompanying the

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on the European Earth observation programme (GMES) and its initial operations (2011 – 2013)

IMPACT ASSESSMENT AND EX ANTE EVALUATION

{COM(2009) 223}
{SEC(2009) 640}

IMPACT ASSESSMENT AND EX ANTE EVALUATION

1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Organisation and timing

This Impact Assessment accompanies a legislative proposal for a Regulation of the European Parliament and the Council on the European Earth observation programme (GMES) and its initial operations (2011 – 2013) and constitutes an ex ante evaluation in line with Article 21(1) of the Implementing Rules of the Financial Regulation[1]. It was elaborated in consultation with a Steering group consisting of representatives of the following DGs: ENV, BUDG, RTD, AGRI, ESTAT, JRC, RTD, TAXUD, DEV, AIDCO, ECHO, INFSO, TREN, RELEX, MARE, REGIO and JLS, following the publication of a Communication entitled "GMES: we care for a safer planet" (the "2008 Communication")[2] that describes an approach for the establishment of a stable financing and governance framework. The Steering group met twice and was consulted on the draft submitted herewith.

Following the opinion of the Impact Assessment board, the following parts of this report were modified:

- regarding the justification of the for the proposed Community budget spending, section 2.1.3 has been amended. Additionally, more details on the overall financial arrangements are given in Annex V;

- the rationale for additional government financial support is explained in more detail in section 2.1.3. User charges are discussed in more detail in section 4.2.3. Additionally, the description of the baseline in section 2.2. was strengthened;

- the temporary nature of the proposal was made more explicit in chapter 3 and in the assessment of the options in chapter 5. The nature of the benefits is substantiated in Annex V.

- the assessment of governance issues is covered in the new section 4.2.2, and chapter 5.4. It is made clear in chapter 6 that it is unlikely that regulation concerning GMES will enter into force before 2014.

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[1] Commission Regulation 2342/2002 of 23 December 2002 laying down detailed rules for the implementation of Council Regulation 1605/2002 on the Financial Regulation applicable to the general budget of the European Communities, OJ L 357 of 31.12.2002, p. 1., as last amended by Commission Regulation 478/2007 of 23 April 2007, OJ L 111 of 28.4.2007, p. 13.

[2] COM(2008)748 final of 12 November 2008.

1.2. Stakeholders consultation

This Impact Assessment is based on a consultation of external stakeholders that was launched with the Communication entitled "GMES, from concept to reality"[3], and on a number of external studies (see Annex I).

Furthermore, since its creation in 2006, the GMES Bureau is organising a wide consultation process with stakeholders, including:

- thematic workshops with users of the future service;
- establishment of 'Implementation Groups' composed of user representatives. The Implementation Groups prepared recommendations concerning the scope, architecture and implementation plans for each service, including the necessary infrastructural requirements;
- the consultation of national GMES coordinators in the framework of the GMES Advisory Council;
- regular bilateral meetings between the European Commission's GMES Bureau and stakeholders from industry, regions and other players; and
- the organisation of conferences dedicated to GMES by successive EU Presidencies.

1.3. Key issues emerging from the stakeholders consultation

The stakeholder consultation has clearly demonstrated that users cannot rely on research projects only. They need access to reliable and accurate data and information that is made available in a timely fashion or, for emergency services, even in rush mode.

To achieve this goal, it is necessary according to stakeholders to:

- take the necessary steps to expand the preparatory operational budget line introduced in 2008 in order to cover initial operations of GMES services;
- to define the scope of activities to complement existing financing and programmatic schemes;
- establish partnerships with the different partners in order to ensure sustainable operational services;
- ensure that, as a user-driven initiative, service specifications correspond to user needs; and
- facilitate market uptake by the value-adding service industry (including SMEs) by ensuring an open data and information policy.

A more detailed overview of the outcome of the stakeholder consultation can be found in Annex III hereto.

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[3] COM(2005)565 final of 10 November 2005.

2. WHAT IS THE CHALLENGE?

2.1. Overall context and objectives

2.1.1. Objectives of the initiative

GMES is an Earth observation system. Earth observation allows for the collection of information about planet Earth's physical, chemical and biological systems, or, more generally, the monitoring of the natural environment. It is based both on space based (i.e. satellites) and non space based facilities, including airborne, seaborne and ground based installations (referred to as "In situ"). Data collected through satellites and In situ infrastructure are processed to enable the provision of information services, for a better management of our environment and enhanced security of the citizens. This will allow e.g. to manage natural resources and biodiversity more efficiently, monitor the state of the oceans and the chemical composition of our atmosphere - important factors for climate change – to respond to natural and man-made disasters including tsunamis, and to ensure border surveillance in a more effective way.

In the last thirty years, substantial R&D efforts in the field of Earth observation have been made by the EU, the European Space Agency (ESA) and their respective Member States, with a view to developing infrastructure and pre-operational Earth observation services.

Data provided through the currently existing services, however, either do not cover all the parameters needed by policy makers[4], or are not provided on a continuous basis, in particular because the lifetime of the service or the underlying observation infrastructure is limited due to budgetary and/or technical constraints. In other words, many of the existing Earth observation services in Europe are unreliable due to infrastructural gaps and lack of guarantees on their availability in the long term. This represents a concern for final users like public authorities, but also for downstream service providers, as they are not likely to invest significantly in non-mature, risky markets and would be facing additional difficulties in raising capital.

In this context, the overall objective of GMES is to

- enable Earth observation services on a sustainable basis, and tailored to the needs of users, including public policy makers and private citizens. The GMES services will allow public policy makers in particular to
  - prepare national, European, and international legislation of environmental matters, including climate change;
  - monitor the implementation of this legislation;
  - access comprehensive and accurate information concerning security matters (e.g. for border surveillance).
- ensure the sustainability of the observation infrastructure necessary to provide the GMES services. This will be done either through the establishment of partnerships with

[4] In particular, information aggregated at European or global level with a sufficient quality is currently not available to European policy makers.

infrastructure owners, or through the development of new infrastructure in the event existing infrastructure is not sufficient to produce the data needed for the GMES services;

- create opportunities for increased private sector usage of information sources, thereby facilitating market uptake by value-adding service providers, many of which are small and medium enterprises (SME).

2.1.2. Financing and timeline

GMES are currently and will continue to be co-financed at European, intergovernmental and national levels, based on partnerships among the different players. This is because, the EU will not finance the cost of the development and operations of all the space based[5] and the in situ installations providing data for the GMES services, as the financing of the total costs for all the necessary infrastructure elements could violate the proportionality and subsidiarity principles. The EC will rather concentrate on domains where a Community intervention will provide a clear added value.

The EU will both coordinate these partnerships and manage its own contribution to GMES, which consists of development activities and an operational phase.

Regarding development activities, this contribution currently consists, in particular, of the co-financing following research activities under FP 7 und FP 6:

- a co-financing of space infrastructure developments[6] that are carried by the European Space Agency (ESA) in order to fill gaps in existing space infrastructure;

- in situ research;

- funding of pre-operational demonstrator services.

Within FP 6, the EU has spent 100M€ on GMES projects, whereas ESA invested another 100M€ in the GMES Service Elements projects. In the space theme of the specific programme "cooperation" of FP 7, the EU will make available approximately 430M€ for GMES service projects and procurement of data for these Services between 2007 and 2013. Additionally, 624 M€ from the space theme of FP 7 will be used to contribute to the development of the ESA Space component programme, which amounts to 2246 M€ (2008 e.c.) in total (including funds contributed by ESA Member States.

First operational services in the field of emergency management and land monitoring are financed under preparatory actions in addition to some other operational elements in the land domain (Corine Land Cover, Urban Atlas).

In the beginning of the next decade (2011 – 2013), operational services could be provided at a larger scale. Investments could be needed to set up the appropriate infrastructure for the required service processing chain and the roll-out of products based on prototypes developed in the previous research actions. The operational processing chain would have to be designed to meet the demands of data volumes to be processed for full pan-European or global

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5 Existing space missions that will provide data for GMES include Spot, TerraSAR-X, EUMETSAT satellites, CosmoSkymed, DMC Deimos, Ikonos, GeoEye, Quickbird, and ENVISAT.

6 ESA is currently developing 5 "Sentinel" missions under its GMES Space Component Programme.

coverage, as well as a steady-state operation on a 24/7 basis, with shortest response times. The funding would mainly be needed for servers, workstations, backup-systems, network infrastructure, software, installation of infrastructure, maintenance, integration and testing, long-term archiving, help-desk functions and the like.

FP7 is an R&D tool and thus not designed to support GMES Initial Operations to the extent that these need to be ensured on a more permanent basis. It is thus necessary to establish appropriate mechanisms for a Community intervention. This is the main challenge that the proposed ic Act is intended to address, and is further elaborated in section 2.2. The full GMES programme, under which the EU contribution to the overall GMES initiative could be financed in the long run, is expected to be in place during the EU's next multiannual financial framework (from 2014). The overall financing needs of GMES after 2013 will be subject to future analysis led by the Commission, on the basis of defined cost-sharing principles and a cost assessment based on the scope of services. This will include a more detailed analysis of costs at Member State level.

In this context, it should be recalled that the long-term GMES funding approach should be developed in a modular way. This means that new expansions in the scope of GMES services and every new evolution of GMES will be assessed against the criterion of cost efficiency user needs and the EU policy interests.

Since 2005, the Commission has thus led a prioritisation process for GMES through its 2005 and 2008 Communications. This has been fully supported in Council orientations (in 2005), resolutions (in 2007 and 2008) and conclusions (in 2008). Already in 2005, there was political agreement to base the implementation of GMES on a phased approach and to focus on three fast-track services (land monitoring, emergency response and marine services). In 2007 and 2008 respectively, a R&D phase was launched for atmospheric monitoring as well as security and climate change services. For the period 2011 – 2013, this prioritisation process has led to the selection of activities of the following fields in the framework of GMES Initial Operations.

(a) emergency response services;

(b) land monitoring services;

and auxiliary activities including:

(c) measures supporting the uptake of services by users;

(d) data access;

(e) GMES space component.

The following specific criteria were used for the selection of activities for GMES Initial Operations.

- sufficient technical maturity;
- continuity with the Preparatory Action 2008-2010, and other existing activities outside the RTD framework programmes, such as Corine land cover;
- proven potential for the development of downstream services;

- service providers are industry players and would therefore cease activities without additional intervention from the EU, whereas in the field of marine and atmosphere, services are provided mainly by public institutions that will be able to continue activities (albeit probably at a less ambitious scale) before 2013 without Community support; and

- regarding emergency services, it is clear that it would be preferable to make available emergency maps on an operational basis to civil protection authorities already in 2011, and not 2014.

These priorities have been discussed extensively with in the aftermath of the Lille GMES Forum organised by the French presidency, including consultations within the GMES Advisory Council. Stakeholders agreed that it will be necessary to complement existing research funds in the period 2011 – 2013 in order to launch services on an operational basis in areas where there is a risk of service interruption. They also acknowledged that the marine and atmospheric monitoring activities are on good track. Owing to the institutional or scientific nature of the European actors involved in their implementation, FP7 seems adequate enough, at this stage, both in volume and as a legal instrument, to allow establishing a capacity which is very close to operational conditions for marine and atmosphere services.

2.1.3. Auxiliary activities

Auxiliary activities, in particular data access, are an indispensable input for the provision of operational emergency and land monitoring services. This is because without access to Earth observation data, the provision of operational GMES services is impossible, as the services consist in an interpretation and processing of available Earth observation data.

The GMES Space Component consists of space observation infrastructure addressing service data needs with missions observing land, atmospheric and oceanographic parameters, including:

- existing or planned European space infrastructure mainly satellites of ESA, EUMETSAT and Member States; and

- space infrastructure co-financed by the EU and ESA.

Within the Space Component, different functions need to be covered for all space infrastructure types (demonstration missions, initial and recurrent elements of operational missions). Currently, following a gap analysis conducted by ESA, ESA and the EC are jointly developing space observation infrastructure in the frame of the ESA GMES Space component Programme. This programme aims at developing a number of satellite missions known as “the Sentinels”. The ESA GSC programme, however, only covers the development of the Sentinels, but not their operation following in-orbit validation. As outlined in the 2008 Communication, the Community Programme should contribute to the sustainability of the space infrastructure, notably to the in-orbit availability and operations. The space infrastructure relevant for land and emergency services[7] will be operated by ESA, until an operator has been selected[8].

[7] This includes Sentinels 1 and 2, carrying radar and multispectral imaging sensors, and the land part of Sentinel 3.

[8] See the 2008 Communication, p 3, 6 and 8.

Other auxiliary activities (i.e. a support to the uptake of other operational services) are only of marginal importance in financial terms in the period 2011 – 2013.

Consequently, the problem definition and the analysis of options will focus on land monitoring and emergency services.

2.2. Problem definition

The stakeholder consultation has confirmed the environmental and policy need for GMES services[9]. Nevertheless, the market seems to fail in providing the services without public intervention. This is mainly due to intrinsic high fixed costs, while at the same time slow and gradual returns normally make the investment not sustainable for the private sector, as a very long span of time is required to reach the break-even point of the investment[10]. Additionally, it should be recalled that most of users of GMES services will be public policy makers. Stakeholders widely agree that a public intervention in core operational services is a prerequisite for wide-ranging operational services to emerge. Without such intervention, there are serious concerns about the extent to which operational services useful for policy makers and others would become available[11]. As outlined in section 2.3.1 below, this public intervention should take place at EU level.

A lack of operational services in the field of emergency response and land monitoring provided under EU coordination in the period 2011 – 2013 would thus result in the following problems:

- there is a risk that once existing research projects end (i.e. in 2011), in the period covered by the proposed Regulation, civil protection authorities would either not have access at all to the maps referred to under chapter 2.2.1., or would continue to produce them on their own in an uncoordinated manner. In the latter case, civil protection authorities would have to rely on data purchased at very high prices, which is also one of the major barriers for the development of the downstream sector. The production of the maps would take place, if at all, at Member State level, which means that it would be much more difficult to achieve economies of scale;

- users of land monitoring services (e.g. environmental agencies) would face comparable problems between 2011 - 2013, including a lack of continuous availability of the products referred to under 2.2.2., and the lack of availability of Earth observation data (in particular satellite data) at reasonable conditions;

- the downstream sector, which depends on a continuous input of information produced in the framework of GMES services, could not develop its full potential without an assurance that the GMES services will be available on a continuous basis. There is consequently a risk that the lack of operational services in the period 2011- 2013, which would leave an important gap between the end of research activities and fully fledged operations after 2014, would significantly deteriorate the boost to the industry's competitiveness and the emergence of commercially viable solutions between 2011 - 2013. This boost could have

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9 See e.g. Section 7 of Annex III hereto.

10 See also the Impact Assessment accompanying the Commission Communication on the European Space policy, SEC(2007)505 of 26.4.2007, p. 10.

11 See Section 3 of Annex III hereto.

been expected to result from the Community's extensive support to the R&D phase of GMES. For a more detailed description of the downstream sector, see Annex II;

- Without a Community intervention in the period 2011-2013 with a view to enabling initial operational land monitoring and emergency response services, there is a risk that there will be un unacceptable interruption between the research projects providing pre-operational services and the services provided in the framework of a fully fledged GMES programme starting in 2014. Concretely, this could mean that industrial teams disintegrate, which could make efficient service provision already at the beginning of the next financial framework difficult or impossible.

Additional problems common to both emergency and land monitoring services before 2014 include (i) the lack of common catalogue and archiving facilities, and (ii) the lack of the harmonisation and interoperability of data and service results. The first point is problematic because e.g. the parameters necessary to understand climate change have to be observed over a longer time period. If information produced by operational services is not archived properly, it might simply be lost and thus not available for long term studies. Lack of harmonisation of data is a problem because it may lead to the incomparability of information produced in different member States. This would mean that e.g. the production of pan-European maps for the purpose of a Europe-wide monitoring would be impossible.

It is considered that for other GMES services, existing research and development funding under FP 7 can sufficiently address the needs between 2011 and 2103. It is for this reason that GMES initial operations focus on emergency response and land monitoring services[12]. All GMES services could be financed on an operational basis from 2014, provided that decisions for funding and organisational arrangements after 2013 will have to be determined as part of the next multiannual financial framework.

In the following, problems related to emergency response and land monitoring services will be analysed.

2.2.1. Problems specific to operational Emergency response services

Civil protection authorities, at European, national, regional and local level require access to accurate Earth observation data and information services in order to react to emergency situations. These include:

- **natural disasters,** caused by the impact of natural phenomena on society and the built environment, including earth quakes, volcanic eruptions, floods, wildfires, tsunamis, hurricanes, droughts, food shortages;

- **man made disasters,** to include industrial accidents, chemical spills and nuclear accidents (but not war, terrorism and complex political crises);

- **complex (political) emergencies:** civil war and unrest or armed conflict with widespread impact on civilian populations, often leading to massive displacement of people across regions and national borders. In such cases the humanitarian community comprises

[12] See also Chapter 2.1.3 above.

assistance, relief and protection operations on a non-discriminatory basis to the victims of conflict[13].

Products that are needed concretely by civil protection authorities are (i) emergency maps that are produced in rush mode to show the impact of the disaster, (ii) maps covering the whole response cycle, including risk maps and mapping for the reconstruction phase, and (iii) reference maps providing basic cartographic information on areas affected by hazards. Civil protection authorities will use these maps in order to obtain a clearer picture of the disaster, which will help them to improve their capacity to react appropriately to the emergency. To provide an example, in the case of floods or forest fires, emergency maps would allow rescue teams to verify which roads are blocked off and therefore cannot be used to reach victims.

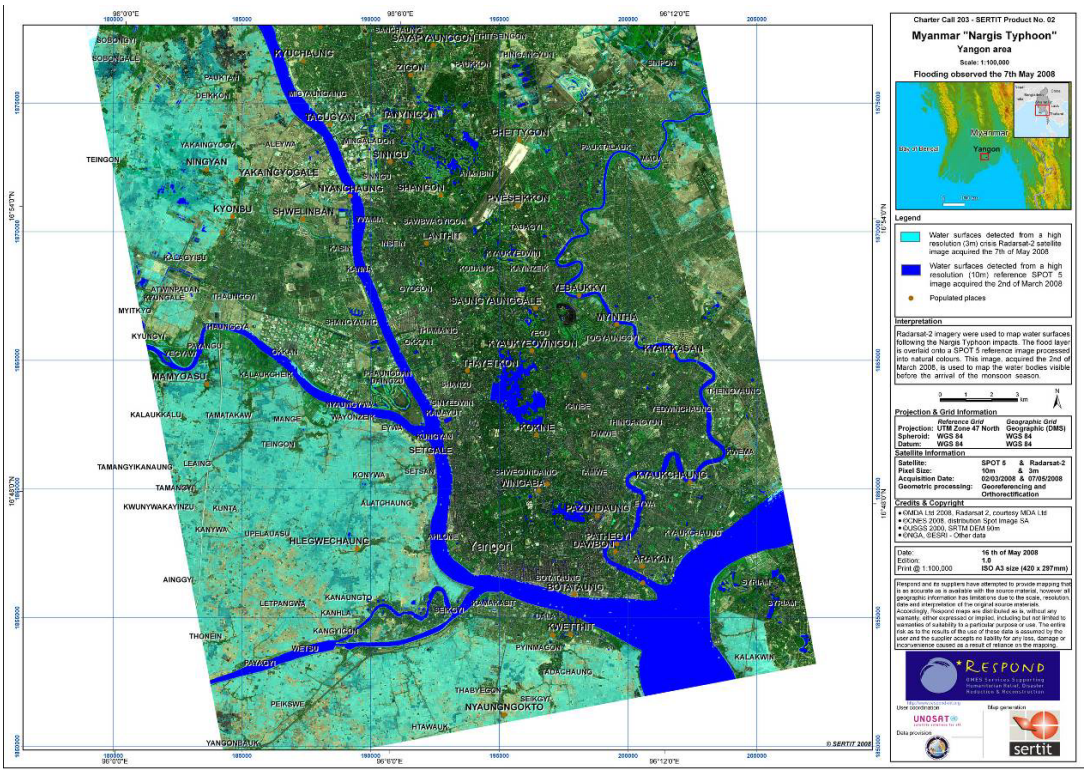

Image 1: flood map for Myanmar

In order to improve Europe's capacity to respond to disasters, the EU and ESA launched the development of pre-operational GMES services through the ESA GMES Service Element programme and the EC 6th Framework Programme for research (FP6)[14]. Further developments are financed through FP7, based on the guidelines developed by the Implementation Group for the ERCS.

A further step towards operational services was taken through a preparatory action in the field of emergency services (the "PA"). The first PA was launched in 2008 covering the period 2008-2010. Its objective is to complement the FP6 and FP7 activities referred to above by developing the operational interfaces and procedures between the users and the service

13 GMES Fast Track Emergency Response Core Service, Strategic Implementation Plan, Final Version, 24/04/2007 ERCS Strategic implementation Plan, available at http://www.gmes.info/library/files/5.%20Implementation%20Groups%20Documents/Emergency%20Response%20Core%20Service%20ERCS/ERCS_Strategic_Implementation_Plan_Final.pdf, p 9.

14 Namely the projects RISK-EOS and PREVIEW in support of European civil protection authorities, and the RESPOND project in the domain of humanitarian aid.

providers. In the frame of this PA, DG ENTR has published on 7 June 2008 a call for tender "Supporting the implementation of an operational Global Monitoring for Environment and Security (GMES) service in the field of emergency management"[15].

This PA, however, will expire in 2010, at the latest. This means that without further financing, no operational services in the field of emergency response management will be available at EU level thereafter. The discontinuity of operational services in the period 2011 – 2013 could have a serious negative impact on the launch of operational services in the context of a fully fledged GMES programme starting in 2014.

2.2.2. Problems specific to operational land monitoring services

Land monitoring is quite a complex activity since it covers a wide range of resources and diversified policies: soils, water, agriculture, forests, energy and utilities, built-up areas, recreation, infrastructures and transports. Better, more frequent and up-to-date information on land cover and land use becomes more and more important due to growing changes affecting the landscape and environment. Land cover/land use information is thus required to support policy implementation and compliance reporting at both European and national level, and at international level[16], taking into consideration that at least 80 % of the EU budget is used today to support policy domains with a strong territorial impact (i.e. agriculture policy, regional policy, transport policy, forestry and biodiversity, food security and humanitarian aid, climate change and emergency planning) for which data and information on land use and land cover changes are indispensable for implementation, monitoring and evaluation of effectiveness[17].

Land use/ land cover and land cover change data are therefore essential for a large community of users, as well as a better access to Earth observation and reference data. Today many initiatives, applications and projects provide land cover and land use products (at local, national, European or global level), but they are spread out, and not always compatible. Most of them are not regularly updated or delivered in a timely manner.

In the field of land monitoring, the added-value of GMES would be to integrate into one system various types of products at different scales, combining in interoperable and seamless way pre-processed images, reference data possibly from existing sources and land use/land cover data starting with the following service elements:

- pan-European land cover products at fine resolution that show e.g. detailed information on forests and soil sealing;

- very fine resolution maps of cities and other 'hot spot' areas (e.g. coastal areas, protected areas etc.)

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15 The document is available on http://ec.europa.eu/enterprise/calls/calls_arc2008.html.

16 The EC is party to many International Environmental Agreements including the three Rio Conventions (UN Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol; UN Convention to Combat Desertification (UNCCD), UN Convention on Biological Diversity (UNCBD)), the UN-ECE Long Range Transboundary Air Pollution Deposition and dispersion modelling, and it is supporting the UN Forum on Forest, UN Millennium Development Goals and the Ramsar Convention on Wetlands.

17 GMES Fast Track Land Monitoring Core Service Strategic Implementation Plan, Final Version, 24/04/2007, (« LMCS Strategic Implementation Plan »), available at http://www.gmes.info/library/files/5.%20Implementation%20Groups%20Documents/Land%20Monitoring%20Core%20Service%20LMCS/LMCS_Strategic_Implementation_Plan_Final.pdf, p 8.

- dynamic land monitoring measuring parameters of importance to understand climate change (e.g. vegetation, surface radiation, water, andsnow).

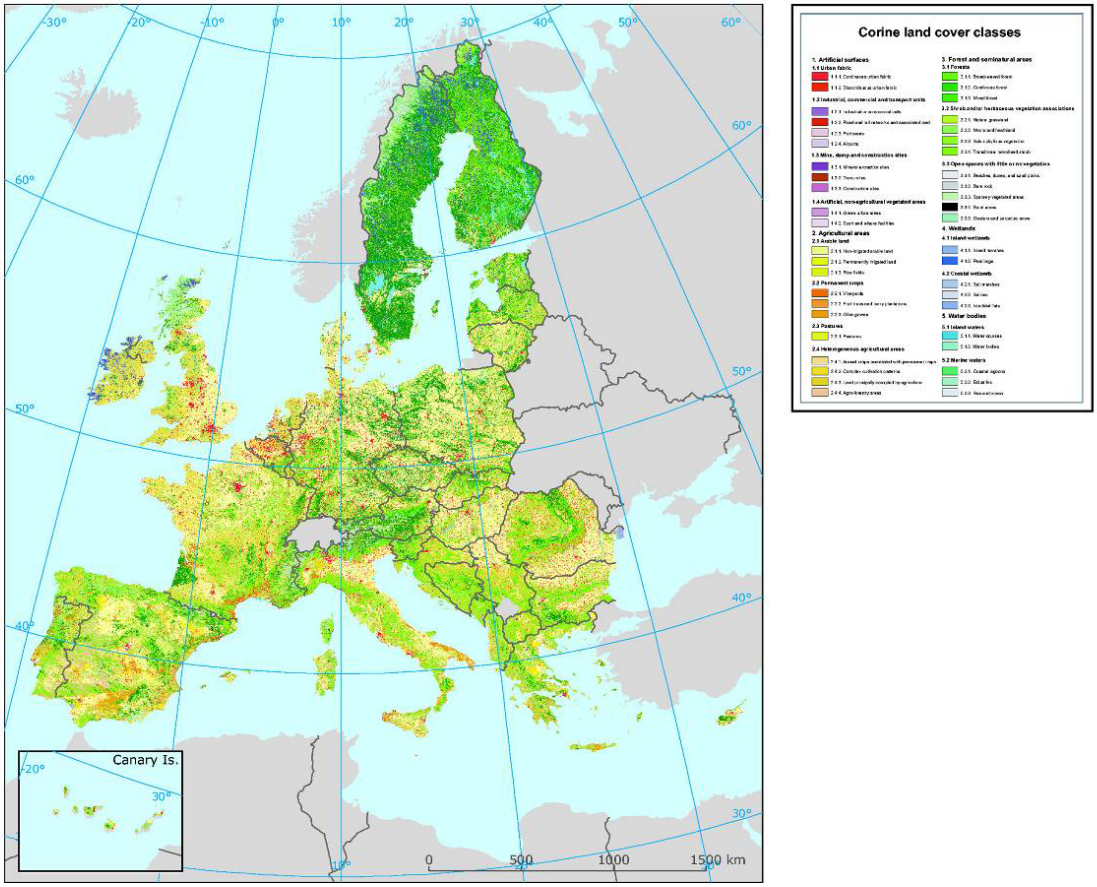

Image 2: Corine 2000 Pan-European Land cover map

In this context, the EU and ESA launched significant research efforts, including the FP6 GEOLAND and Boss4GMES, FP7 GEOLAND2 and GSE projects (managed by ESA). Additionally, the Commission will launch a preparatory action in the field of land monitoring in 2008. Nevertheless a risk exists that the services delivered in the framework of the research projects and the preparatory action mentioned above will never be made available in an operational context between 2011 and 2013 without a Community intervention.

2.3. Does the EU have the right to act?

The legal basis for the Community's right to act in this field is Article 157(3) of the EC Treaty.

Article 157(3) provides for the adoption of specific measures in support of actions taken in the Member States to ensure that the conditions necessary for the competitiveness of the Community's industry exist. The objectives of (i) encouraging an environment favourable to initiative and to the development of undertakings throughout the Community, particularly small and medium-sized undertakings, and of (ii) encouraging an environment favourable to initiative and to the development of undertakings throughout the Community are of particular importance in this regard.

2.3.1. Subsidiarity

As Article 157(3) of the EC Treaty does not establish an exclusive competence of the EC, the proposed action needs to be examined in the light of the principle of subsidiarity. This means that the Community shall take action only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore, by reason of the scale or effects of the proposed action, be better achieved by the Community.

For the services with a pan-European (or even global) coverage, in particular the pan-European land cover services referred to under Chapter 2.2.2, Member States cannot sufficiently achieve the objectives of the proposed action, as the inputs from different Member States have to be aggregated at European level. The provision of other services referred to in chapter 2.2.1. and 2.2.2 (e.g. emergency maps or thematic land monitoring maps of a more limited geographical scope) can be better achieved by the Community for two reasons. First, a more coherent and centralised management of input data, from space based or in situ sensors will allow for economies of scale[18]. Secondly, an uncoordinated provision of Earth observation services at Member State level would lead to duplications and would render the monitoring of the implementation of EC environmental legislation on the basis of transparent and objective criteria difficult or even impossible. If information produced at Member State level is not comparable, it will not be possible for the Commission to ascertain whether environmental legislation has been implemented correctly in all Member States.

2.3.2. Proportionality

Any action by the Community shall not go beyond what is necessary to achieve the objectives of the EC Treaty. The action proposed for the initial operations of GMES fulfils this requirement for several reasons. First, the operational GMES services in the field of land monitoring and emergency response do not replace existing services, but rather complement them or ensure their continuity. Secondly, service provision will be centralised at Community level only when indispensable.

3. OBJECTIVES

3.1. General objectives

The general objectives of the proposed Regulation correspond to the objectives of GMES itself, as outlined in chapter 2.1. above.

3.2. Specific objectives

For the period 2011 – 2013, the specific objectives of the proposed act are to

- enable the provision of the services referred to in Chapter 2.2.1. above (including emergency maps and reference maps) to civil protection authorities between 2011 and 2013, in order to allow them to respond to emergencies more efficiently and effectively;

[18] For this reason, procurement of space data for FP 7 service projects is coordinated centrally by the European Space Agency (ESA) on behalf of the Commission under a grant agreement. See also ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 12 - 13.

- enable the provision of the land monitoring services referred to in Chapter 2.2.2 above (in particular pre-processed data, land cover products, high resolution maps of cities and thematic maps) to public authorities (including environmental agencies) in Europe between 2011 and 2013, so that they are better able to perform their tasks of policy making, implementation and monitoring;

- contribute to the production and availability of environmental information to the public, in conformity in particular with the principles of the Aarhus convention[19], the INSPIRE Directive and the Shared Environmental Information System (SEIS)[20];

- stimulate, by lowering the costs of access to information, the growth of the Earth Observation downstream sector in terms of jobs, innovation and international competitiveness between 2011 and 2013.

3.3. Operational objectives

The operational objectives for the Regulation are:

- to enable the provision of the following operational emergency response services between 2011 - 2013:
  - European mapping services for emergency response;
  - product integration for emergency response;
- to enable the provision of the following operational land monitoring services between 2011 - 2013:
  - periodic land cover mapping service;
  - dynamic land monitoring activities including essential climate variables in support to climate change monitoring;
- to provide auxiliary activities between 2011 and 2013, including measures supporting the uptake of operational services by users, data procurement in support of services and GMES space component operations[21].

3.4. Consistency with other EU policies

The Commission will ensure complementarity and consistency with other Community policies, in particular in relation to competition, the European GNSS programmes, the

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[19] The Convention on Access to Information, Public Participation in Decision-Making and Access to Justice In Environmental Matters, of 25 June 1998, provides for the right of everyone to receive environmental information that is held by public authorities ("access to environmental information"), to participate in environmental decision-making, and the right to review procedures to challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general ("access to justice").

[20] See also Chapter 3.4 below.

[21] This concerns in particular the Sentinels, i.e. five space missions developed in the framework of an ESA optional programme that is co-financed by the EU. For more information, see http://www.esa.int/esaLP/SEMZHM0DU8E_LPgmes_0.html.

protection of personal data, the cohesion policy[22] and agricultural policy[23]. Additionally, GMES should be a tool for cooperation actions linked to development, humanitarian aid and emergency situations worldwide, and more specifically with Africa.

Further, the GMES services are considered essential not only because their more direct users are policy makers, but also owing to the fact that they stimulate innovation and growth in the downstream sector. GMES is thus fully in line with the Lisbon strategy.

The Commission will ensure that the proposed action is consistent with and complementary to EU policies relating to research, development and innovation. Any potential Community contribution to operational GMES services resulting from this Regulation could not be financed through FP 7, but would be necessary in order to build on and fully take advantage of the substantial R&D support that has been provided to date.

Consistency with specific existing policies directly related to GMES is analysed in more detail for the two services in Annex IV.

4. POLICY OPTIONS

4.1. Definition of the options

The policy options at hand to address the objectives as defined in Chapter 3 above are as follows:

- Baseline
- Option 1: Open method of coordination only
- Option 2: Regulatory intervention
- Option 3: Community financing

The content of these options is described in the following sections.

4.1.1. Baseline

Under the baseline scenario, the EU would not take any specific measures, in addition to existing research activities, in order to ensure the provision of operational services in the field of land monitoring and emergency services following the research activities and the preparatory action referred to in chapter 2.1. above.

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[22] The Community Strategic guidelines on Cohesion 2007 and 2013 underline the need to strengthen the links between environmental protection and growth and make specific reference to GMES in section 1.1.2.

[23] In particular, the Commission will ensure coherence with the project AGRI4CAST, which provides crop yield forecasts, the Land use/cover area frame survey (LUCAS) project; and the Urban Atlas project.

4.1.2. Option 1: Open method of coordination only

Under Option 1, the Community would not support the provision of operational land monitoring and emergency service financially, but rather follow the "open method of co-ordination", as described in the White Paper on European governance[24]. According to this White Paper, the open method of co-ordination "is a way of encouraging co-operation, the exchange of best practice and agreeing common targets and guidelines for Member States, sometimes backed up by national action plans as in the case of employment and social exclusion. It relies on regular monitoring of progress to meet those targets, allowing Member States to compare their efforts and learn from the experience of others"[25]. In order to ensure overall accountability,

- the open method of co-ordination should be used to achieve defined Treaty objectives;
- the Commission should be closely involved and play a co-ordinating role;
- the data and information generated should be widely available[26].

In the field of operational GMES land monitoring and emergency services, the open method of coordination would mean that the EU would merely coordinate existing national and intergovernmental activities. Concretely, the EU would create fora for discussion between (mainly institutional users) in the Member States, elaborate guidelines, e.g. concerning a common methodologies for service provision or quality assurance, and determine benchmarks. The EU would not manage auxiliary activities such as data procurement, but would rather try to facilitate access to data by national institutions, e.g. through the elaboration of model license agreements and the organisation of workshops.

4.1.3. Option 2: Regulatory intervention

Under option 2, the provision of the services referred to in Chapter 2.2.1 and 2.2.2 would be imposed by regulatory means, e.g. by Regulation of the Council and the European Parliament. Option 2 would be comparable functionally to legislation that already exists, including

- the Directive 2004/52/EC of 29 April 2004 on the interoperability of electronic road toll systems in the Community[27], which imposes the use of specific technologies for all new electronic toll systems brought into service in the Community on or after 1 January 2007;
- EU legislative acts concerning environmental monitoring, e.g. the Commission Decision of 29 January 2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council[28].

These examples demonstrate that a regulatory intervention is not a merely hypothetical option, provided that the conformity of the proposed act or acts with the principles of subsidiarity and proportionality is ensured.

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24 COM(2001) 428 final of 25.7. 2001.
25 See the White Paper on European governance, p 21.
26 See the White Paper on European governance, p 22.
27 OJ L 200/50 of 7.6.2004.
28 OJ L 59/1 0f 26.2.2004.

4.1.4. Option 3: Community financing

Under option 3, the EU would contribute to the financing of the provision of the operational emergency and land monitoring services referred to in chapter 2.2.1 and 2.2.2 above. In practice, in particular two implementation schemes are possible:

- the Commission concludes procurement contracts with the service providers. Within the Commission, the corresponding procurement contracts could be managed either by a dedicated internal structure such as the GMES Bureau, or by a standard Commission unit. In both cases, the service providers would make available the operational emergency and land monitoring services to users (including Commission services, civil protection agencies and environmental agencies in the Member States, and downstream service providers) according to the principle of full and open access, unless security restrictions apply. Finally, the Commission would assess the quality of the services provided to users.

- The Commission awards grant agreements[29] to Member States, groups of Member States or specialised EU agencies who conclude in turn contracts with the actual service providers. These grant agreements would be based on the principle that service providers make available their products fully and openly, unless security restrictions apply.

For the purpose of this Impact Assessment, it is assumed that these two schemes would have the same effect in terms of costs and benefits. This assumption is motivated by the fact that in both schemes, the Commission would ensure that the operational services correspond to user needs through the bodies outlined in the 2008 Communication, including a User Forum and the GMES Partners Board.

4.2. Underlying assumptions

4.2.1. Complementarity of the options

The options defined under Chapter 4.1. are not mutually exclusive. It would be possible to combine all three options. For the sake of clarity, however, the impact of these options will be analysed separately. It is thus assumed e.g. under Option 1 that no additional regulatory measures or financial support at European level exist. In this context, the crucial question is whether the open method of coordination or a regulatory intervention would be sufficient on their own to achieve the objectives defined under Chapter 3, without financial support from the EC. In practice, it is unlikely that GMES will be implemented at EU level simply through the funding of infrastructure and services, without coordination of existing activities of GMES partners.

4.2.2. Governance

Generally speaking, the overall approach for governance of GMES has been described in detail in the 2008 Communication, and its Impact Assessment. It is within this framework that GMES Initial Operations will be implemented, as well as in the framework of common practices for the management of Community programmes.

The activities of Member States, financed by national budgets, and synergies with the Community contribution will be coordinated in the GMES Partners Board. A Programme

[29] In theory, funds could also be transferred on the basis of delegation agreements.

Committee will assist the Commission in the management of Community funds. Specialised Community agencies, such as the EEA, will support the Commission regarding user interfaces. ESA will coordinate the space component. Detailed coordination arrangements will be elaborated within these fora.

According to the draft conclusions from the evaluation study of the GMES Bureau, it is advisable to maintain a specific internal Commission management structure. It will be up to the next Commission to decide what this structure will look like when the Regulation is adopted (end 2010 at the earliest).

The analysis of the different options has been carried out in this context, taking into consideration that the overall governance of GMES is not part of the Basic Act on GMES Initial Operations.

4.2.3. Full and open access to GMES data and information

The options referred to under Chapter 4.1. have been defined under the assumption that GMES services should be fully and openly accessible, as long as EU and Member States security interests do not suggest otherwise. The principle of full and open access has been approved by the Commission in the 2008 Communication and was welcomed by the Council in its Conclusion of 2 December 2008.

The reason why GMES data and information should be fully and openly accessible is that full and open access will help to promote the widest possible use and sharing of data and information. Downstream service providers could use GMES information and data as an input to provide and market innovative services, but this should be seen as an opportunity rather than a threat. Studies have identified the cost of data as a major obstacle to the development of this market and a barrier to entry. This was also demonstrated also during the review of the Directive on the re-use of public sector information (the PSI Directive)[30].

Generally speaking, the GMES Data and Information policy falls under the framework for the dissemination of environmental and geospatial information (SEIS and INSPIRE)[31] rather than the Community framework for infrastructure pricing. Further, it is recalled that the Community has endorsed the principle of full and open access to Earth observation data when it adopted the Resolution of the Third Earth Observation Summit on 16 February 2005. This Resolution includes a reference to the 10-Year Implementation Plan of Earth Observation System of Systems (GEOSS), which contains the principle of full and open access.

Additionally, it should be noted that beneficiaries of Community funding would be mostly public authorities. This is why, at least in an initial period, it seems advisable to make available data fully and openly, especially considering the current small size of the sector. A full and open data policy also means that at least in the short and medium run, the provision of GMES services will not be based on a concession or PPP scheme. As outlined in the 2008

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30 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 345/90 of 31.12.2003. Respondents to the public consultation in the framework of the review (available athttp://ec.europa.eu/information_society/policy/psi/docs/pdfs/online_consultation/report_psi_online_consultaion_stakeholders.pdf) have signalled that the high prices charged for PSI may be limiting the economic development of particular sectors.

31 See p 5 of the 2008 Communication.

Communication, the Commission will continue to explore whether the development of market opportunities and cost based user charges could eventually allow the reduction of the proportion of public investment after 2014.

Finally, it should be recalled that the principle of full and open access applies to data and information owned or co-owned by the EC. Conditions for the access to and the on-ward distribution of other data (e.g. space data from third party infrastructures) will be negotiated with data owners.

4.2.4. Developments after 2013

The assessment of the different options is based on the assumption that in the next financial framework, the full set of GMES services (i.e. land, emergency, marine, atmosphere, security and climate change) will be financed or co-financed by the GMES programme. As outlined in section 2.1.2, the overall financing needs of GMES after 2013 will be subject to future analysis led by the Commission, on the basis of defined cost-sharing principles and a cost assessment based on the scope of services. As GMES initial operations aim at preparing fully fledged operations after 2013, a complete lack of funding for GMES in the next financial framework would limit the usefulness also of GMES initial operations. Assuming that the EU will not cease funding of the second flagship programme of its space policy completely, the exact scope of activities will be defined following a modular approach, taking into consideration available funds.

5. ANALYSIS OF IMPACTS OF OPTIONS

5.1. Baseline Scenario

5.1.1. Economic impact of Baseline Scenario

The stakeholder consultation has demonstrated that potential providers of the operational services referred to in Chapter 2.2. might leave the market due to the absence of perspective of EU financing outside research budgets in the period 2011 - 2013. Service providers would probably still continue seeking research co-financing and therefore co-investing in GMES for a short time, but without a clear perspective concerning operational activities the risk exists that in particular smaller providers would not survive if the Community intervention is postponed until 2014 and beyond[32]. Additionally, providers of downstream services (i.e. providers that use the GMES services financed or co-financed by the EU as an input for their own services) might not be able to offer innovative services owing to the lack of affordable upstream services. This would mean that the multiplicator effect of the EU investment in operational services would be lost. Consequently, the EU Earth observation might lose out to non-European companies, in particular those active in countries with a proactive Earth observation strategy. In this context, it should be recalled that the downstream sector is still dependent to a large extent on public investments[33].

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[32] Regarding the importance of public intervention, see also ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 82.

[33] As outlined in the Vega study entitled "The state of the health of the European and Canadian EO industry in 2006".

The value of the benefits arising from a fully fledged operational GMES programme through 2030 was estimated by PWC at 34.7 € billions, comparable to 0,2 % of the EU GDP at 2005 prices.[34]. Although initial operational activities (2011-2013) are limited in scope, a small, but not insignificant growth potential for the EU GDP would be lost (in addition to the multiplicator effect referred to in the previous paragraph) if no operational GMES services were financed at EU level.

As outlined in the 2008 Communication, public investment in GMES would also encourage industry to explore innovative ways of integrating observing, communication and information technologies. A lack of EU investment would thus mean that Europe's potential for the introduction and dissemination of new production methods, technologies and products in the field of Earth observation would not be tapped fully in the beginning of the next decade. As the downstream sector is composed predominantly of SMEs[35], which are still strongly dependent on public grants due to the scarce level of maturity of the market, the lack of EU action would be particularly detrimental, taking into consideration that SMEs are at the heart of the Lisbon Growth and Jobs Strategy[36].

Additionally, the baseline would indirectly have a negative impact on the budgets of public authorities at European, national, regional and local level in comparison with other options for the period covered by the proposed Regulation. Either the baseline would mean that these authorities do not have access to the products referred to in chapters 2.2.1. and 2.2.2. above at all, or that national authorities develop their own systems In the former case, it can be expected that the response to emergencies would be less efficient. This would lead to huge economic costs, as the damages including loss of human lives would be unnecessarily high[37]. In the field of land monitoring, the lack of thematic maps or land cover products could mean that environmental legislation is implemented in a suboptimal way because public authorities might not have access to information of a sufficient quality. Even where national authorities produce their own maps, the baseline would lead to higher overall costs, mainly owing to the lack of economies of scale regarding the access to the space or in situ data needed to produce the maps. Further, a purely national approach could lead to fragmentation and duplication of efforts in Europe.

Finally, the baseline would have a negative impact in the field of international relations. First, already in the Communication "GMES - From concept to reality"[38], it was underlined that GMES would be the major contribution to the Global Earth Observation System of Systems (GEOSS)[39]. If the EU did not move forward with operational GMES services before 2014, this would limit its credibility within the Group on Earth Observation (GEO). The same is true for the "GMES and Africa" partnership. In the field of Earth observation, the EU will only be a credible partner for developing countries if GMES delivers operational services in addition to existing research projects.

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34 See the study carried out by PriceWaterhouseCoopers entitled "Socioeconomic benefits analysis of GMES, available at http://esamultimedia.esa.int/docs/GMES/261006_GMES_D10_final.pdf , p 180 .

35 See ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 88.

36 See p 1 of the Communication Think Small First" - A "Small Business Act" for Europe, COM(2008) 394 final of 19.6.2008.

37 Average annual flood damage (calculated for the period 1980 – 2005) was around 2.2 billion € in 2005 prices, for wildfire, the figure was around 141 M€. It is obvious that even a small reduction of these numbers would be very beneficial. See also chapter 5.4.2

38 COM(2005)565 final of 10 November 2005.

39 See also p 5 of the 2008 Communication.

5.1.2. Environmental impact of Baseline

Although authorities at European, national, regional and local level (including environmental agencies) to some extent already use pre-operational or operational Earth observation services, two cross-cutting issues remain. First, existing pan-European services (e.g. the Corine Land Cover service) do not meet all the requirements of users. Secondly, the sustainability of existing services is not ensured, in particular in the case of services provided in the framework of research projects. This means that public authorities might not be willing to integrate these services into their standard operational procedures, as the relevant research projects have a limited duration and a gap of several years between the end of research projets and the potential launch of a fully fledged GMES programme in 2014. It is thus widely acknowledged among stakeholders and potential end users that a more comprehensive and harmonised approach would be preferable.

Regarding emergency response, the baseline would mean (i) that the prevention of risks relating to natural disasters (including forest fires and floods) would be made more difficult owing to the lack of precise risk mapping services, and that (ii) the response to natural disasters could be les efficient. This could result in emergencies of a larger scale before 2014.

The baseline would not allow to meet the main objective of GMES in the period covered by the proposed Regulation, namely to provide operational Earth observation services in support of environmental policies of the EU and its Member States.

5.1.3. Social impacts of Baseline

The social impact of the baseline is closely linked to its economic impact. Without operational GMES services, players in the downstream sector might either leave the market or reduce their activities in the field of Earth observation. A recent study suggests that the development of downstream services requires to reduce the current uncertainty over the conditions of access, price and data policy for GMES data and the real content of core services output, which has to date represented an important constraint to investments[40]. A gap of several years between the end of research projets and the potential launch of a fully fledged GMES programme in 2014 could potentially lead to the loss of invaluable know-how in Europe and of important opportunities for the creation of jobs in a high tech sector.

5.2. Open method of coordination only – Option 1

5.2.1. Economic impact of Option 1

Option 1 would be instrumental for a better coordination of existing operational activities in the field of land monitoring and emergency response. This could lead to non-negligible benefits compared with the baseline scenario for the following reasons:

- the open method of co-ordination could reduce the duplication of services covering the same parameters for the same geographical area;

- improvements in timing and quality of delivered information could be achieved through the exchange of best practices and benchmarking.

[40] See ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 13.

In the Inspire Extended Impact Assessment[41] a better harmonisation of data exchange can lead to significant benefits, 30% of which are related to better delivery of data. In the following, the impact and cost-effectiveness of Option 1 is analysed for a best case and worst case scenario. The best case scenario corresponds to the maximum level of effectiveness which can be attained by the option, i.e. the maximum extent to which the specific objectives referred to insection 3.2 are met, whereas in a worst case scenario, they are not met at all. As the assessment carried out below demonstrates that even the best case scenario is characterised by some cost inefficiencies and limited effectiveness, it appears that no intermediate scenarios need to be analysed. Consequently, a more comprehensive sensitivity analysis assessing intermediate effectiveness scenarios both in respect to their outcome (in terms of cost-effectiveness) and their probability is not of key importance.

In the best case scenario, the open method of coordination would enable the provision of almost all the emergency and land monitoring services referred to in section 2.2 and would thus solve the problems defined in section 3.2 in the period 2011 - 2013. Consequently, the impact and the benefits would be comparable to those specified for Option 3 in Annex V hereto. Regarding costs, it can be assumed that Option 1 would be less costly for the EU than a financial community intervention, as the EU budget would mainly cover staff costs and coordination activities (e.g. organisation of workshops), but not the costs for data access and the processing and dissemination of data. Nevertheless it is likely that overall costs of service provision, including the costs incurred at Member State level would be higher than in Option 3 for two reasons:

- given that input data needed for the services would have to be procured separately by each Member State, no economies of scale could be achieved. Further, the buying power of Member States would be reduced, given that they would all negotiate with data owners on their own. Therefore the procurement of data needed to provide the services would be more costly;

- a totally decentralised service provision scheme will necessitate some duplication, which will also need to higher costs.

The best case scenario is unlikely for three reasons.

- The efficient provision of services of a pan-European nature will be very difficult to implement if inputs from Member States (e.g. national land cover maps) are not aggregated at European level. A mere coordination of efforts is not sufficient to adequately achieve this objective. This aggregation rather necessitates a financial intervention from the EU;

- stakeholders widely agree[42] that a mere coordination at EU level is not sufficient to contribute to capacity building in the countries that currently do not have a sufficient expertise or infrastructure to ensure the provision of operational Earth observation services

- finally, a lack of sustainability (in particular for budgetary reasons) cannot be remedied by simple coordination.

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41 See http://inspire.jrc.ec.europa.eu/reports/inspire_extended_impact_assessment.pdf.

42 See the Impact Assessment accompanying the 2008 Communication, Annex II, section 8.5.

These shortcomings lead to the conclusion that the worst case scenario is more likely for Option 1. This worst case scenario would only be marginally better than the baseline.

Option 1 in its worst case scenario is unlikely to have a positive impact on the downstream sector (i.e. providers that use the GMES services financed or co-financed by the EU as an input for their own services) for the time period covered by the proposed Regulation. A mere coordination of Earth observation services is not sufficient to allow companies (in particular SMEs) to justify investments in innovative value added services. This is because the services referred to in Chapter 2.2.1 and 2.2.2. are intended to improve the efficiency of the downstream sector by providing access to basic processed and modelled products more cheaply than would be the case if each company had to undertake the basic processing and modelling. With regard to the competitiveness in the global market, downstream services related to the Land Monitoring Service are currently regarded as those with the "weakest positioning and lowest market perspectives"[43]. Moreover, Land Monitoring downstream services are regarded as the segment that will be significantly impacted by the provision of operational GMES Services[44]. Stakeholders generally agree that emergency Response downstream services are also seen as significantly impacted by the respective GMES Service implementation.

Additionally, providers of downstream services might not be able to offer innovative services owing to the lack of affordable and cheap upstream services in the worst case scenario of Option 1. In fact, according to different literature sources[45], the high cost of input data can be regarded as one of the main barriers to the growth of the EO downstream industry. Other concerns on the sustainability of the downstream market are linked to the heterogeneous and fragmented user community, insufficient and unreliable access to data for operational applications, and the lack of long term commitment from large institutional customers[46].

The downstream market is, at present time, a relatively small market, especially as compared to the US downstream market which is between two and three times the size of the European Industry, and has in average larger and more profitable companies[47]. A recent study suggests that the development of downstream services requires to cut-off the current uncertainty over the conditions of access, price and data policy for GMES data and the real content of core services output, which has to date represented an important constraint to investments[48]. To sum up, it is unlikely that under the worst case scenario of Option 1, GMES would give a significant boost to the Earth observation industry in Europe before 2013. The cost effectiveness of the worst case scenario of option 1 is thus low.

5.2.2. Environmental impact of Option 1

The analysis of environmental impacts for the period 2011 – 2013 depends on whether a best case or worst case scenario is assumed.

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43 ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 36.

44 A mapping of the downstream application segments according to GMES Core Services influence can be found in ECORYS, Study on the Competitiveness of the GMES Downstream Sector, p.27.

45 ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 37.

46 ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p.38.

47 ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 11 - 12.

48 ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 12.

In the best case scenario, the open method of co-ordination would allow for efficiency gains regarding existing services. Nevertheless, authorities at Member State level would have to manage their own mapping services on the basis of expensive Earth observation data (in particular satellite data) procured separately by each authority or member State.

In the worst case scenario, option 1 but would not be sufficient (i) to ensure the provision of new services, or (ii) the sustainability of existing services. In the field of land monitoring services this means that public authorities would (i) either not have access to land cover products at all, or (ii) would not have products of a sufficient quality at their disposal. Regarding emergency response, this option would mean that some civil protection authorities would not have access to mapping services at all, which would make the response to natural disasters (including forest fires and floods) much more difficult. In a worst case scenario, the environmental impact of option 1 would correspond to the baseline. As states above, a worst case scenario is likely to materialise.

5.2.3. Social impact of Option 1

As Option 1 entails the risk that the sustainability of operational services is not ensured in the likely event the worst case scenario occurs, companies in he downstream sector might not be willing to invest. This would also mean that job creation remains suboptimal for the period 2011 – 2013. Although nominal revenues of the downstream sector have increased by around 2% per annum on average between 2002 and 2006, while employment evolved in a lower pace, slight under 1%[49]. It is questionable whether Option 1 would substantially improve this trend. Consequently, the full long-term business potential of GMES and related job-creation mentioned in section 5.1 would not be achieved under option 1.

5.3. Regulatory intervention – Option 2

5.3.1. Economic impact of Option 2

The political and economic impact of option 2 depends on the way a regulatory measure is implemented in the Member States. If a Regulation imposing the provision of the services referred to in Chapter 2.2.1 and 2.2.2 is implemented fully in all the Member States (best case scenario for Option 2), the specific objectives defined in Chapter 3.2. would most likely be achieved for the period 2011 - 2013. This would lead to gross benefits comparable to those specified in Chapter 5.4./Annex V. It can be assumed, however, that a provision of operational GMES services at Member State level would be costly, in particular if the access to Earth observation data is not centralised at EU level[50]. As in Option 1, Member States would have to procure the data and to ensure the provision of the services in a fragmented way, which would lead to inefficiencies related to the conditions at which the required data and services are procured. The implications of this fragmented buying power would be of the same type of those analysed in the case of Option 1.

Given the technical complexity of the services in question, it is however likely that some Member States would not be in a position to implement fully a regulatory measure imposing the provision of the services referred to in Chapter 2.1.1 and 2.1.2. Without financial assistance with the objective of capacity building in Member States with less know how, it is thus possible that operational emergency and land monitoring services would not be available

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49 ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p.23.

50 Regarding data access, the situation would thus be comparable to Option 1, see chapter 5.2.1.

at all, or with an insufficient quality. In a worst case scenario, a regulatory intervention could produce effects only in the countries that have started developing their own services in any event.

The best case scenario described in the first paragraph of this subchapter is rather unrealistic for reasons largely comparable to those used assessing the likely outcome of Option 1:

- Assuming that GMES services will be made available fully and openly to users, the aggregation of inputs from Member States with a view to providing pan-European services necessitates funds used to outsource processing and distribution activities at Community level;

- regulation alone could be insufficient if national, regional and local authorities do not have the expertise to implement services;

- regulatory measures are not enough if Member States do not dispose of sufficient funds to finance data access and service provision.

The political and economic impact of the worst case scenario of Option 2 is to a large extent comparable to the political and economic impact of Option 1. In other words, a boost to the downstream sector is not realistic for the period 2011 - 2013. Additionally, Option 2 might reinforce geographical disparities of the downstream sector. Currently, the main operational centres of EO activity in 2006 are the UK and Germany. Additionally, France, Italy, Belgium and Spain also have a relatively strong downstream industry. These countries also account for the largest concentrations in employment, which is obviously related to the number of organisations established in a country. Almost all EO downstream organisations are located in the EU15, plus Norway and Switzerland. Regarding the new Member States, only the Czech Republic accommodates a few EO downstream organisations[51]. The risk exists that a regulatory intervention at EU level that is not accompanied by supporting measures would not strengthen the Earth observation industry in countries that do not yet dispose of a strong industrial base in the sector, which would require financial assistance.

5.3.2. Environmental impact of Option 2

The environmental impact of Option 2 depends on the level of implementation of any regulatory measure. As mentioned above, the best case scenario of full implementation in all Member States is unlikely owing to the lack of know how in particular in the new Member States. In a worst case scenario, the environmental impact would correspond to the baseline. The uncertainty associated with the environmental outcome is a key concern also for option 2.

5.3.3. Social impact of Option 2

Taking into consideration the links between social and environmental impact, Option 2 entails the risk that in the worst case scenario, job creation in the Earth observation sector would only take placed in the countries that have developed national services without Community intervention, whereas in may countries (in particular the new Member States) a regulatory intervention would not contribute to an increase of employment in the Earth observation

[51] ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 23.

sector. Consequently, the full long-term business potential of GMES and related job-creation mentioned in section 5.1 might not be achieved under option 2 either.

5.4. Community financing - Option 3

5.4.1. Economic impact

The financial intervention of the EU under Option 3 would mean that the provision of operational emergency and land monitoring services would be supported by a EU financial contribution. This financial Community intervention could mean that the objectives referred to in section 3.2 above are fully met (best case scenario), partly met, or not met at all (worst case scenario). It can reasonable be expected that the financial Community intervention will meet the objectives defined for the proposed Regulation for the following reasons:

- the Commission, which will be responsible for the overall management of GMES on behalf of the Community, has acquired a robust expertise in the management of initiatives comparable to GMES, including Corine land cover, and research activities relating to GMES;

- the technical management of GMES Initial Operations will be delegated to entities with a proven expertise, including ESA for the GMES space component, and the EEA for in situ infrastructure coordination;

- the financial Community intervention in the period 2011 -2013 will concentrate on domains where a Community intervention will provide a clear added value;

- the areas where the Community co-finances activities will be closely coordinated with GMES partners in the framework of the GMES Partners Board[52] in order to ensure that overall results are line with the objectives of GMES and the GMES data and information policy;

- the exact scope and content of the activities that will be financed or co-financed will be determined in a way that avoids crowding out of private investment, based (i) on an intensive consultation of all relevant players, including users and downstream service providers, and (ii) interaction with Member States through a comitology procedure;

- the implementation mechanisms of GMES will allow avoiding overcompensation. In particular

    – the beneficiaries of the Community contribution on services would be mostly public sector users. In other words, through the Community action public authorities will be able to improve their own services related to land monitoring and emergency response. This benefit will partly include some Community financing to stimulate the integration of GMES in these domains which already exist in Member States. The private sector would be an indirect beneficiary of this funding mostly as subcontractor of public authorities. Contracts with private entities will contain provisions ensuring a rigorous control of costs.

[52] See also Chapter 6.2. of the 2008 Communication.

– regarding data procurement, the long-standing experience of ESA and JRC will be fundamental in assessing cost estimates.

– regarding the initial operations of the Sentinels, there will be continuity with the current budget implementation approach through ESA, which provides for robust scrutiny mechanisms.

Given that it is unlikely that the financial Community intervention will not achieve its objectives in the period 2011 - 2013, it is justified to focus the following assessment on a best case scenario of Option 3.

It is envisaged that the indicative financial Community intervention could amount to 150 M€ for the period 2011 – 2013, including 43 M€ for research activities from the space theme of FP 7 for research actions accompanying GMES initial operations. A detailed assessment of (i) the activities to be financed and the corresponding costs, and (ii) the benefits of the best case scenario of Option 3 can be found in Annex V. The assessment of benefits is based on conservative assumption. In other words, the quantitative impact of the best case scenario is estimated at the bottom range of possible benefits.

According to stakeholders and an external study, it can reasonably be expected that the Community financing would have a positive impact on the competitiveness of EU firms in comparison with non-EU competitors, as the private sector, including downstream companies would have planning certainty concerning the availability of GMES services[53]. This is of paramount importance for SMEs, which form the backbone of the Earth observation industry in Europe[54].

Further, the making available of data and information produced by services that are supported financially by the Community according to the principle of full and open access could most likely lead to innovations in the downstream sector, which depends on a flow of data at reasonable conditions[55]. This, in turn, would significantly contribute to job creation in a high tech sector of strategic importance in the period covered by the proposed Regulation. The probability of reaching the full potential the GMES programme mentioned in section 5.1 would be significantly higher under option 3.

Another, albeit more indirect, economic impact of option 3 would be that the cost associated with a number of environmental problems such as flooding, wildfire and urban management is likely to be reduced if operational services are guaranteed. This aspect is elaborated in more detail the next section of this chapter. Another indirect economic impact is that Member States and other users would have less need to develop their own solutions, implying cost savings and avoidance of duplications. These aspects are discussed in greater detail in section 5.1.1. The overall cost benefit assessment of option 3 will have to take these indirect economic impacts into proper consideration.

Finally, it is recalled that EU financing of operational services would constitute a political message of paramount importance also for the external relations of the EU, and would

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53 See, in particular, ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 812.

54 See ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 93.

55 See ECORYS (2008), Study on the Competitiveness of the GMES Downstream Sector, p. 13.

reinforce the credibility of the EU as a partner in the GEOSS and the strategic EU-Africa partnership.

5.4.2. Environmental impact

Regarding **emergency services**, Option 3 would allow civil protection authorities throughout Europe in particular to have access to accurate emergency response maps including maps produced in rush mode already in 2011. These maps would beter enable civil protection authorities to prevent and respond to crises throughout the whole response cycle, both allowing better assessment and management of risk in the prevention phase, and better management of the response during the crisis and in the post-crisis phase. This could reduce the scale of environmental risk, including floods and forest fires.

An external study has demonstrated that floods have caused average annual damages (calculated for the period 1980 – 2005) of around 2.2 billion € in 2005 prices, owing to loss of life, effects of flood morbidity and damage to property[56]. GMES can help to reduce these damages on the assumption that precise flood maps could enable a much more efficient response by civil protection authorities. Stakeholders suggested that GMES could reduce damage, by improving the efficiency in managing and responding to crises, from the pre-event phase to the post-event phases, and noted that in the context of extreme events, inputs to planning and risk management, this assumption is regarded as conservative by the consultant that carried out the assessment (PWC). **This would correspond to net economic benefits of around €135 million in 2012, based on conservative assumptions[57].**

Average annual wildfire damage (calculated for the period 1980 – 2005) was around 141 million € in 2005 prices[58]. GMES services could provide civil protection authorities with inputs for all stages of action in relation to wildfires, including a fast appraisal of the fire situation which in turn allows authorities to optimise the fire fighting facilities at their disposal. Stakeholders consulted thought that GMES could deliver a 1% reduction in mortality, morbidity and property damage. **This would correspond to net economic benefits of around 9 million € in 2012[59], based on conservative assumptions.**

A Community financing would enable the provision of the *land cover* products referred to in Chapter 2.2.2 on a reliable basis. These products, mostly of a generic, multipurpose nature, would make possible the development of tailored downstream services in a large number of areas, including soils, water, agriculture, forests, energy and utilities, built-up areas, recreation, infrastructures and transports. In the following, the benefits of selected products that would be based on the generic land cover products above are discussed, including (i) agriculture and rural development, (ii) urban and regional policies, and (iii) ecosystems and biodiversity – forest monitoring.

In the field of **agriculture and rural development**, GMES would potentially support the CAP information requirements between 2011 and 2013, through the providing of land use and land cover data at more frequent intervals, at higher spatial resolution, and with continuity over time. Other applications of GMES, including for example, irrigation pressure mapping

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56 For more details see PWC, Socio-economic analysis of GMES benefits, p 138 – 139, and Annex V.

57 See PWC, Socio-economic analysis of GMES benefits, p 146 – 147.

58 See PWC, Socio-economic analysis of GMES benefits, p 140 – 141, and Annex V.

59 See PWC, Socio-economic analysis of GMES benefits, p 148 – 149.

and soil sealing mapping also offer the potential for landowners to enhance yields through better predictive tools to manage scarce resources such as water[60].

Regarding **Urban Management**, GMES could enable local authorities and other users to understand the impacts of land use policy better, anticipate trends, develop policies to minimise urban sprawl/soil sealing and enable them to manage the urban environment, and the urban-rural interface in a more effective way[61]. The main monetary benefits identified in an external cost benefit analysis derive from efficiency gains within city and regional administrations and an improved means of impact assessment at EU institutions level, notably the evaluation of the implementation of the EC Structural Funds. For the period 2011 – 2013, the **study foresees total benefits of around EUR 168 million, including estimated benefits of EUR 56 million in 2012[62].**

In the field of **biodiversity and ecosystem services, including forest monitoring,** the products referred to in chapter 2.2.2 could be used to provide services improving the management of forests grown for logging; increase regeneration through monitoring disturbances and re-growth; and provide information on forest indicators and land cover to improve policy making. The benefits of GMES can be calculated through avoided deforestation (attributable to GMES) on the basis that GMES could reduce deforestation by 5%-10%. Valuing tropical forest at €105/Ha, the global annual economic costs of deforestation is calculated as €1.5 billion (2005 prices). Net economic benefits would thus amount to between €75-150 million per annum (in nominal undiscounted terms)[63].

5.4.3. Social impact

The above analysis for operational GMES emergency and land monitoring services does not cover the impact on the downstream sector. It is assumed that EU financing would lead to the provision of sustainable services that will be the basis for innovative value added services in Europe already between 2011 and 2013. This could reverse the trend of very slow growth in employment in this key high tech sector[64]. Additionally, the availability of operational GMES services could be instrumental in reducing the disparities between old and new Member States in the field of Earth observation. This is because downstream services market development, in particular in countries with a weaker industrial base, will most likely accelerate only with the full and open access to inputs from operational GMES services.

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60 See PWC, Socio-economic analysis of GMES benefits, p 96.

61 See PWC, Socio-economic analysis of GMES benefits, p 96 – 97.

62 See the Cost Benefit Analysis for the GMES Urban Services, prepared by Indra, available at http://esamultimedia.esa.int/docs/GMES/URBAN_C2_Ph2_V2%5B1%5D.0_00_12_04_Final.pdf., p. 42.

63 See PWC, Socio-economic analysis of GMES benefits, p 107, and Annex V.

64 See also chapter 5.2.3.

6. COMPARING THE OPTIONS

The following table contains a comparison of the options in the light of the objectives defined in chapter 3, and the principle of cost-effectiveness.

Option	Likelihood of reaching objectives and corresponding benefits[65]	Total Costs (including Community budget and Member State budgets)		Cost effectiveness
1	+[66]	Community budget: •Appropriations -[67] •Human Resources + •Administrative exp. +	Costs in MS ++++[68]	+[69]
2	+	Community budget: •Appropriations - •Human Resources + •Administrative exp. +	Costs in MS ++++	+
3	+++[70]	Community budget:[71] •Appropriations ++ •Human Resources + •Administrative exp. +	Costs in MS +++	+++

65 The likelihood of reaching the objectives has been discussed in section 5.2.1, 5.3.1, and 5.4.1. The benefits that are quantified in section 5.4 and Annex V are those which would materialise if the objectives defined in section 3.2. are fully met. In the reference year 2012, annual benefits linked directly to GMES include 135 M€ for flood services, 9M€ for wildfire services, a minimum of 75 M€ f in the field of deforestation and 56 M€ for urban planning, taking into consideration (i) that these numbers are based on conservative assumptions, and (ii) do not include benefits e.g. relating to emergency response to volcano eruptions and Earth quakes, nor benefits linked to efficiency gains in the field of agriculture and rural developments.

66 It is considered to be unlikely that options 1 and 2 will allow to reach the specific objectives of GMES Initial Operations owing to (i) problems with the provision of pan-European services, (ii) the lack of capacities and know-how in some of the Member States, and (iii) a lack of sustainability (in particular for budgetary reasons). In such a worst case scenario, Option 1 and 2 would be better than the baseline only marginally.

67 Appropriations include funds spend through grants, procurements or delegation agreements. In Options 1 and 2, no significant EC budgets would be spent through appropriations

68 Although no detailed numbers concerning the costs incurred by the Member States are available, previous experience in the field of Corine land cover and data submitted by the EEA shows that these costs are higher than EC costs by a factor of 3, meaning that total costs could be higher than EC costs by a factor of 4. It is assumed that both options 1 and 2 would lead to higher overall cost for the EU and its Member States due to (i) higher costs for the procurement of data needed to provide the services, given the lack of economies of scale and countervailing buying power, and (ii) the necessity to duplicate infrastructures in a totally decentralised service provision scheme.

69 Given the likelihood that Options 1 and 2 will not allow reaching the specific objectives of GMES Initial Operations, cost-effectiveness of these options is low.

70 Section 5.4. explains in detail why for Option 3, it can reasonably be assumed that the objectives defined in Section 3.2. are fully met. Consequently, the quantified benefits would fully materialise.

71 Detailed cost figures for the EC have been included in the legislative financial statement. For option 3, in the reference year 2012, total commitment appropriations would amount to 41 M€, 0,4 M€ for administrative expenditure, and 2,5 M€ for human resources. In options 1 and 2, the cost of human resources would be lower, as no staff members would be needed to manage appropriations.

The likelihood of reaching the objectives has been discussed in section 5.2.1, 5.3.1, and 5.4.1, which contain a discussion of the impact of the different options depending on whether the specific objectives of GMES are fully met (best case scenario), or not met (worst case scenario). The benefits that are quantified in section 5.4 and Annex V are those which would materialise if the objectives defined in section 3.2. are fully met. In the reference year 2012, annual benefits linked directly to GMES include 135 M€ for flood services, 9M€ for wildfire services, a minimum of 75 M€ f in the field of deforestation and 56 M€ for urban planning, taking into consideration (i) that these numbers are based on conservative assumptions, and (ii) do not include benefits e.g. relating to emergency response to volcano eruptions and earth quakes, nor benefits linked to efficiency gains in the field of agriculture and rural developments.

It is considered to be unlikely that options 1 and 2 will allow to reach the specific objectives of GMES Initial Operations owing to (i) problems with the provision of pan-European services, (ii) the lack of capacities and know-how in some of the Member States, and (iii) a lack of sustainability (in particular for budgetary reasons). In such a worst case scenario, Option 1 and 2 would be better than the baseline only marginally. Section 5.4. explains in detail why for Option 3, it can reasonably be assumed that the objectives defined in Section 3.2. will be fully met.

Regarding costs, it is not sufficient to focus on EC costs only, which would amount to 150 M€ for the whole period covered by GMES Initial Operations (2011 – 2013), including 43 M€ for research activities from the space theme of FP 7 for research actions accompanying GMES initial operations. Costs at Member State level must also be taken into consideration. Although no detailed numbers concerning the costs incurred by the Member States are available, previous experience in the field of Corine land cover and data submitted by the EEA shows that these costs could be higher than EC costs by a factor of 3, meaning that total costs could be higher than EC costs by a factor of 4 in option 3. It is assumed that both options 1 and 2 would lead to higher overall cost for the EU and its Member States due to (i) higher costs for the procurement of data needed to provide the services, given the lack of economies of scale and countervailing buying power, and (ii) the necessity to duplicate infrastructures in a totally decentralised service provision scheme.

Option 3 is thus considered to be the preferred option for the period 2011 – 2013, as it has been demonstrated that this option would (i) entail a high likelihood that the specific objectives of GMES initial operations are met, and (ii) could allow reducing overall costs, including through a centralised procurement of data needed for the services. Option 3 would also give a boost to the downstream sector, which would have better access to data. As foreseen in the Communication "GMES - We care for a Safer Planet", in any event EU financing should be accompanied by co-ordination activities. Additionally, the Commission will continue analysing whether a regulatory intervention (e.g. with a view to establishing common methodologies for land cover products) is necessary. In the period covered by the proposed Regulation, it is unlikely that EC regulation specifically targeted at GMES will enter into force.

7. MONITORING AND EVALUATION

7.1. Evaluation

Evaluation tasks will be carried out in three phases (ex ante, interim and ex post). In addition to this Impact Assessment, which constitutes an ex ante evaluation in accordance with Article 21(1) of the Implementing Rules, the Commission will carry out evaluations of i) the preparatory action in the field of emergency management and land monitoring referred to in Chapter 2.1.1 above, and (ii) data access activities, in order to prepare the first work programme for operational activities. Additionally, an interim evaluation report will be prepared no later than the end of 2012. Finally, an ex post evaluation will be prepared after the end of initial operational activities.

The interim and ex post evaluation will focus on the following indicators:

- achievement of the operational objectives referred to in chapter 3.3. In particular, it will have to verified whether (i) service quality is in conformity with applicable technical specifications, (ii) whether service specifications correspond to user requirements and thus ensure the widespread use of the services provided;

- impact of operational emergency and land monitoring services on the Earth observation industry in Europe, in particular in terms of relevance, utility, effectiveness and efficiency of services.

7.2. Monitoring

The Commission will ensure that contracts and grants concluded in the framework of operational emergency and land monitoring services provide for supervision and financial control by the Commission, if necessary by means of on-the-spot checks, including sample checks, and audits by the Court of Auditors. If need be, the Commission could be assisted by external technical experts when monitoring the implementation of the programme. On the basis of the results of the on-the-spot checks, the Commission will ensure that, if necessary, the scale or the conditions of allocation of the financial contribution originally approved and also the timetable for payments are adjusted.

In addition to financial supervision, the Commission will put in place mechanisms to ensure the continuous quality of the services provided. Finally, the Commission will organise user for a in order to ascertain that services are user-driven.

ANNEX I

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GOSIS study (funded under FP6) on GMES governance models
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ANNEX II

THE DOWNSTREAM SECTOR IN EUROPE

At downstream level, the relevant GMES sector can be defined as those organisations that offer value added services based on Earth Observation data, but also large industrial sectors which integrate information derived from Earth observation in their service offer or production processes, according to the model of meteorological or geographical information. Within the downstream sector, two distinctions should be made:

- Companies that use EO data and derived information, the provision and availability of which would be affected by the introduction of GMES services, versus those that use other EO data;

- Public entities versus private actors.

The economic performance of the GMES downstream sector has been reported in three studies: a study by Euroconsult in 2007[72], and two studies by VEGA, from 2004[73] and updated in 2008[74].

Euroconsult assessed the downstream value-adding sectors of space-based applications. This concerned earth observation (EO), communication and navigation. An overview of the world and European revenues and the compound annual growth rate (CAGR) is provided in the following table.

Sector	**World revenues 2005**	**European revenues 2005**	**Europe %**	**2000-2005 CAGR Europe**
Telecom	€54.3 billion	€18.1 billion	33%	6.5%
Navigation	€17.3 billion	€2.3 billion	13%	22%
Earth observation	€1.3 billion	€0.4 billion	31%	4%
Total	€72.9 billion	€20.8 billion	29%	11%

Table 1: Revenues of the downstream value adding sectors of space-based applications for 2005. Source: Euroconsult (2007). European data include Canada, an associate member of ESA, which accounts for around 10%.

The table indicates that EO is the smallest of the three value adding space segments in absolute numbers. European revenues take up around one-third of world revenues. European revenues from EO amount to approximately 2% of total European revenues of downstream value adding sectors, which is equal the share that world EO revenues have in world value-adding revenues.

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72 Euroconsult, 2007, Assessment of the downstream value-adding sectors of space-based applications.

73 VEGA and Booz Allen and Hamilton, 2004, The state and health of the European and Canadian EO service industry

74 VEGA, 2008, The state and health of the European and Canadian EO service industry in 2006

The revenue figures above are for EO value adding activity undertaken on a contracted basis including public sector revenues, which account for around €150 million, mostly coming from Meteorology and Met-ocean. European data quoted above include Canada, an associate member of ESA, which accounts for around 10% of the total. The following table provides as split of total European revenues per segment, and additionally provides the growth rate in the period 2000-2005.

Segment	**Revenue in 2005**	**CAGR 2000-2005**
Meteorology	€ 211 million	2%
Defence and security	€ 65 million	5%
Oceanography	€ 49 million	10%
Natural Resource Monitoring	€ 52 million	2%
Land Monitoring	€ 13 million	2%
Total	€ 390 million	4%

Table 2. European revenues EO value adding industry per segment in 2005. Source: Euroconsult (2007). European data include Canada, an associate member of ESA, which accounts for around 10%.

Euroconsult also indicated that EO value adding industry is the only segment where, in commercial activity, the downstream sector is smaller than the upstream sector (Satellites, launches, operations and ground equipment).

The Euroconsult figures as mentioned above can be compared with the figures provided by VEGA. VEGA reports the total revenue in Europe and Canada for EO value adding industry at € 285 in 2002, growing 2% per annum on average to € 306 million in 2006. This figure does not entirely match with the € 390 million in 2005, as presented by Euroconsult. However, these revenues include public sector revenues from meteorology and met-ocean, while we understand that this is excluded in the VEGA study. If we correct for this, there is a 'gap' of around € 60 million. Part of this can be explained by the difference in base year (2005 for Euroconsult, and 2006 for VEGA), but not all. The difference may arise from methodological differences.

VEGA indicates that about 30% of all revenues are from National/ESA/EC grants, hence not from customers paying for services. This figure rises to 50% for small/medium sized companies.

VEGA estimates employment in the sector to have risen from 2,900 employees in 2002 to 3,000 in 2006.An overview of employment and revenue is presented in the following table.

	2002	2006	CAGR
Revenue*	€ 285 million	€ 306 million	1.8%
Employees*	2,900	3,000	0.85%
Labour productivity (revenue per employee)	€ 98,000[75]	€ 102,000	0.93%

*Table 3. European revenue and employment. Source: VEGA. *Does not include revenue or employment generated by the public sector*

The table indicates that revenues have increased by around 2% per annum on average between 2002 and 2006, while employment evolved in a lower pace, slight under 1%. This implies that the productivity per employee has grown.

These figures from both Euroconsult and VEGA are for all EO activity, even if the company concerned is not in the "space sector". Hence they include, for example, the EO related revenues of large engineering /survey companies that use EO as part of their overall business. VEGA also estimated that the value adding products and services provided by the EO value adding industry are made up for 80% from a combination of spaceborne plus aerial or ground borne data. The OECD[76] indicates that in the total EO downstream sector (commercial remote sensing, including data sales), the revenues amounted to € 2 billion worldwide (satellite plus aerial component) in 2003. It was estimated that the satellite component amounted to one third of the total.

Conclusion

The GMES direct downstream sector employs around 3,000 persons in 2006. The total revenue in Europe amounts to € 250 - 300 million in 2006, excluding revenues by the public sector, which amount around € 150 million. These values include revenues from grants; corrected for this, revenues from paying customers amount to € 175 -210 million, excluding revenues by the public sector.

According to VEGA, there are 151 companies in Europe and Canada which can be defined as value adding companies (2006), excluding the public sector. In 2002 there were 162 companies identified. The decrease can be explained by consolidation activities that have taken place.

The sector is primarily made up of small and medium sized companies. The distribution among categories is presented in the following table.

[75] VEGA reports revenue per employee being € 107,000, which is based on a correction for outliers in the survey sample. However, these outliers were not excluded when calculating total revenue, which does not seem methodologically sound. Therefore this table presents the 'raw' figures without correction for outliers.

[76] Space 2030, Tackling society's challenges, OECD, 2005

Size class	Number of companies
Small (0-10 employees)	87
Medium (11-60 employees)	68
Large (>60 employees)	6
Total	151

Table 4. Size distribution of value adding companies (Europe and Canada). Source: VEGA

On average, the sector employs 20 persons per company and generates a turnover of around € 2 million per company. VEGA notes that profitability is highly concentrated with 89% of the profits coming from just 5 companies. VEGA indicates that the main operational centres of EO activity are in the UK and Germany, with France, Italy and Spain also making a significant contribution.

Conclusion

The GMES downstream sector is a relatively small sector, composed of around 150 companies. More than half of these companies are small companies employing less than 10 persons. The average turnover amounts to € 2 million per company. Note that the public sector is not included in these figures.

The use of GMES information in large industrial sectors such as energy, agriculture, water resources, etc should be comparable to those of similar information such as meteorology or cartography and remains to be assessed.

VEGA indicates that about 30% of all revenues of the EO value adding sector is from National/ESA/EC grants, hence not from customers paying for services. This figure rises to 50% for small/medium sized companies.

The European EO value adding sector takes up around one-third of global revenues. Both the below revenue and non weighted revenue tables give a picture of the geographical market reach of companies. The graph indicates that the majority of the users or customers of European value adding companies are located in the country of the company itself. The revenue weighted analysis shows that where there are activities outside Europe, the market is dominated by the activities of large companies operating in Asia and North America according to VEGA.

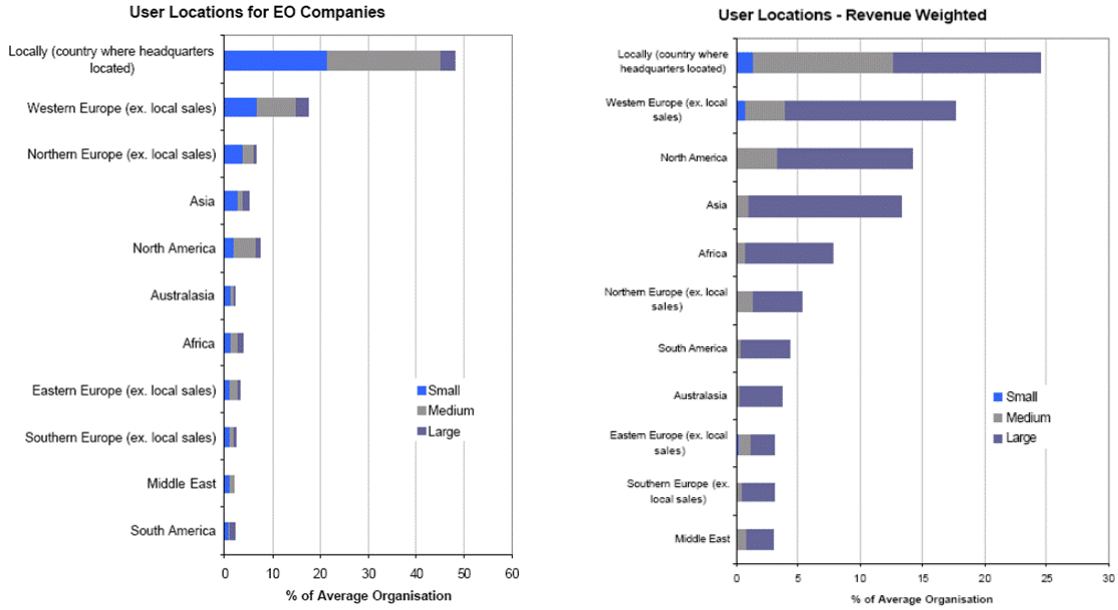


Figure : user locations for EO companies. Source: VEGA

Overall, nearly 10% of all European products are also sold to global users (VEGA 2008). Historical comparisons of growth in EO Services by customer location shows that in the period 2003 – 2006 there was a growth in products sold globally.

In terms of profitability trend of the EO service industry as a whole, profitability is typically below 10% and concentrated in a few larger companies, with only 89% of profit value across the sample companies from the VEGA survey (VEGA 2008) being delivered by five organisations. In 2006, a significant profit (greater than 1 million Euros) is limited to just five companies in the research sample[77], including all the large respondents and just one medium sized organisation.

Whilst it is not directly related to profitability, the current ratio[78] of the industry has been analysed in the literature. Whilst the trend is upwards in the EO value adding industry, many companies remain below the 'safe' level of 1 (for the current ratio) and the industry remains below benchmarks. For example, current ratios for engineering companies in the EU are 1.5 and in the US 1.1, while the EO industry as a whole is 0.89 (Galant 2007).

Despite issues with funding relating to support from the public institutions[79], the EO sector shows above average investment in R&D compared with other sectors, with the average R&D expenditure accounting for 27.5% of EO revenue. It is important to note that technical

77 Source: VEGA (2008). It should be noted that profitability of EO companies is shown by this study to be typically presented in low single figures as percentage of revenue, variable between companies and volatile year on year.

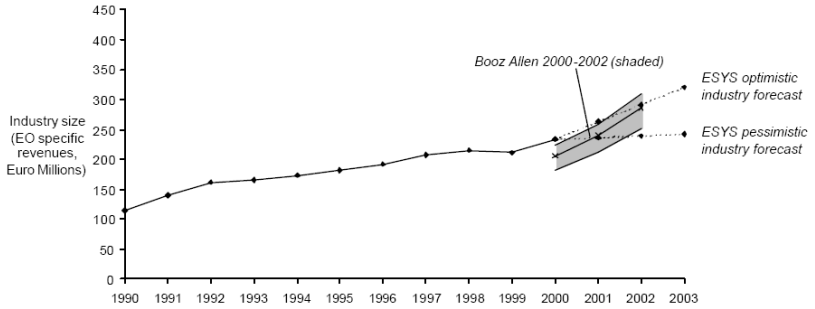
78 An indication of a company's ability to meet short-term debt obligations; the higher the ratio, the more liquid the company is. Current ratio is equal to current assets divided by current liabilities.

79 Issues being that revenues are primarily generated from operational services but revenues grants still comprise about a quarter of company revenues on average (VEGA 2008). Organisations awarding grants to the EO sector included National public grants, European public grants - ESA EC & other (VEGA 2008)

development activities in the EO sector are funded by clients / public funds and not direct by internal investment (VEGA 2008).

GMES aims at the delivery of information services. At global level, a recent study of total revenues for meteorology, airborne and satellite remote sensing estimated global revenues of the order US$ 7B for 2007 rising to approximately US$ 10B in 2012. These figures include the larger airborne remote sensing data market. Concentrating only on EO, the projected growth is approximately 8% per annum. These estimates are consistent with an independent study by Euroconsult as well as related studies of the market for Geographic Information Systems.

Since 1995, total revenue of the European and Canadian EO service industry has been regularly assessed by a series of independent studies commissioned by both EC and ESA. Three snapshots of annual revenues within the industry (including both R&D grants and commercial sales) were compiled in 1995, 1998 and 2001 followed by two detailed assessments of the state and health of the EO service industry in 2004 and most recently in 2007. These studies show a consistent picture – Europe earns between 33% and 50% of the global commercial market for EO based services and this market is growing at approximately 7 – 8 % per annum. The most recent assessment estimates total European and Canadian EO service revenue (not including data sales) as approximately €306 M for 2006. In addition, combined data sales and ground station procurement revenues were estimated to be approximately €106M.



Historic evolution of total revenue in the European EO service industry – source ESYS and Vega

In comparison, the global commercial revenues in the much larger satellite telecommunications and navigation service sectors are estimated at approximately US$ 55 B per annum and US$ 21 B per annum respectively.

ANNEX III

RESULTS OF THE STAKEHOLDER CONSULTATION

1. INTRODUCTION

In 2004[80] the Commission underlined the strategic role of GMES, identified elements for its implementation and the next year defined the strategy to move from concept to reality notably through a phased implementation approach[81]. The Space Council supported this approach and at the same time stressed the need for a consolidation of the overall GMES architecture, and the identification of appropriate governance and financing schemes.

In 2006, the Commission set up the GMES Bureau to strengthen the management of GMES. The Bureau is tasked to prepare, in close coordination with the relevant stakeholders and users, the Commission proposals and requirements on GMES.

The following chapters provide a synthesis of the input received by the Commission in the last two years from expert groups, stakeholders and Member States, and highlight the consensus achieved on the main issues where it is necessary to act to ensure an operational implementation of GMES.

2. TOWARDS AN OPERATIONAL EU GMES PROGRAMME

So far, GMES has been a European initiative that has drawn political attention to the need to preserve and strengthen service and infrastructure elements. Substantial R&D effort has been invested by the EU, ESA and their respective Member States. In the future, it is considered that GMES should be the product of a series of partnerships that need to be defined at the EU level, taking into consideration the role of agencies, Member States, value added services industry (including SME's) and user communities.

The variety of partnerships, infrastructure and services involved in GMES is linked with the areas of interest of the different partners, notably Member States. Consequently, in the operational phase of GMES, this should be reflected in the programmatic, management and financing schemes.

As a user-driven initiative, GMES should be designed in such a way that there is continuous user uptake through constant consultation with users and integration of their changing needs in an iterative process.

Financial and programmatic schemes should be designed to guarantee long-term sustainability of GMES and the efficient management of Community funds, and to support scientific and technical service evolution.

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80 Global Monitoring for Environment and Security (GMES): Establishing a GMES capacity by 2008 – Action Plan 2004-2008 (COM (2004) 65 Final).

81 Global Monitoring for Environment and Security (GMES): from concept to reality (COM (2005) 565 Final).

3. DEFINITION OF THE EU GMES PROGRAMME

Following various Council Orientations and Resolutions, the EU has been assigned a leading role in the development of GMES, with ESA being the implementing agency for its space observation component. The roles of all actors need to be consolidated. It is imperative that the EU defines the overall vision for GMES and uses its available instruments such as coordination, financing and regulatory measures for the governance of the different components of GMES. Those financial and programmatic instruments should guarantee a long-term sustainability of services and infrastructure.

Building on existing operational activities, previous and current R&D activities and the Preparatory Action, the GMES programme should contain a definition of its overall objectives and the areas where EU action is required, and indicative budgetary resources. It should have a clear scoping complementing the actions at national and intergovernmental levels and ensuring the user driven character of GMES.

The GMES architecture consists of several individual components. Each of these components has its own characteristics in terms of ownership, facilities, decision-making process, financing model, industrial and economic set-up and management. Where lacking, dedicated governance mechanisms should be implemented for each of these GMES components taking into account existing and future technical and institutional specific characteristics and structures.

The overall governance scheme will aim at establishing a sustainable institutional and financial framework for GMES and integrating GMES actors with a view to establishing genuine partnerships. It should allow for the interaction of the individual GMES components and their associated sub-governance schemes, and should ensure the efficient management of Community funds allocated to the programme, the management of necessary contractual relations for the operation of GMES, and legal representation towards external actors and international communities and coordination bodies, including the Group on Earth Observations (GEO).

Within the overall governance of the programme, mechanisms able to bring together actors of different institutional nature should be defined, ensuring a proper representation of the EU Member States. The specific issue of countries who are not members of the EU and who are involved in the implementation of GMES has to be addressed in this context.

Key issues raised by Stakeholders

- Ensuring that the EU and its Member States have the level of engagement and incentive to commit to the long-term availability of institutional observation and service infrastructure and resources for GMES.
- The EU GMES Programme should be defined in such a way that it adequately complements existing financing and programmatic schemes, thereby becoming a decisive factor for the establishment of a partnership between the EU and national and intergovernmental actors.
- Decision-making should be streamlined with clear roles and responsibilities involving all different actors, and especially funding bodies, and putting users at the forefront. The role of mandated bodies in this process is particularly important. The process at the operational

phase should be transparent and binding on reaching consensus and on implementing decisions including the evolution of GMES.

- To ensure transition to a governance system for an operational GMES architecture, robust programme management is needed, particularly to ensure integration between existing GMES components, coherent management of key programme elements, and full involvement of all players.

- User communities should be involved in governance and management at overarching and component level, so as to promote a continuing dialogue between the entities defining user requirements, observation and service infrastructure and service operators, and the bodies deciding on the future evolution and funding of GMES.

4. FUNDING

GMES is essentially a shared and distributed system and therefore it is expected to be co-financed at European, intergovernmental and national levels.

The costs of GMES during its operational phase depend on the scope of the services, the consolidated cost of the observation infrastructure needed to provide these services, and the extension of the international cooperation.

The share of the EU budget in the overall amount will depend on the scope for the activities funded and managed at EU level. According to the additionality principle, the EU contribution will not replace existing and planned national investments but will rather complement them in order to ensure a long-term sustainability for GMES. There is a need for continuity of EU R&D budgets as well as for the establishment of new budgets at EU level to support the operations of GMES.

Key issues raised by Stakeholders

- Preparing an operational funding line in the European Union budget by 2014 while ensuring the phased operational implementation of GMES in line with Space Council orientations at the same timeframe.

- Taking the necessary steps to expand the preparatory operational budget line introduced in 2008 in order to cover expenses required for the finalisation of the build-up and early operation of GMES services and the GMES observation component.

- The long-term GMES funding approach should ensure a smooth transition between three stages that partly overlap: demonstration stage to be funded from R&D appropriations, pre-operational stage with mixed R&D and operational funding, operational stage with operational funding from EU and national operational budgets, bearing in mind that demonstration activities and future operational elements will continue to require R&D funding during the operational stage.

5. THE DOWNSTREAM SECTOR

GMES has been selected as one of the quick start projects in the Commission's Initiative for Growth[82]. It should stimulate the industrial sector to expand its service offer and to develop the innovative integration of observing, communications and information technologies that will create opportunities for increased private sector usage of information sources. The European industrial base will be an important asset in maintaining a European autonomous capacity and political independence in decision making.

The stimulation of the downstream sector should also be facilitated by the mobilisation of traditional EU instruments in support of competitiveness and innovation. Full, equal and open access to GMES data and information will contribute to the Lisbon growth and job strategy and preserve the competitive market in the value adding sector.

Key issues raised by Stakeholders

- The GMES data and information policy should be based on the principle of "full and open access" to the extent allowed by the overall financial model and other legal and security-related constraints.
- Structured user support measures, with special focus on capacity building for shared needs among different Member States and for different application sectors.
- Structured business support measures with special focus on small and medium enterprises should stimulate growth and job creation.
- In order to support the continued development of innovative services, primarily in the downstream sector, R&D funds must continue to be made available.

6. INTERNATIONAL COOPERATION

Although European autonomy for GMES services is of key importance, the EU recognises that international cooperation in Earth Observation is imperative to fulfill the need for information based on global in-situ and remote sensing data. This cannot be pursued without exchanging equivalent observation data through cooperation schemes, thereby sharing the burden and cost of an expensive observation infrastructure with major non-European partners.

Further, only a coordinated approach bringing together the main actors in the world can lead to efficient counteraction facing global threats. The joint development of shared or complementary Earth observation tools has led the major actors in the world to recognise the reality and criticality of the on-going climate change process.

International cooperation should, when appropriate and efficient, build on existing cooperation schemes developed by European national and intergovernmental actors with international counterparts.

[82] "A European initiative for growth: Investing in networks and knowledge for growth and jobs: Final report to the European Council" COM(2003) 690 final/2 (21.11.2003)

Among those is the GEO process. GMES will be the main European contribution to the global 10-year implementation plan for the Global Earth Observation System of Systems (GEOSS). By registering GMES components in the GEOSS, GMES will contribute to increasing the knowledge of the Earth processes, enhance the prediction of the Earth systems, and will encourage the increased use of Earth observation, the development of a system of worldwide observation systems, and collaborative tools for observation and analysis with international partners.

Key issues raised by Stakeholders

The strategy regarding possibilities of international cooperation linked to GMES should be built along the following lines:

- Balanced cooperation on observation infrastructure that does not compromise the GMES objective for European autonomy in information generation, access and control and technological capacity in key areas;
- R&D cooperation to prepare the future and foster interoperability;
- Cooperation, in line with EU external relations policies, especially for contributing to sustainable development, as well as for European solidarity and capacity building approach including for instance support to food security, humanitarian aid, management of emergencies and crises.
- Strengthening the existing political mandate to support a co-ordinated European approach within the current development of the GEO process to implement the GEOSS data sharing principles and to define the European contribution to this international endeavour.

7. IMPLEMENTING GMES: CONSOLIDATED VIEWS AND OPEN ISSUES PER COMPONENT

Following the wide consultation notably through the GMES Advisory Council and in accordance with the *Munich Roadmap*, there is now a shared vision on the scope, architecture, and governance principles for GMES. The following sections summarise, starting from the existing stakeholders' consensus where available, the main issues raised by Stakeholders and linked to the different components of the GMES architecture.

7.1. The GMES Service Component

Through its service component, GMES will ensure regular observation and monitoring of the sub-systems of the Earth– including its atmosphere, oceans and continental surfaces – and will provide reliable, validated information in support of a broad range of environmental and security applications and decisions. According the current analysis of the user needs, the scoping of these services is as follows:

- *Land monitoring*

The Land Monitoring Core Service (LMCS) addresses a wide range of resources and policies (concerning soils, water, agriculture, forestry, biodiversity, transport, regional development etc.) involving very diverse user communities at global, European, national, regional and local level, requiring different types of information, from common multi-purpose up to specific information in terms of thematic or geographical area.

The LMCS will offer a portfolio of data and products, with different levels of elaboration (from pre-processed images to elaborated information), finding a compromise between multi-purpose requirements and specific thematic requirements, that are important for addressing European policies and for land management support.

Multi-purpose products will include pre-processed spaceborne and airborne observation products, specific reference data complementing existing reference data (e.g. European Digital Elevation Model), bio-geophysical parameters (dynamic vegetation and surface parameters in real-time at global level); a set of land use / land cover and land cover change products.

Thematic products at European or global levels such as crop forecasts, agricultural statistics, water models (quality, irrigation), environmental indicators, carbon fluxes, soil degradation and desertification models, urban and industrial areas and hot spots, will address more specific thematic requirements.

- *Marine*

The objective of the Marine Core Service (MCS) is to establish an integrated European capacity for ocean forecasting and monitoring allowing a systematic delivery of forecasts (from one day nowcasting to one month seasonal forecasting), re-analysis (time series) and scenario simulations (for climate change impact assessments):

– on sea state and dynamics (e.g. 3D currents, temperature, salinity) and primary ecosystem (surface phytoplankton and primary production) characteristics; and

– at global scale (all world ocean) with daily updates on 5-10 km horizontal grids and over European regional seas (Baltic, Mediterranean, North Sea, North East Atlantic Basin), with daily updates at customised space resolution (1-5 km horizontal grids).

As oceanographic models form the basis of its global and regional forecast services, the MCS depends on observation data from space and in-situ infrastructure and weather analysis and forecast information from numerical weather prediction models. Thematic Assembly Centres will be responsible for specific pre-processing of different parameters to be used as observation time-series and input to the global and regional Monitoring and Forecasting Centres. Regional models are foreseen for the Baltic, Mediterranean, Black Seas, Arctic Ocean, Northwest Shelf and the North Atlantic.

- *Atmosphere*

The GMES Atmosphere Core Service (GACS) provides products for three main application areas: (i) air quality, including long range transport of pollution, (ii) climate forcing and (iii) stratospheric ozone, UV and solar radiation. These products cover short term (including near real-time) to long term information needs (especially through reanalysis).

The atmospheric service will fill existing gaps in accessible information on atmospheric chemistry and composition. This will include:

– provision of Global Climate Observing System (GCOS) Essential Climate Variables (ECV's) compliant with Global Climate Observing System (GCOS) requirements;

– gridded information on atmospheric composition;

– long-term databases in order to clearly establish trends;

– reanalysis at regular intervals;

– ensuring effective access to in-situ and satellite observation data, including in near real time for services, e.g. in the field of solar energy;

– forecasting and assessment capabilities for policy development, health and other applications.

- *Emergency management*

The objective is to deliver a set of basic services to improve the capability of users to face major emergencies at national, European and global levels either within or outside Europe. It will cover information relating to natural disasters including meteorological-driven hazards (e.g. storms, fires, floods), geophysical hazards (e.g. earthquakes, tsunamis, volcanic eruptions, landslides and subsidence), and man made disasters and humanitarian emergencies.

The initial scope of the GMES Emergency Response Core Service (ERCS) is to provide rapid mapping services, delivering reference maps and assessment maps with a synthetic representation of anomalous events, their impact following effects and their time and space evolution, as well as the distribution in space and time of the available resources (rescue teams, equipment, material etc.), assets, and the actual damage. The ERCS will expand beyond the emergency response part of the crisis cycle and evolve to cover the entire crisis cycle (crisis prevention, early warning, post-crisis reconstruction and situation assessment). The products will be diversified (mapping services, forecasts and early warning systems, scenario preparation).

- *Security*

Preliminary discussions with different stakeholders have shown that security users should be offered the same rights as other user users of GMES services bearing in mind that GMES is a civil system under civil control. Experienced security actors underlined the sensitivity linked to the acquisition, handling and dissemination of geospatial information. Security users have specific needs which justify the creation of specific services.

In order for GMES services, data and information, to be used for public decision-making, most particularly but not solely for what concerns security-related services, they should fulfil basic security criteria in terms of confidentiality, anonymity, traceability as well as security of infrastructure and processes. These requirements will need to be considered by GMES services in general without hindering their overall development.

With the aim to raise stakeholder's awareness and to obtain guidance for scoping and implementation, the EU Institute for Security Studies held a seminar on the security dimension of GMES in March 2007. The discussions at the seminar identified a number of areas where GMES could have a relevant role to play in facilitating monitoring or implementation of policies, including e.g. maritime and border surveillance and global situation awareness. Following the coordination between the Commission and the General Secretariat of the Council, a number of action areas meeting policy requirements have been identified including: border surveillance, maritime surveillance and support to EU external action.

The specific support of GMES to security applications as well as the importance of correctly addressing security of information produced by GMES is currently being elaborated by the Commission. The results of ongoing analyses will be communicated at a later stage.

Key issues raised by Stakeholders

- Ensure in the definition of the initial scope for GMES services that their deliverables meet user needs (including the needs of downstream sector).
- Establish a mechanism for approval and continuous management of user feedback and requirements as well as for the validation of their implementation.
- Appropriate balance among coordination, financing and regulatory actions by the EU.
- Establish operational financing sources and associated procurement policy.

7.2. The GMES Space Component

The GMES Space Component (KSC) shall ensure sustainable provision of satellite derived Earth observation data to the GMES service component. The KSC architecture is driven by and derived from service requirements provided by the user communities represented in the overall GMES governance scheme. This requires that any investment in the space component needs to correspond to user requirements aggregated by the Commission.

The KSC is subject to a space infrastructure mission lifecycle which is driven by service requirements and which determines the roles and responsibilities of the various actors, funding sources and decision-making process. This lifecycle includes the following stages:

- demonstration stage through missions or technologies implemented with R&D funding;
- pre-operational stage with initial elements of an operational series through a mix of R&D and operational funding; and
- operational stage with recurrent elements of an operational series[83].

Stakeholders agree that the main challenge today is to ensure the implementation of the second and third stages mentioned above. This is true for a major part of KSC missions, including the ESA Sentinels and most of the national missions in Europe.

The current situation presents gaps and cannot guarantee the availability and continuity of the whole KSC mission range and mission lifecycle described above. The availability of KSC missions covering the third stage of lifecycle, i.e. recurrent elements of operational series, should be specifically considered. This would imply organising different funding and associated procurement policies.

[83] For instance, regarding the Sentinel missions, the recurrent units are defined as those units that follow after the completion of the full operational capability. In addition, it is essential that also during the operational stage R&D elements are implemented, e.g. for the development of the next generation Sentinels, which will incur the need for R&D funds.

Moreover, it is clear that at least four major functional roles are required, including coordination of infrastructure availability, procurement and operations of the operational infrastructure, and R&D for future infrastructure. These functions need to be further developed or created for sustaining an operational European capacity as shown in the following paragraphs. While the operation of national assets will clearly remain in the hands of respective national and commercial operators, the EUMETSAT and ESA capacities will be operated by European public entities that have the appropriate mandate and are technically capable of providing such operational services.

There is need to identify a decision-making process which brings together all relevant GMES Space Component partners in Europe. This process should build on the distributed architecture of the GMES Space Component. It should start with the definition and prioritisation of GMES service requirements through the general GMES governance scheme. Subsequently, these service requirements should be translated into mission and architecture requirements taking into consideration especially the available resources and plans for Earth Observation space infrastructure. ESA, as coordinator of this GMES component, should then develop an implementation plan to be steered and approved by the general GMES governance which will allocate its resources, if necessary with prioritisation decisions. At this stage, the GMES Space Component partners coordinated by ESA should then proceed with the implementation following the most appropriate programmatic scheme.

The decision-making process should take into consideration the implementation process, including decision making and funding, of individual partners. Nevertheless, there is a need to establish a process linking the various partners enabling to reach consensus and to drive the implementation (including financing) process.

Regarding financing, as the KSC capacities gradually reach the third stage of the operational lifecycle (i.e. recurrent elements of operational series), one major issue linked to the long-term continuity of the KSC is the availability of operational funding sources, notably the possibility to establish operational funding from the EU budget completing future operational funding sources at national level.

The precise content and costing of the KSC will drive the establishment of new operational budgets. Such issues are carefully examined in the long-term implementation plans for the GMES Space Component to be elaborated by ESA with EUMETSAT, Member States and other stakeholders. This process is expected to be finalised by 2009 to allow the Commission to fulfil its commitment to prepare proposals on the necessary EU operational budget.

Key issues raised by Stakeholders

- Ensure that the KSC corresponds to the requirements of GMES services
- Ensure an overall programmatic approach for a full mission lifecycle with special focus on a sustainable approach for recurrent elements of operational series.
- Identify how Member States can contribute to the GMES Space Component with their national missions and how the continuity of these missions can be ensured.
- Finalise content and costing of the KSC through overall consensus of the long-term KSC implementation plans to be coordinated by ESA.

- Identify the steps towards the establishment of operating entities and the definition of their role.
- Establish decision-making processes within the GMES Space Component and identify its involvement in the GMES overall governance.
- Establish operational financing sources and the associated industrial policy for infrastructure and data.

7.3. The in situ Component

The in-situ observation component is based on an observation infrastructure owned and operated to a large degree by the Member States, in some cases coordinated in the frame of European or international networks. In-situ observation activities and associated infrastructure derive from a range of national, EU and international regulatory requirements and agreements or form part of research processes. None were created to meet the needs of GMES, and they generally cover a much wider field than the requirements of GMES services. In-situ data flows, and products, are often inconsistent between different collection bodies, incomplete, not well-adapted to GMES service needs (e.g. for near real time data), subject to usage conditions that can affect their ready availability, and dependent on research funding. They therefore do not have the necessary operational sustainability.

In-situ observation data provide data not available from space sources (e.g. in the marine area, data from submersible floats) or essential reference data (e.g. topographic maps), and could also be used for calibration of space data or validation of space-based derived parameters.

The existing observation infrastructure is subject to a complex pattern of ownership and management, responds to a range of national, EU and international regulatory requirements and from numerous research processes. Many national, European and international networks coordinate monitoring and the analysis and consolidation of data.

In-situ observation data flows are highly fragmented; there are significant gaps in the data; there are inconsistencies between data collected by different bodies; and systems are not well adapted to GMES service needs (e.g. for near real time observation requirements in some cases).

Each service Implementation Group (IG) has produced its own list of essential in-situ data flows. This process has demonstrated wide differences between the requirements of the services. Given the complexity of the in-situ observation component, the European Environment Agency (EEA) has been tasked by the Commission to analyse and coordinate the in-situ observation data requirements of GMES.

Discussion among stakeholders of how to realise these requirements has brought to the surface a number of issues, including:

- concerns that Member States might not in practice, and for various reasons, be able or willing to guarantee the provision of in-situ observation input and that EU funding might need to be considered;

- a need for more clarity about what environmental communities might gain from GMES services in return for the provision of input, particularly as in practice their interest would often be in downstream services;

- what some regard as lack of transparency in the development of the initiative so far, and inadequate engagement of national authorities;

- the importance of quality control for input data for services.

A service-driven approach based on the evolving GMES Services needs to be followed. This will require close engagement with bodies in Member States and international and European coordinating bodies, which are key players in the management of data provision; global in-situ observation networks; and channels of user focus, especially in ensuring that data and products delivered by GMES services to which they contribute genuinely meet their needs – including for downstream services.

The financial responsibility for most in-situ observation data gathering and management is outside the EU framework, and GMES should not change this. But funding issues for new elements may need to be addressed in the framework of GMES funding.

Key issues raised by Stakeholders

- Reviewing organisational structures and ensuring adequate engagement of environmental bodies as both providers of data and products, and users of services.

- Identifying possible instruments of coordination, regulation or funding, shared between the EU and Member States, to facilitate the provision of *in situ* input.

- Identification of content and costs of GMES in situ observation component through overall consensus on the medium and long term scenarios under the coordination of relevant European institutions.

- Identification and co-ordination of the European approach on global in-situ observation networks.

- Contributing to the continuity of data provision and a mechanism for assessing data quality.

8. GMES DATA AND INFORMATION POLICY AND DATA MANAGEMENT

The complex GMES architecture includes data and information flowing among the different components and from/to sources outside the GMES perimeter. In particular, the observation infrastructure component produces and delivers data of various processing levels and sources. Data from this component are regularly processed by the GMES Service component (in this case, there is a flow of data between the components) in order to generate information made available to users, including the downstream sector.

Due to the complexity of an operational GMES architecture, a two-step process should be envisaged for elaborating a GMES data and information policy, based on (i) the definition of

objectives and principles of a GMES Data Policy, and (ii) the implementation of these objectives and principles.

The principles of the GMES data policy are to promote the widest possible use and sharing of GMES data, to strengthen markets using Earth Observation (and especially the European downstream sector) and consequently to enable growth and job creation, to contribute to the sustainability of the provision of GMES data, to ensure adequate protection of GMES data, and to support the European public sector, including its research communities. An objective should then be that GMES data should therefore be fully and openly accessible, within the constraints and exceptions (e.g. security issues) deriving from the overall GMES legal and policy environment. This principle is not only compliant with the INSPIRE rules and in accordance with the GEOSS Data Sharing Principles, but also targets the objective of promoting the widest possible use and sharing of GMES data.

GMES data are provided in a complex legal and financial environment. Data flows will be subject to binding rules at national, Community and international level. The detailed implementation mechanisms for a GMES data and information policy will not only depend on these legal constraints, but also on the governance framework and financing model for the GMES Service in question.

Key issues raised by Stakeholders

- Achieve consensus on the high-level objectives and principles for GMES data and information policy and the related financial model.
- Identify ways to implement data policy objectives and principles.

ANNEX IV

CONSISTENCY WITH SPECIFIC COMMUNITY POLICIES

This Annex contains an analysis of the complementarity of GMES with other EU policies in the field of emergency response and land monitoring.

1. SUPPORT TO EMERGENCY RESPONSE SERVICES

Monitoring and Information Centre (MIC) of the Directorate General for Environment

The MIC, operated by the European Commission in Brussels, is the operational heart of the Community Mechanism for Civil Protection. Any country affected by a major disaster – inside or outside the EU – can launch a request for assistance through the MIC. The GMES services may be triggered by the MIC or directly by the civil protection authorities of EU Member States. The MIC will be informed of the information requested and received by civil protection authorities. The MIC is thus fully involved in the provision of GMES services.

Flood and Fires Alert and Monitoring Systems

Some Member States have developed national alert systems for floods and fires. In complement to those activities, two alert systems, developed by the EC Joint Research Centre in collaboration with Member States, are working at European level: the European Flood Alert System (EFAS) and the European Forest Fire Information System (EFFIS). This information is delivered through the MIC.

Global Disaster Alert and Coordination System

Jointly with the United Nations, the Joint Research Centre of the European Commission coordinates the Global Disaster Alert and Coordination System (GDACS), which is a near real-time alert system for natural disasters (earthquakes, tsunamis, cyclones, floods and volcanic eruptions) and a tool for disaster response. GDACS has a global, rather than European, scope and is therefore especially relevant to support external actions. Following the users' requirements review at Commission services level, operational GMES services should interface with GDACS.

International Charter on Space and Major Disasters ("the Charter")

The Charter aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorised users. Each member agency has committed resources to support the provisions of the Charter and thus helps mitigate the impact of disasters on human life and property. Unlike operational GMES services, the Charter is a purely voluntary mechanism and therefore cannot replace operational GMES services in support of emergency response.

2. LAND MONITORING

Shared Environmental Information System (SEIS)

GMES will contribute to and benefit from the SEIS. First GMES contributes to the availability of relevant data/products provided through its services. Secondly, SEIS will contribute to in situ data flows for GMES by enabling near real time availability of data (starting with data covered by environmental legislation, the initial focus of SEIS, and later on EEA Reportnet datastreams, which are partly voluntary).

Infrastructure for Spatial Information in Europe (INSPIRE)

INSPIRE is based on a Directive[84] that covers spatial data held by public authorities in the Member States. As outlined in the Communication, GMES need to be compliant with the INSPIRE framework. It should be reiterated that INSPIRE does not oblige Member States to create new geo-spatial data sets, whereas the objective of GMES is to ensure the continuous availability of operational Earth observation services.

[84] Directive 2007/2/EC of 14 March 2007.

ANNEX V

ASSESSMENTS OF THE COSTS AND BENEFITS OF COMMUNITY INTERVENTION CONCERNING OPERATIONAL EMERGENCY RESPONSE AND LAND MONITORING SERVICES

1. COST ASSESSMENT

If it is assumed that the Community finances the full set of operational activities in the field of emergency response and land monitoring described in sections 2.2.1 and 2.2.2, the costs of GMES initial oeprations for EU part would amount to 150 M€ for the period 2011 – 2103, including 43 M€ for research activities from the space theme of FP 7 for research actions accompanying GMES initial operations (see the cost table below).

Activities	TOTAL 2011-2013 (in M€)
Emergency Response services	12
Land Monitoring services	26
Uptake of the services by the users	5
Data access	24
GMES Space component	40
TOTAL COSTS	**107**
TOTAL COSTS FOR RESEARCH ACTIVITIES UNDER THE FP7 SPACE THEME ACCOMPANYING INITIAL OPERATIONS	**43**
TOTAL (including FP 7)	**150**

This envelope complements the following funding for GMES within FP 7:

Development of Services (Marine, Atmosphere, Climate, Security), including data access for FP projects 215 MEUR

Development of Space infrastructure co-funded with ESA 460 MEUR

A full analysis of the total costs of GMES (including costs for national and intergovernmental activities and total infrastructure cost) is not possible in practice for the period 2011 – 2013, as it is difficult to obtain detailed input from Member States in the available timeframe. Nevertheless, past experience in previous Corine Land cover exercises demonstrates that depending on the services, the leverage of EU funding in the Member States might be up to 1:3 (in terms of the ratio of Community budgets and national budgets).

A more detailed explanation of the activities that will be financed can be found below. The proposed Regulation is targeted at public and private organisations and businesses active in the provision of Earth observation-based services. Following the general principle that GMES must avoid duplication of existing capacities, the services financed in the framework of GMES Initial Operations complement existing services based on US satellite capacity. US satellite capacity could be used in certain cases to provide data for GMES services.

1.1. Emergency response services

Land monitoring services include European mapping service for Emergency Response, and product integration for emergency response.

1.1.1. European mapping service for Emergency Response

European mapping service for emergency response will offer a combination of maps and/or various levels of pre-processed data produced at European level upon request from users:

- Rapid mapping activated on demand by users in case of crisis event, showing the extent and impact of the events during crisis and post-crisis phase.

- Other mapping on demand covering the other phases of the response cycle: risk mapping in support to the prevention phase, mapping for the reconstruction phase, or thematic mapping.

- Reference mapping providing basic cartographic information as routine background production (not 'on demand') on 'hotspot risk areas' to allow rapid delivery in case of crisis (less than 6 h).

- Validation and quality control activities of the maps, which correspond to 10% of the mapping production costs.

- Data archiving, catalogue and dissemination functions

1.1.2. Product integration for emergency response:

Some user communities in the MS have already developed activities in the field of Remote Sensing applied to Emergency Response, which can be enhanced with data provided at EU level. This action will focus on specific dedicated information for national or regional end-users, on the basis of raw-prep-processed data provided by EU level.

1.2. Land monitoring services

Land monitoring services will focus on Periodic Land Cover mapping service on the European, regional and national level, and dynamic Land monitoring activities incl. Essential Climate Variables in support to Climate Change monitoring.

1.2.1. Periodic Land Cover mapping services

Periodic Land Cover mapping services will comprise a combination of three types of information (pre-processed images, reference data and multiple land cover/land use mapping products). It will cover:

- Image pre-processing.
- Access to reference data at European level (mainly topographic data at various scales, DEM, and possibly orthophotos).
- Multiple Land cover/land use and land cover change products
- Pan-EU Land cover products
- Urban Atlas maps at VHR
    - Validation and quality control activities of the
    - Data archiving, catalogue and dissemination functions
- For the Pan-EU land cover/land cover change activities, an approach based on the synergy with activities at national or regional level could be developed. The objective would be to better harmonise and synchronise regional, national and European activities, and to derive European products from the aggregation of national and regional inventories, using a common object-oriented model based on the INSPIRE data specifications for land cover datasets.

1.2.2. Dynamic Land monitoring activities incl. Essential Climate Variables in support to Climate Change

For dynamic Land monitoring activities include monitoring of Essential Climate Variables in support to Climate Change monitoring. It is expected to produce on an operational and daily basis a set of bio-geophysical parameters, in support to the implementation of the terrestrial ECV's (Essential Climate Variables) defined by GCOS (Global Climate Observation System) and GTOS (Global Terrestrial Observing System). These parameters (Vegetation, Surface radiation, Fire, Water, Snow, permafrost, soil moisture parameters) will be mostly generated from low/medium resolution images in Near Real Time.

1.3. Auxiliary activities

Measure to support user uptake include the following:

- The implementation of technical interfaces between users and services adapted to the specific user environment (IT, procedures etc.)
- The validation of these interfaces in operational conditions
- Training of users
- Communication activities to disseminate information to various user communities.

Data access activities will ensure that the services have access to the necessary data from space mission and in situ infrastructure. Activities within the GMES Space Component include routine operations of three space missions currently developed in the framework of the ESAGMES Space Component Programme (Sentinels 1A, 2A, and 3A).

2. ASSESSMENT OF BENEFITS

Benefits mentioned in the report are linked to the modular implementation of an operational GMES starting in 2008-2009 with the preparatory actions on emergency and land monitoring services, and following them up with the 2011-2013 programme. While they are *indirect* benefits, in the sense that they depend on the actual use of GMES services by users (in particular public authorities), they cannot be considered as independent from the implementation timing ("merely postponed"). A stop-and-go approach (i.e. products tested with the preparatory actions disappear for a few years before being put again at the disposal in 2014) would seriously undermine the confidence of users and therefore the materialisation of benefits. The Impact Assessment is based on the assumption that the relevant GMES services will be fully operational in 2011. Benefits in this Annex have been calculated for option 3 (best case scenario). As outlined in the report, the best case scenarii of Options 1 and 2 would have comparable benefits, provided that the best case scenarii for these options are rather unlikely.

2.1. Benefits of Emergency response service

As outlined above, the emergency response services cover the full cycle of risk mapping in support to the prevention phase, mapping for the reconstruction phase, or thematic mapping. The benefits of operational mapping services in support of emergency service are discussed in more detail for two areas, namely response to floods and forest fires. In both cases, the primary users are civil protection authorities.

For flood response, benefits are based on the assumption that total damages can be reduced by a certain percentage because of the use of flood maps. **Average annual flood damage (calculated for the period 1980 – 2005) was around 2.2 billion € in 2005 prices[85].**

The GMES contribution to reductions in the impacts of flooding needs to be judged against the background of existing hydrological networks and warning systems. Such systems involve a network of river gauges which have telemetry links to flood forecasting centres. As with many environmental systems, these work well under normal conditions, but their performance can become erratic when faced with extremes.

Information which can help to characterise the extremes is therefore very important and this is one area where GMES could make an important contribution. By delineating the extent of floods it is possible to make improvements to the models which in turn allow better predictions, as well as improving the baseline for planning flood alleviation schemes. GMES could therefore make an important contribution to flood hydrology. It should be noted that although GMES will include in-situ monitoring as well as space based applications, the value of the pre-existing river gauge and telemetry networks is not included in the GMES contribution because these would continue to be operated without GMES.

A workshop was held with key stakeholders to assess the extent to which GMES could contribute to flood forecasting and ultimately, damage cost reduction. Stakeholders suggested

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85 To calculate this number, the UNITE methodology was used, which provides an assessments of the value of a life saved. The Value Of Statistical Life (VOSL) is taken to be €1.5M per capita. The effects of flood morbidity are estimated to average about 1.5 months, i.e. 0.125 of a year, allowing for some direct injuries and displacement as discussed above. Estimates for property damages are based on the EM-DAT data base, see PWC, Socio-economic analysis of GMES benefits, p 138 – 139.

that GMES could reduce damage, and noted that in, inputs to planning and risk management the context of extreme events. This assumption is regarded as conservative by the consultant that cirred out the assessment (PWC). **This would correspond to net economic benefits of around €135 million in 2012**[86]**.**

Also regarding wildfires, the benefits are based on the assumption that total damages can be reduced by a certain percentage because of GMES. **Average annual wildfire damage (calculated for the period 1980 – 2005) was around 141 million € in 2005 prices**[87]**.**

GMES services could provide civil protection authorities with inputs for all stages of action in relation to wildfires. Prior to events, GMES could provide inputs to assessments of biomass available for burning and guidance on strategies for minimising risk. During events, GMES provides a fast appraisal of the fire situation which in turn allows authorities to optimise the fire fighting facilities at their disposal. The services also allow for damage appraisal.

The assessment of the GMES input here centres on the ability to contribute actively to the management of events which are still in progress. Stakeholders noted that the majority of these benefits were likely to accrue in Southern Europe where prevalence of wildfires is greatest. These improvements are based primarily on improvements in fire-fighting operations enabled by rapid and regular situation updates that GMES provides alongside other vital information such as weather dynamics. It is also assumed that GMES will contribute to fire risk assessments and that these will also help with longer term counter-measures. Stakeholders consulted thought that GMES could deliver a 1% reduction in mortality, morbidity and property damage. **This would correspond to net economic benefits of around 9 million € in 2012**[88]**.**

To sum up it can be said that the benefits of GMES emergency services exceed the cost of service provision at Community level significantly.

2.2. Benefits of land monitoring service

The products described in Annex II are mostly of a generic, multipurpose nature. They are intermediate in the sense that normally they would be used to produce more detailed thematic services. Consequently, it is difficult to calculate benefits of these products on a stand alone basis[89]. In the following, the benefits of selected products that would be based on the generic land cover products above are discussed, including

- agriculture and rural development;
- urban and regional policies;
- ecosystems and biodiversity – forest monitoring.

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86 See PWC, Socio-economic analysis of GMES benefits, p 146 – 147.

87 Again, the Value Of Statistical Life (VOSL) is taken to be €1.5M per capita. Morbidity figures take into consideration acute health problems and chronic health problems and are estimated to average about 3 months, i.e. 0.25 of a year. Estimates for Property damages are based on the EM-DAT data base, see PWC, Socio-economic analysis of GMES benefits, p 140 – 141.

88 See PWC, Socio-economic analysis of GMES benefits, p 148 – 149.

89 For a discussion of potential benefits of generic land cover products, see the Cost Benefit Analysis for the GMES Service Element SAGE (Soil and Water), prepared by ECORYS, available at http://esamultimedia.esa.int/docs/GMES/SAGE_C2_Ph2_V2%5B1%5D.01_29_08_04.pdf.

In the field of **agriculture and rural development**, GMES, through providing this land use and land cover data more frequently, at higher spatial resolution, with continuity over time, could potentially support the CAP information requirements, expanding on current MARS capabilities. This would include development of indicators and progress monitoring of cross-compliance, agri-environmental and diversification measures, supporting DG Agriculture's aim to have a clear and financially sound agricultural policy. Other applications of GMES, including for example, irrigation pressure mapping and soil sealing mapping also offer the potential for landowners to enhance yields through better predictive tools to manage scarce resources such as water[90].

Regarding **Urban Management**, GMES could enable local authorities and other users to understand the impacts of land use policy better, anticipate trends, develop policies to minimise urban sprawl/soil sealing and enable them to manage the urban environment, and the urban-rural interface in a more effective way[91]. Potential benefits of urban services were discussed in more detail in the Cost Benefit Analysis of the project GMES Urban Services (GUS)[92]. GUS is a predecessor of Urban Atlas, which means that the CBA for GUS is of relevance also for initial operational GMES services.

In the GUS CBA, the main development trends affecting the future demand for urban environmental information and spatial planning include:

- Increased EU regulation related to urban areas impacting the need for Urban spatial planning combined with increased pressure from citizens to improve life quality in urban areas

- Implementation of geographic information systems (GIS) and an increase in the level of sophistication regarding the use of GIS and the Internet within the City and Regional administrations will continue to facilitate the development of eGovernment services to the citizens and indirectly act as an important driver for the use of geographical information in a broader sense.

The main monetary benefits identified in the GUS CBA derive from efficiency gains within City and Regional administrations and an improved means of impact assessment at EU institutions level, notably the evaluation of the implementation of the EC Structural Funds. For the period 2011 – 2013, the **GUS CBA foresees total benefits of around 168 million €, compared to overall costs of around 21 M€[93].**

In the field of **biodiversity and ecosystem services, including forest monitoring,** GMES could potentially help improve the management of forests grown for logging; increase regeneration through monitoring disturbances and re-growth; and provide information on forest indicators and land cover to improve policy making. This represents a separable impact from CO2 sequestration benefits through avoided deforestation. Here, the benefits are related solely to the value of forest areas as ecosystems that provide a range of direct and indirect services over the time period under consideration.

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90 See PWC, Socio-economic analysis of GMES benefits, p 96.

91 See PWC, Socio-economic analysis of GMES benefits, p 96 – 97.

92 Available at http://esamultimedia.esa.int/docs/GMES/URBAN_C2_Ph2_V2%5B1%5D.0_00_12_04_Final.pdf.

93 See the GUS CBA, p 1, 32 and 42.

The economic benefits of GMES can be calculated through avoided deforestation (attributable to GMES) on the basis that GMES could reduce deforestation by 5%-10%. It is important to note that due to the inherent difficulty in separating the contribution of GMES from the potential contribution of other dependencies, this figure represents the total GMES potential deforestation reduction, rather than that which may specifically be attributable to GMES. Valuing tropical forest at €105/Ha, the global annual economic costs of deforestation is calculated as €1.5 billion (2005 prices). Net economic benefits would thus amount to between €75-150 million per annum (in nominal undiscounted terms)[94].

[94] See PWC, Socio-economic analysis of GMES benefits, p 107.