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THE GEOSPATIAL INFORMATION LIKE KEY DRIVER FOR SUSTAINABLE DEVELOPMENT AND SOCIAL COHESION. TOWARDS A NEW PRODUCTION MODEL

AROZARENA A., VALCARCEL N., VILLA G.
National Geographic Institute of Spain, MADRID, SPAIN

1. INTRODUCTION

The current situation of citizens in the world is characterized primarily by its economic component. However, this economist approach of the situation, we could not analyze and much less explain, if we don't consider their dimension and integration in the environmental vision.

The symptoms are clear:

Energy crisis in the short, medium and long term. Because our growth relies heavily on nonrenewable and polluting energy (gas, oil…), this means therefore, scarcity and high cost of the basic input in any economy. Continuous knowledge, evaluation and monitoring of these natural resources on Earth, by airborne and satellite sensors, is one of the issues and attitudes technical/economical, more relevant to humanity.

Water resource crisis, it is becoming more untenable to maintain this basic resource for life and livelihood, permanently limiting the growth and mostly all life on Earth. Comprehensive and continuous knowledge of its evolution, especially in its geographical component, is essential.

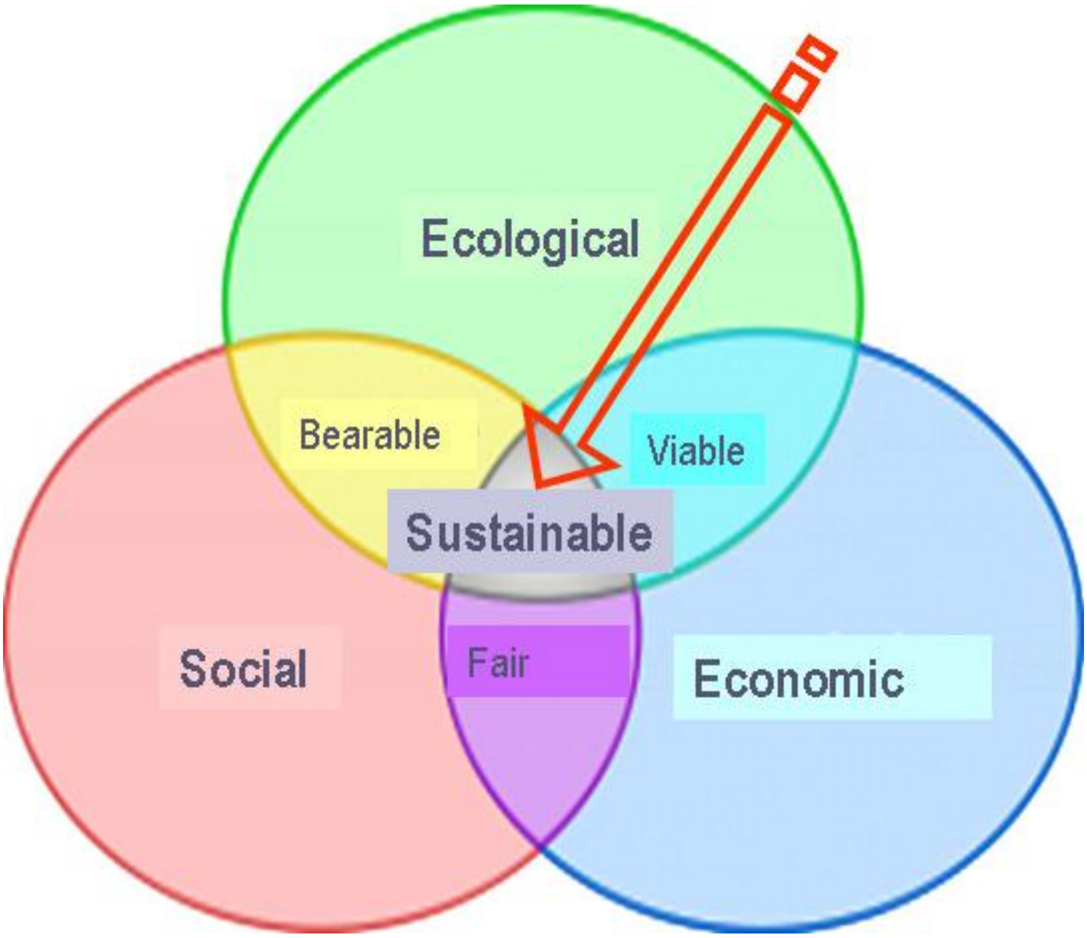
Environmental degradation, expressed forcefully by a loss of biodiversity and their involvement in a more than noticeable Climate Change is one of the greatest challenges facing humanity. Their space surveillance and quantification of this evolution is necessary and permanent.

Moreover, over 80% of the world population is concentrated in large cities and coastal areas, where the geospatial component and analysis and planning is crucial, and also the increasingly problematic status of food (production and distribution) forms a setting where the limiting factors to growth, and why not, survival, mean a new growth model, at all levels, settling in the coming decades a potential new power-sharing.

This new growth model should be based on flexible criteria (in terms of its design) of Sustainable Development and Sustainability.

Both concepts involve a new vision of economic growth and social development, where the Geospatial Information not only as necessary, if not essential for the viability of any policy decisions affecting areas and activities.

- Sustainable Development is a social choice, and therefore for citizens, through their political institutions, claims that transformation. It is a balance between ecological, economic and social, where optimization of resources should lead to the most advanced societies to a full integration between these aspects (fig 1)



For the United Nations: "There will be no human progress, if not integrated their activities on the environment."

- On the concept of Sustainability, we can say that this is a way to act differently, of all humanity factors. In our case carrying out sustainable projects.

In this sense we can look at certain key aspects of sustainability and how we should apply:

- Production, carrying out decentralized and cooperative projects with all the players involved.
- Consumption, implying, from the beginning of the project, clearly and effectively to users and their requirements.
- Dissemination, facilitating the accessibility and interoperability of data and information (INSPIRE)

The crisis situation (economic/environmental) affects to the projects and especially those who wish to integrate sustainability criteria. Solidarity, decreases with the intensity of the crisis and therefore we are forced to seek and expand new ways to collaboration. The "least common denominator" in the agreements is more and more minimal.

2. THE GEOSPATIAL INFORMATION

Geospatial Information, can be defined as the combination of analytical methods on data sets of geographic information and the necessary digital systems for capturing, processing, exploitation and dissemination.

In this sense, the GI is a powerful tool of communication and analysis. Communication, because it serves as a language for data and information transmission and analysis, because it allows extracting in metric way (accuracy) a lot of geographical basic and specialized information.

In addition, the GI, is introduced recently as a common language among the wide range of actors involved in the management of natural and artificial resources.

It is easy to understand their importance, based on some considerations:

- Everything happens in a physical location.
- The territory is the place where there are natural and human activities.
- Is an essential component to address the challenges mankind faces in its integration with the Earth.
- The location is the common thread in the decision making of public and private sector.

3. PRINCIPLES AND CHARACTERISTICS OF GEOSPATIAL INFORMATION

Some of the principles that affect this information are:

- Clear definition and modelling of users needs, transforming them by consensus, to technical requirements.
- Efficiency in the overall management, for which standardized processes to the production system is presented as the best solution and investment.
- Co-operation and co-funding, is perhaps one of the best tools for sustainability.
- The consensual and participatory Land Observation of stakeholders, structured spatial, spectral, radiometric and temporal, is another key to success.
- The successful projects integration at Regional, National and International level, is not only convenient, if not essential to determine its viability.
- Also, the incorporation of existing legislation in these fields of information, not only mandatory, but it with established regulations, enables the integration and harmonization of all information.

In Europe, we should remember (among others):

- Directive 2003/98/EC of the European Parliament and the Council , 17 November 2003 on the reuse of public sector information
- Directive 2007/2/EC of the European Parliament and Council ,14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
- European Commission Communication 2004: capacity-building GMES (Global Monitoring of Environment and Security)
- Regulation on "European Programme on Earth Observation (GMES) and its initial operations (2011-2013)". November 2010

At the global level:

- 2002. The World Summit on Sustainable Development in Johannesburg highlighted the urgent need for coordinated observations relating to state of the Earth.
- 2003. The Group of Eight meeting in Evian, France, said the importance of Earth Observation as a priority.
- 2005. The Third Summit on Earth Observation in Brussels endorsed the implementation plan of GEOSS 10 years and established the Intergovernmental Group on Earth Observations (GEO)

It is important at this time determine which are the necessary characteristics of Geospatial Information, which condition all processes from data capture to its dissemination and final use:

- Homogeneous, requires that the databases are consistent throughout all territory, mainly geometric and semantic aspects.
- Objective, trying to permanently remove any consideration of subjectivity in all production processes.
- Exact at equivalent scale and / or to the real needs of users.
- Decentralized, the involvement of various actors involved in the production systems is one of the pillars of sustainability.
- Quickly execution and implementation, it was not even possible to produce land information with a time not relevant or meaningful to end users.
- Updating in reasonable logical terms defined and accepted by users and producers, before starting production.
- Independent of capture methods and systems, information must correspond as reliably as possible to its real nature in the territory.
- It must allow and provide for the necessary capacity for data fusion from sensors and / or treatment (harmonization of processes).
- Integration into Local, National and International.

All of these features, necessary to perform an adequate management work (decision making) are likely to be derived largely from the various systems of Land Observation, discussed later.

We can conclude so far that this new Information System, must be based on a new Production Model, where the various actors involved, from users to producers / disseminators, will have a new role, interrelated and complex, where the Land Observation by airborne sensors is possibly one of the key pieces of the system.

4. LAND OBSERVATION

At this point we should analyze the Land Observation component (LO) in connection with Geospatial Information.

As already indicated, the LO is a mixed system for observation and extraction of information remotely, using space and airborne sensors that allow the merger and integration data.

We can say that the LO is also:

- A fundamental system of knowledge and information itself.
- Is serving as a permanent meeting point between various Government Authorities, from Local to Global (worldwide).
- It's easy to bring together the users needs for the various types of spatial, spectral, temporal and radiometric resolutions.
- Empowers the production collaborative and decentralized.
- Implicit timeshare databases, which facilitates an appropriate data policy to the users needs.
- Enables cost-sharing and needs
- Due its characteristics is an ongoing platform for innovation and training.

In the Spanish case, the Land Observation, with such components, it was developed since 2006 by the National Plan for Land Observation (PNOT) with the integration of all public authorities (we will present at the end of this text).

5. THE USER KEY AGENT OF PRODUCTION SYSTEM

We can now summarize and analyze the user's role as a plaintiff's products and services which can and must be integrated (from scratch) in this new conception of the productive system in its various stages and phases.

The current strategy for information, would be defined, sequentially, the following phases:

- Definition and search for new partners and collaborators, both public and private, those are involved in the use and / or management of Geospatial Information.
- Definition and assumption of roles and responsibilities of each intervening agent, knowing that each of them can play multiple roles throughout the production information system (user / partner / collaborator).
- Find the bilateral / multilateral agreements between the parties involved, according to their different needs. In this sense we can and must find points of contact for: issues, resolutions, attributes, deadlines ...
- Addition and generalization of agreements (bilateral / multilateral).
- Joint definition of the overall project.

It is important in this moment, highlight the user's current position of GI in terms of their visibility and accessibility (web 2.0):

- The information and analysis capacity is on the net (cloud computing).
- Want to active participation throughout the system and production process through blogs, forums, mailing lists, social networking, etc.
- Communication between stakeholders is constant. This communication can be developed as web services.
- Participation in events related electronic GI may direct and continuous (webinar).

In addition, the production system should consider, from the beginniing, the possibility of integrating a network manager (community manager).

Once modeled user needs, technical requirements definition involves:

- Set the User/s.
- Objectives (purposes): it implies a hierarchy of needs.
- Processes and Activities (system functions). Each target is divided into processes (standardized or normalized) and likewise, each process activities.
- Attributes of the System, which is explicit:

. Type of information (Accuracy -> Updating)

. Data type (Standardised Data Model)

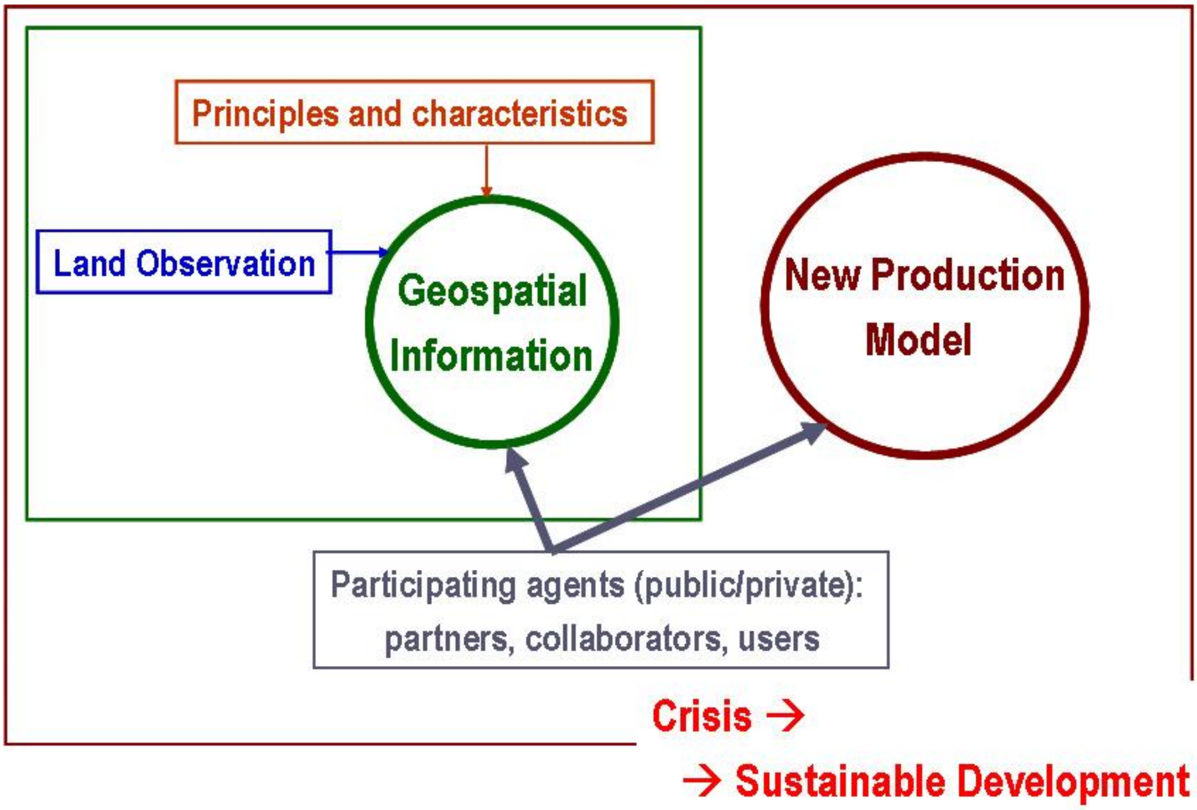
. Exploitation type

. Use Case

This scheme will provide us the products and services demanded by users.

6. INTEGRATED PRODUCTION SYSTEM OF GEOSPATIAL INFORMATION

Finally, with all the concepts and schemes described above, we will define the new Integrated Production System for Geospatial Information (fig. 2)



This new production system is based on:
- Innovation, that is, knowledge (the territory).
- Competitiveness, contemplating the different ways of acting joint public/private partnership, in terms of GI.
- New Tools in Information Technology and Land Observation.

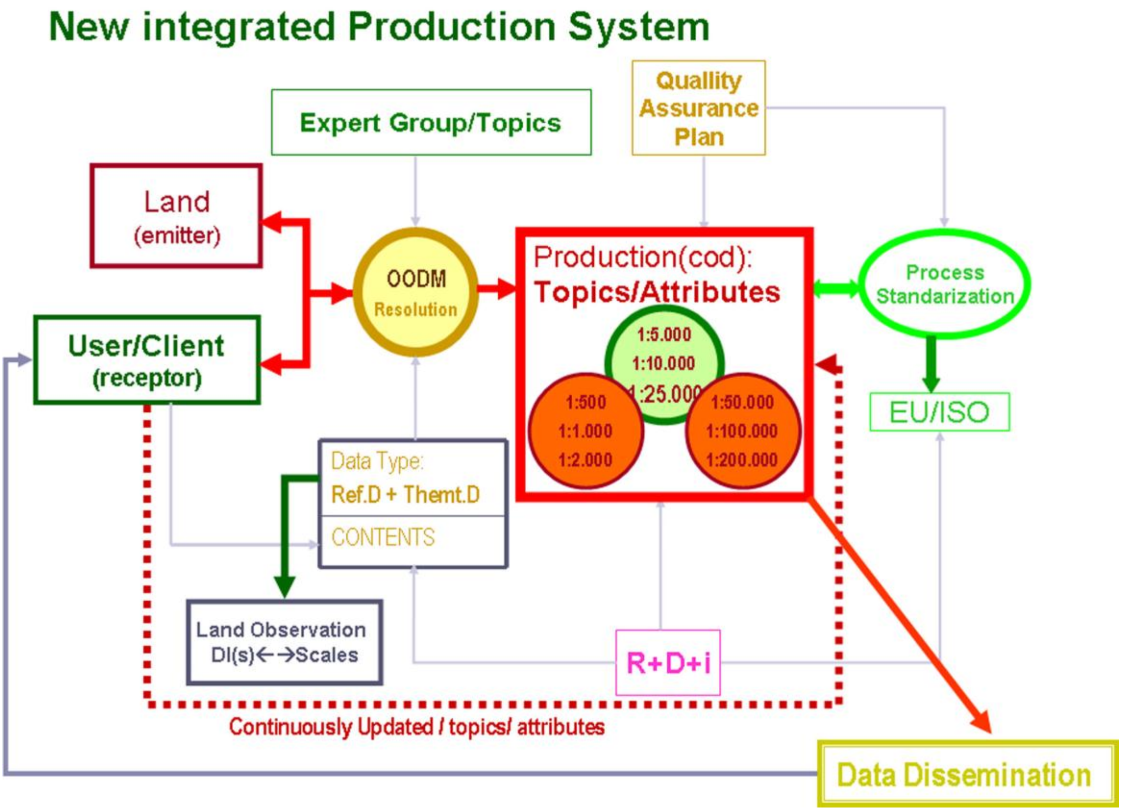
In this sense, we can define what we mean by Innovation:
- Ongoing training.
- Definition of best practices and open public access.
- The ongoing R&D with specialized Centers.
- Produce, constantly promoting the use of new technologies.
- Public tenders, with innovative companies.
- Promotion of networking (cooperative)
- Institutional collaboration based not only on the production, but also on advice and ongoing assistance.

Regarding Competitiveness, and from the public point of view:
- Objectivity and transparency in all our actions.
- Reduced marginal costs.
- Actions Plans based on efficient quality assurance.
- Future vision, using new technologies.
- To promote social cohesion
- Collaboration and decentralization, public / private.
- Ensuring availability of information over time.
- Harmonisation (standards) of production.

The use of New Tools, at this time and selectively, means:
- Standardization of processes/products, this will help the management of production. Production Partnership Management (PPM).
- Use of systems "win/win option" through public / private partnerships.

- Use of conceptual Multiple Spatial Representation. This will facilitate the reuse and increased resilience (adaptation) of information.
- Automatic change detection.
- Use of new dissemination techniques (web 2.0)

Therefore, the overall scheme of the new production would be (fig. 3):



Spain in 2006 has developed, using these criteria, the PNOT (National Plan for Land Observation), whose most important features are:
- It is based on real needs of Public Administrations.
- Decentralized and cooperative production (public/private).
- Co-financing: 66% Central Administration+ 34% Regional Administrations.
- Object-Oriented Data Model.
- Three distinct phases, defined and agreed upon with all the players involved (fig. 4):

SPANISH NATIONAL PROGRAM FOR OBSERVATION OF TERRITORY (**PNOT**)							
1ª phase: Aerial and satellite image adquisition and processing		National Aerial Orthophoto Program (**PNOA**)			National Remote Sensing Program (**PNT**)		
		very high	high	medium	high	medium	low
	Spatial resolution	**10 cm**	**25 cm**	**50 cm**	pancro: **1 to 10 m**	pancro: **10 to 15 m**	multispectral: **100 to 1.000 m**
		urban and coastal areas	(alternate coverages)		multispectral: **4 to 30 m**	multispectral: **20 to 50 m**	
	Update period	4 years	2 years		2 to 12 months	1 to 6 months	2 to 30 days
	Aproximate cost (euros / Km^2)	350	55 (rigurous) 19 (quick)	29 (rigurous) 7.5 (quick)	4 (2.5 m)	0.05	0
	Examples of sensors	Digital aerial cameras (4 bands) with GPS-IMU Lidar	Digital aerial cameras (4 bands) with GPS-IMU Lidar		SPOT, Formosat, IRS, Cartosat, etc… Future INGENIO	Landsat 5 (TM) Future DEIMOS Future Sentinel 2	MODIS MERIS Vegetation NOAA

2ª Phase: Extraction of vector information	Theme	Organizations involved	Scales / Projects and databases				
			1: 500 to 1: 2.000	1: 5.000 to 1: 10.000	1: 25.000 to 1: 50.000	1: 100.000 to 1: 200.000	1: 1 Milion
	Topography	National			**Topographic database BTN25**	**BCN200**	**BCN1000**
	Topography	Regional		Topographic Maps			
	Topography	Local	Topographic Maps				
	Cadastre	National	**Urban cadaster**	**Rural cadaster**			
	Land Cover	World					**. Globcover**
	Land Cover	European				**. Corine Land Cover 2006** **. Land Monitoring Core Service**	
	Land Cover	National		**. SIGPAC**	**. SIOSE** **. Agriculture Map** **. Forest Map**		
	Land Cover	Regional		**. Regional Land Cover databases**			
	Environment	World European National Regional Academia			Remote sensing biophysical parameters and agri-environmental indicators		
3ª Phase: Dissemination of the information	Spatial Data Infrastructures: **INSPIRE**, **IDEE (Spanish National SDI)**, regional SDI,… Image servers (WMS,…)						

The PNOT is part of the production philosophy defined like Bottom-Up, convergent in time

o Captures the basic information through Land Observation.

o Extraction of Information from these images, with the aim of creating Harmonised Reference and Thematic Datasets.

o Dissemination Data Policy to facilitate the use and accessibility (free and open to all levels).

The plan assumes the production philosophy defined as Bottom-up, convergent in time with the Top/Down approach

The PNOT is structured in three main projects. The characteristics most relevant are:

National Plan for Orthophotography (PNOA):

- High resolution. Pixel: 25 or 50cm 10cm.
- Biennial orthophoto coverage throughout the Spanish territory (25/50cm)
- Digital Elevation Model biennial throughout the Spanish territory (LIDAR) high accuracy (+ / - 15cm)
- Co-financing
- Unique flights for all agencies involved.

National Plan for Remote Sensing (PNT):

- High resolution: Pixel 2.5 - 10mm, 1 year coverage. Example SPOT5/ RAPIDEYE
- Medium resolution: Pixel 10 - 30m, 22 covers per year. Example LANDSAT 5MT
- Low resolution:> 50; least 1 weekly coverage. Modis TERRA example.

Land Cover/Use Information System in Spain (SIOSE)

- Integrate and harmonize land cover/use information from existing databases in the Regional/Central Administrations and the European Union
- 1:25000 scale
- Comply with EU/GMES requirements in land cover/use.
- Renewal every 2 years.

7. CONCLUSIONS

- The Bottom/Up approach, harmonized with the Top/Down, is the best system to meet the global needs of the user/s.
- Decentralized cooperation is an essential tool.
- The clear definition and assumption of the intervening role of each agent is crucial.
- The consensus in the production system, means that projects are viable and sustainable.
- Land Observation, by aero/spatial systems, is the basic input for production systems.
- The contribution of sustainable projects to Sustainable Development, is the best contribution from our industry to the economic and environmental management planning.

We conclude by saying that we are moving from deterministic paradigm to the paradigm of uncertainty, replacing:

- Simplicity for Complexity
- Uniformity for Diversity
- Independence for Interdependence
- Stability for Dynamic Stability
- Control for Risk

These concepts are fully present today, however, and were listed in 1969 by the ecologist Mc. Harg I.