Fundamental Cartography Production On SDI Framework

J. IRIGOYEN, E. COLL, J.C. MARTINEZ
Department of Cartographic Engineering, Geodesy and Photogrammetry
Polytechnic University of Valencia
Camino de Vera, 46022, Valencia
SPAIN

Abstract: -. Usually, every country has specific organisms in charge of the design, production, spread and update of fundamental cartography. Each one of these organisms produces cartographic projects with the procedures, tools and staff better adapted to its objectives. Final result of cartographic campaigns are usually products that are presented on paper or other tangible formats. During the last years, cartographic organisms offer as one of their products the digital cartography, that is much more versatile if the end user applies appropriate computer tools. Specially with the spread of the Internet, GPS navigators and Geographic Information Systems (GIS), digital cartography has turned into one of the main products which has reveal the need of establishing a network of cartographic servers for the organisms that use geographic information. In this way, some national (IDEE) and European (INSPIRE) initiatives are being developed. We should support these meritorious initiatives, that should go beyond the current approaches. In this paper the need of change of the approach and the way cartography is produced is reviewed, as well as the advantages that would appear based on the Spatial Data Infrastructures (SDI) framework.

Key-Words: - SDI, GIS, Cartography, Cartographic production, Map servers

1 Introduction

Basic cartography is the one composed of topographic maps, ocean and aeronautical charts. Thematic maps are created based on this cartography, depending on the purpose for which they are intended.

Each country has specific organisms that manage the design, production, spreading and periodic update of basic cartography. Cartographic campaigns expect to obtain a representation of a selected area at a scale and with a specific update period. In these campaigns, the organisms use the suitable procedures, tools and staff, in order to achieve the objectives previously set out. However, as these objectives are different depending on the organisms, no optimal procedures or tools exist to be applied on map production.

2 Basic cartography

Some years ago, the maps printed on paper were the basic aim of cartographic campaigns. Territory was represented on a specific scale, and contents were established by the corresponding regulations for each project. Geographic data were captured and handled depending on the required representation on the paper. In this way, lots of elements were simplified, (other ones) eliminated, or grouped for the representation on the print map to be as aesthetical as possible.

When informatics and computers began to be considered cartographic tools, the printed map kept being the basic aim of cartographic campaigns. The tools changed, but the final result was the same.

With the popularization of computers and Geographic Information Systems (GIS), cartographic organisms discover the chance to offer a new kind of product: the digital cartography. This one allows performing lots of spatial operations in a more simple, effective and comfortable way than with conventional cartography. However, the main product kept being printed maps: digital cartography to produce terrain models or as a spatial basis for GIS were derivate products, and were obtained during the production of printed maps.

The basic work tool use to be a “Computer Aided Design” (CAD) or a design program. The majority of the operations to obtain printed cartography as well as the remains of derivate products are performed with this program.

Digital cartography was at the beginning product like the others, but it’s at present the main product in a cartographic campaign. Nowadays, informatics tools allow obtaining higher performance of the cartography by simplifying many operations and allowing tasks that would be too complicated with traditional procedures. Specifically, GIS and Global Positioning System navigators demand each day higher amounts/quantities of updated cartography,

with a large variety of scales, and from wide geographic areas.

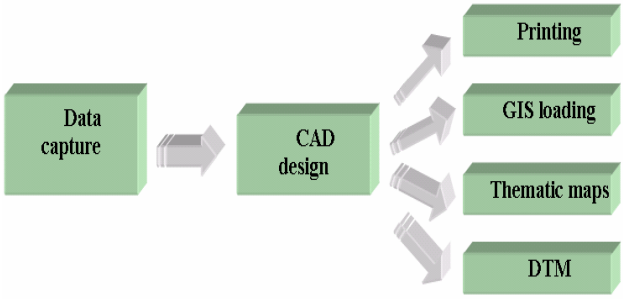

Fig 1. Traditional work flow of the cartographic production

When the main aim is to obtain a printed map, problems appear to obtain digital cartography and data for the GIS. For example, there is lots of information that is captured and is not represented on the printed map. Final user doesn't see all this information. Many other elements that are used in order to get an aesthetic representation of the printed map are unnecessary and must be deleted when loading data on GIS. On the other hand lots of information cannot be loaded on GIS because of CAD limitations [1]. In [3] a cartographic production flow that follows the previous model is shown. Many of the problems would be solved by changing the production model. Instead of using CAD as the main tool for obtaining cartographic products, the use of GIS tools presents many advantages. For example, when creating the printed map, many of the operations that are costly with a CAD, are simple to solve on a GIS, because it has specific tools like closing of polygons, fillings allocation, cartographic generalization, management of cartographic projections, tolerances, topologic rules, etc. Besides, GIS stores all the information, graphic and alphanumeric; in this way, the rest of the products obtained from the GIS (topographic and thematic maps, digital terrain models, etc.) are simplifications of this information (Fig. 2).

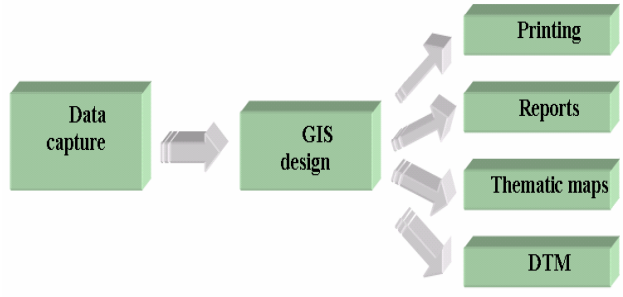

Fig 2. Proposed work flow for cartography publication.

As digital cartography presents more advantages than printed cartography, the aim of cartographic campaigns should be logically the production of cartography to load it on GIS, while printed map would be a derivate product from the GIS.

3 Spatial Data Infrastructures

The spread of GIS, navigators and the Internet is changing the way cartography is used. For the society, the need for updated cartography is each time more noticeable. Nowadays, it's common to have cars with GPS that works with cartography at real-time. We live in the era of the information, where news and events run through media from one side to the other side of the planet instantaneously. Lots of updated information can be easily consulted on the Internet. In this way the cartography is an essential support to allocate this information. Geographic information should be available, when needed, for people as well as for organisms.

Some initiatives try to solve these needs. At European level, INSPIRE [2] (INfrastructure for SPatial InfoRmation in Europe) project attempts to optimize the exploitation of environmental data already available from the members of the Economic European Community. This project demands firstly the existing spatial information to be documented, secondly the services assigned to improve the accessibility and interoperability of the data should begin to run, and thirdly, to pay attention on the handicaps that could hinder the use of these services. INSPIRE will open the way to a progressive harmonization of spatial data from State members. In principle, INSPIRE is aimed to provide the environmental data to all the organisms that need them in order to help in that policies and studies: many environmental phenomena are cross-frontier like species migration, wind, water flows, or impact and pressures on the environment like floods, pollution, water contamination, catastrophes, etc.

Spatial Data Infrastructures (SDI) try to optimize the access to the data produced by cartographic organisms . It is not a data collection, but a joint of the geographic data already available. The access to a network of cartographic servers will be possible through Internet, servers that will provide a vast geographic database composed of the cartography available on each moment.

4 SDI and essential cartography

SDI concept is very interesting and necessary. With a cartographic network, many possibilities arise. Through the Internet, access to cartography from any place, at any moment would be available, a well as to obtain write information of that places. A vehicle with a GPS navigator would be able to obtain up-to-date cartography at any moment. Those organisms that would need cartography at a fixed scale from a specific place could get it in an easy and comfortable way. But SDI shouldn't be exclusively used to be consulted. If all cartographic organisms made their cartography available, many problems can be resolved and interesting advantages can appear.

For example, from a big scale cartography of a territory, it's possible to generalize this cartography to obtain small scale maps. In this way, having up-to-date big scale cartography, obtaining the small scales ones has a low cost. Sharing the information, it's possible to get new products with lower cost, because task repetitions, photogrammetric projects, surveying works, etc, can be eliminated. All the thematic maps will have the same basic up-to-date cartography (tourist and hiker maps, mountain bike routes, etc). It's even possible to get new maps with custom extents, in accordance with user requirements (by municipalities, regions, provinces etc.).

Nevertheless, from these pages we want to point out that in order to reach these goals, there are several necessary steps, non exempt of technical and administrative difficulties. Firstly, it's necessary to have a basic cartography that covers all the country, on which thematic cartography will be based. Thus, the vast majority of maps need as a base the topographical or ocean cartography. This essential cartography must be a common, reliable and accurate support. A big scale cartography should cover all the land, like the 1:1000, 1:2000, and 1:5000. From this scales, the rest of smaller scale maps can be obtained at a lower cost. The aim is not to join all the cartography from each organism, as the SDI procedures, but to coordinate and share the production from all the organisms. On other hand and summarizing the previous sections, the produced cartography must include its geographic component as well as the alphanumeric information available on the databases that could be used on GIS; thus, cartography must be created according to the proposal model. (Fig.2)

Lastly, keeping in mind that organisms should work with the same cartography, a standard common format has to be specified. All basic cartography should be produced in this format, which must include the spatial and alphanumeric information, as well as the spatial relations (topology), being the big scales cartography the one to be produced before the small scales.

The three pillars: coordinated and shared production, standard common format, and GIS as the main tool for cartography production are essentials in order to eliminate many of the problems from Spanish cartography (Fig. 3).

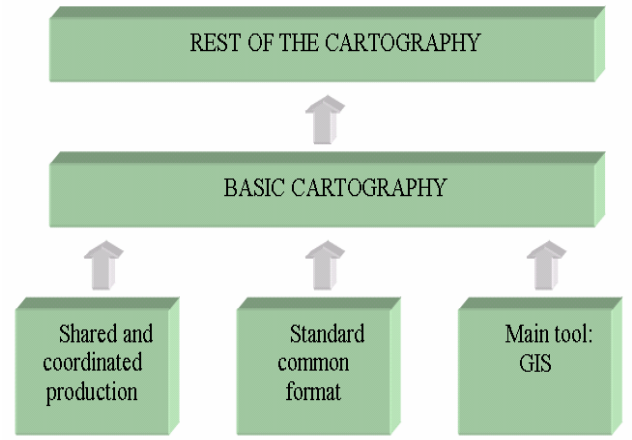

Fig. 3: The three pillars of cartography production.

5 The three pillars

Regarding the first pillar "Shared and coordinated production", a law was developed in Spain, the "Law on the Organization of Cartography" (7/1986) that was an attempt to avoid the duplication of the cartography produced by different organizations, and the waste of resources by means of improving communication between the main cartography producers organizations.

Besides, in Spain several attempts are being done to use the cartography produced by the Autonomous Communities to manufacture the national one. In the last meetings of the *Consejo Superior Geográfico* (Higher Geographic Council), much work has been done in order to achieve the three objectives that have been included in what has been called The National Cartographic Programme:

- To guarantee the consistency and the interoperability of the official geographic information
- To further the efficiency of the public spending
- To ensure the production quality and its utility as a public service

The second pillar is the "Standard common format". In this direction the research group of the GIS teaching unit of the Polytechnic University of Valencia, in the SIGMUN project [4] is working on the specification of a new data model that would help to cover the needs from big scale cartography producers: councils and Cadastre.

The new data model will also allow the cartographic generalization al lower scales, its integration on GIS and the obtaining of several derivative cartographic products. For it, the data model will follow the patterns establish by the OGC [5] as a guarantee of the interoperability among systems. The project is concluding the phase of needs study of the city councils from the cartography administration point of view [6].

Obviously, the data model is directly related with the third pillar: "Main tool: GIS". The data model integrates graphic and alphanumeric data from the territory generating a mostly complete model of the reality.

We consider that the three pillars are the basis for the cartography of a country or community of countries to have enough quality and operability in the future, for the cartography to constitute the base of other complex projects.

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