ASPECTS OF ELECTRONIC ATLAS CREATION

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Abstract
Despite the current state of the development of web publication technology and methods of graphic visual representation of geodata in GIS, design and creation of electronic maps and atlases is still an innovative task. The basic principles and methods are in the case of web maps also provided by cartography. The section of cartography – web cartography, describes methods, procedures and principles of the creation of maps in electronic form, which are to be released on the Internet. Technical publications dealing with the problems of web cartography are still available in a limited number. Those very few are e.g. Cartwright, Peterson, Gartner (1999), Kraak, Brown (2001), Peterson (2003b) and Voženílek (2005). This article discusses procedures of electronic atlas creation with emphases on specialities of electronic maps and atlases.

1. Procedures of electronic atlas creation

An electronic atlas can be defined as a set of systematic arranged topographic and thematic layers. The layers create maps which are organized by unit managerial system and they are intended for publishing in digital format via information technology. Process of design of electronic atlas is more difficult than of the printed one. It is necessary to consider the advantages and disadvantages of the electronic medium as such.
The whole process can be in principle divided into two stages:

    A. Conceptual design of the atlas,
    B. Production and distribution of the atlas.

The conceptual design stage begins with the specification of the setting, proceeds with assessing the principles of the technological, geoinformatic, cartographic and graphic implementation, and is rounded off by the verification of assumptions stated in the atlas proposal. The first stage is finished at the moment, when the model maps and other components of the electronic atlas are proved to be operating, and when they meet the preconditions stated in the project submission. The following stage constitutes the production: producing the atlas, replication and distribution.

The complete process of the production of a new electronic atlas includes other stages which complement the two above stated. These are available at figure 1.

2. Target users of the atlas and their needs.

Start of production of the atlas has to be preceded by the so-called **public order**, i.e. by the existing need of such a product. To prove the existence of such a need, it is necessary to **define the target users** and their **common and specific needs,** which influence the form of the atlas

(on intranet, internet, on a CD or concurrently printed), its content (territorial scope, map themes, methods of their implementation, supporting compositional elements) and the form of the product (user's graphic interface). Examples of the target groups may be officers of public administration, processors of territorial concept, scientists and experts of the field, teachers/students of basic and high schools or universities, general public, tourist industry participants, etc. Preparation of the atlas for each of these groups needs naming the specific conditions, which include technical level of the content, thematic orientation of the whole product and its parts, and cartographic processing (used methods, character code). Defining the target users is important for the designers of the graphic representation of the atlas together with the operating elements.

3. Project submission of the electronic atlas

The submitter of the work can define the project's targets on the basis of the information about the users of the atlas and can create the set of the demands on its form. The **thematic concept**, **technical processing** and **economic aspects** (info about the availability of the product for free, restricted availability or forbidden access) are stated in the submission of the project of the atlas. The submission also mentions the **requirements on interactive elements** (interactive control of the map and of the atlas), **compositional elements** (maps, accessory texts, pictures, graphs) and **the way of publishing and distributing the atlas**. Important information, which determines the extent of the preparations and production, is the fact whether the product is going to be a combination of electronic and printed materials.

The submission of the project of the atlas is a mandatory document and any change of it has to be consulted with or approved by the submitter, in case if the processor of the project is an external co-operator of the submitter. The submission specification can be usually done after the completion of the stage of the atlas's concept proposal.

4. Proposal of the schedule, budget and the team of executives

The processor proposes the schedule, budget and structure of the team of executives on the basis of the submission of the project. Roles included in the team emerge from the requirements on the form and content of the product. The direct communication among the members of the team is necessary all the time. This communication is clearly defined by the set of rules. Cast of the roles by particular experts and their tasks are part of the proposal of the team of executives. The basic structure of the team of executives is made up of roles: main redactor (main co-ordinator of project), cartographer, geoinformation scientist, programmer, editor of the atlas texts, graphic designer, atlas reviewer, experts for particular themes of atlas and economist.

Merging of roles carried out by one person is possible. The possible combination of expertise is geoinformation scientist – cartographer, cartographer - graphic designer. In case of bigger projects the merging of the roles is not recommended because of the quality of the final product. Particular experts have to co-ordinate their tasks across the professions. More people can cast individual roles usually cast by one person so that the number of specialists taking part in the team of executives corresponds to demands and extent of the project.
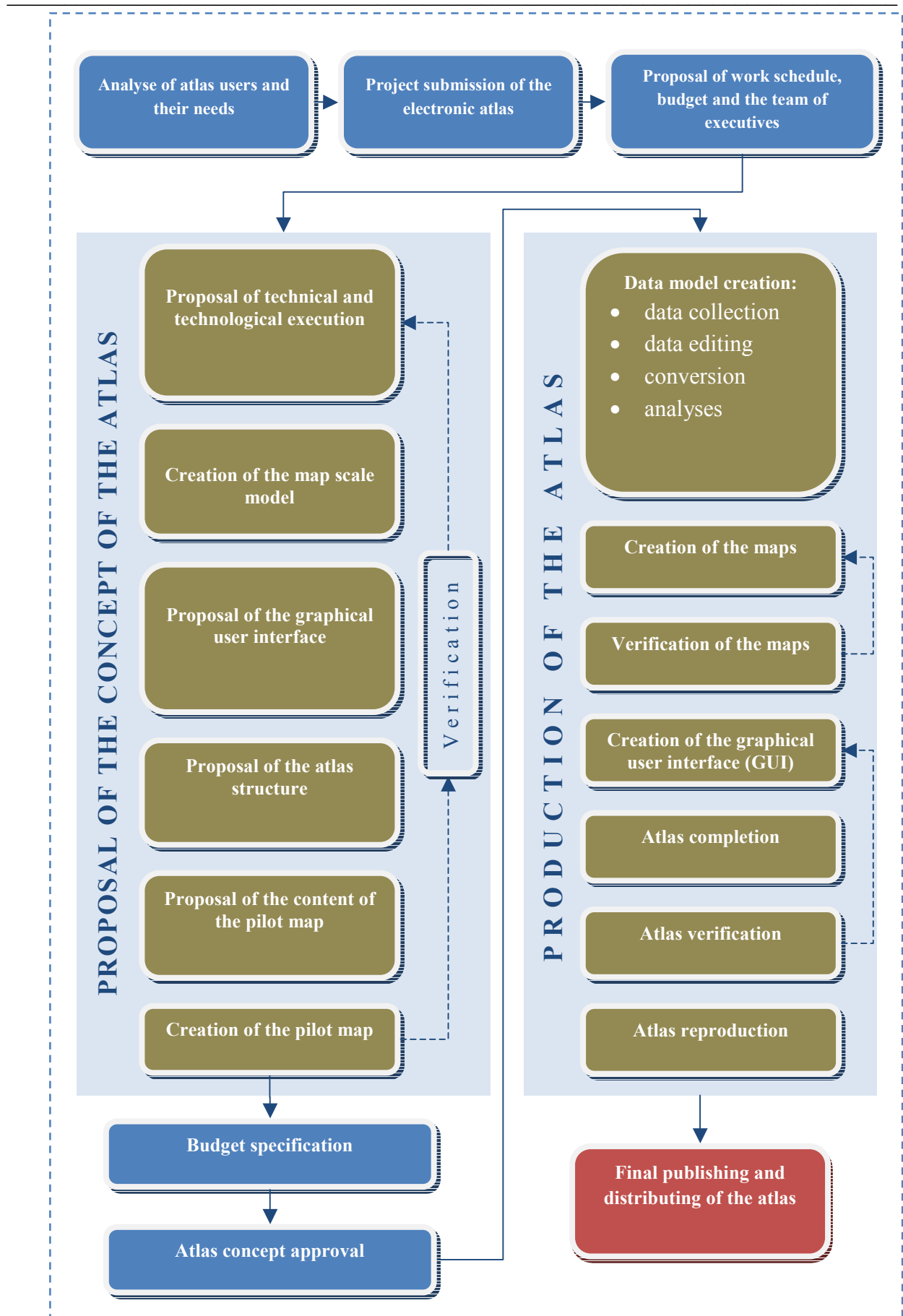
Figure 1 Scheme of the process of atlas creation.

5. Proposal of the concept of the atlas

Proposal of the concept of the atlas is a demanding stage of the whole project. Final document includes detailed description of verified aspects of the production of the work supplemented with concrete examples of the implementation of the atlas. These are basically the preparation works, which state the procedures and rules of the production.

The concept contains minutely analysed approaches to the implementation of the submission of the project. These are stated in some steps, which do not necessarily have to follow one after another.

a. **Proposal of the technical and technological execution** – assesses technique of atlas production and of particular elements (methods, procedures); applied programme means (or programme systems) and programming languages used for publishing the atlas. Separate part is devoted to GIS methods used for: creating the data model; its updating; data entry; data format; co-ordinated systems; data editing and analyses. The concept suggests the metadata structure, which is the basic information source for map and atlas imprint.

b. **Creation of the map scale model** – electronic atlas scale model differs to some extent from the scale model of the printed atlas. In case of submission of a project that requires the atlas to be published in both the electronic and the printed form a separate scale model has to be created for both the forms. The electronic atlas scale model contains a proposal of organisation of individual components and of interaction rules which interconnect these components. The model defines the image (content and arrangement of compositional elements) of these key parts of the electronic atlas:
   - *front page* – basic information on the product, its authors, ways of working with the atlas, and contacts
   - *contents* – the main signpost of the product, which serves for moving among particular themes (map "sheets")
   - *electronic maps* – main part of the atlas represented by electronic map (collection of electronic maps) supplemented by elements for its operating (caption, scale, tool bar, etc.)
   - *further pages* – among other parts of the atlas can be the guide for its use, text to the particular maps, info on databases, info on imprint (metadata), methodical instructions for using the atlas by basic and high school teachers, links to other sources of information, etc.

   There is a concept for every part of the atlas developed, which is subsequently processed graphically and programmed into the final form of the concept of the atlas. Among the basic information resulting from the scale model are data about the size of the depictive screen of the electronic atlas (unit of measurement is one pixel).

   The scale model of the electronic map represents the highest claims on preparation. The author of the map assesses the size, arrangement of individual compositional elements and its behaviour. The author also determines the scale displayed after downloading the application (*starting scale*), *minimal* and *maximal scale*.

c. **Proposal of the graphical user interface (GUI)** – proposed model of the atlas is graphically processed and programmed. Files of graphical and topographical rules,

unified and mandatory for the whole atlas are assigned during the stage of GUI proposal (subsequently programmed and implemented into GUI as cascading style sheet- CSS). Co-operation of the graphic and programmer is necessary in this stage. The graphic designer creates the overall image of the atlas, including unifying graphic elements, logo of the atlas and assesses the colour scheme used for particular parts of the atlas (including colours used for the font and hypertext links).

d. **Proposal of the atlas structure** – deals with the overall structure of the atlas determined by the list of the topics on the basis of the project submission and in co-operation with the professional guarantors. For the atlas to be well arranged, sections containing thematically similar maps are set. A professional guarantor is set for particular maps (and for the explanatory notes).

e. **Proposal of the content of the maps** – in the following stage, after the structure of the atlas proposal, the content of the pilot maps designated for concept operating verification is elaborated. In co-operation with the cartographer, the visual representation methods, character code, map caption, the range of the scales for the display of separate layers and used interactive elements of the map behaviour (layers with the possibility to identify their elements, questioning the database) are set. Finally, the data necessary for the map creation are also set.

f. **Creation of the pilot map** – the component of the concept of the atlas is the creation of the pilot map, which specifically points out the resulting technical arrangement. The pilot map is often the so-called *basic map of the atlas* containing layers of topographical base. These are the components, which may help the user to secure the spatial orientation in the depicted area. Topographical base is assessed for the individual map scales separately – in case of electronic maps, the compliance of this requirement is secured by establishing the rules of layers visibility within the map scales. Topographical base also serves to distinguish maps of physical-geographical themes from the socio-economical themes. Examples of physical-geographical layers are natural elements – river system and areas of water, forests, arable land, important quotas, contours, etc. Examples of layers of the socio-economical themes are residential structure, built-up area (urban area), communication network (roads and railways), administration, etc.

It is possible, within this stage, to prepare further examples of maps, whose content and applied cartographic methods differ from one another and which can reveal possible deficiencies in the concept of the proposed methods.

6. Atlas concept approval

The outcome of the atlas concept proposal is the concept of the atlas, which includes the set of rules for production of the atlas in all respects and an operating example of the future form of the atlas. The concept of the atlas has to pass the amendment procedure, whose aim is to eliminate the majority of deficiencies and to prove practicability of the atlas within the specified conditions. The role of the critics of the concept proposal is indispensable during this stage. Only the verified concept can start the actual production of the atlas during which the authors of the individual maps can encounter further problems, whose solution has to be added to the concept. The radical changes from the original concept can result in a breach of the stated schedule of the implementation of the project. This can be linked with increased cost or it can endanger the keeping the uniformity of the whole atlas.

Verification of atlas functionality has to be carried out thoroughly and for various platforms (various web browsers, operating systems), monitors (CRT, LCD, various diagonals and resolution adjustment), and in an ideal case by users of different levels of user skills.

The budget of the schedule, the structure and the cast of the team of executives are specified on the basis of the verified concept of the atlas.

7. Production of the atlas

The second of the two extensive stages of the creation of the electronic atlas is its production. The stage incorporates a number of phases, which, on the basis of approved and mandatory concept, create a complex and publishable work – electronic atlas. Among the individual phases of the production the principles of quality verification are applied.

a. **Data model creation** – on the basis of requirements on the structure of the atlas and on the content of individual maps, the data model of the electronic atlas is created. The rules stated in the concept of technical and technological implementation of the concept of the atlas are followed during the data model creation. The bases of the atlas are the layers creating the topographical base of the maps.
Data model administers the data concurrently with the metadata. The requirements on the structure of the metadata are defined in the concept of the atlas. Execution of metadata is required filled in the form provided by the data authors, who are the guarantors or processors of individual maps.

b. **Production of the maps and their verification** – represents a very important phase of the process of atlas creation. The individual maps are created – often in GIS – on the basis of the proposal of the map content (stated in the submission), and on the basis of the cartographic rules through the visualisation of parts of the data model. Maps pass the amendment procedure and the review procedure on the basis of their preview, which can be available in printed form or are left in the digital form (suitable formats are: PDF, JPEG, GIF, PNG). After the approval of the preview, the map is converted into the format suitable for publication in the electronic form (in accord with the technical implementation). Follows the repeated amendment procedure and correction of possible deficiencies.

c. **Creation of the graphical user interface (GUI)** – the phase of programming GUI and its individual parts according to the submission and editing its individual parts.

d. **Atlas completion** – phase of incorporating individual maps and other components into the form of compact atlas.

e. **Atlas verification** – final verification and review phase of the atlas production.

f. **Atlas reproduction** – in case o publishing the atlas on portable media (CD, DVD) follows the reproduction phase.

8. Publishing and distributing the atlas.

Final phase of the production of the atlas is its distribution (in case of publishing on portable media) or public syndication on the Internet. Even this phase should include the principle of the feedback between the authors and the users. Its underestimation means disclaiming one of the basic advantages, which distinguish the printed atlases from the electronic ones – the opportunity of cheap and effective correction of the atlas defects, which had not been eliminated even through repeated checks of the atlas during the course of its production. The schedule should take this into account and should create an easy mechanism for sending the

users's comments on the form of the atlas, which could be incorporated into the atlas corrections.

The essential element of the project termination is the promotion of the final product. This should ensure that the information about the existence of the product should reach the target group stated in the submission. Evaluation of the whole project should compare to what extent is the final product different from the proposal and it also should summarise the authors' experience.

9. Conclusion

The Internet and electronic forms represent the new medium for cartography. A great task of research and development is still to determinate specific principles and rules for creation of the electronic atlases. Generally, in the process of web applications creation, it is necessary to take into consideration the limitations and the opportunities offered by the electronic medium. Both the general (e.g. limitation of map display on the PC monitor due to its resolution) and the specific attributes have to be considered. As mentioned in this article, cartography and cartographers plays important role in process of the electronic atlases planning and creation.

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