

Web atlas technology as a tool of Czech Official Development Assistance

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Abstract.

The Czech Republic expresses solidarity with the people in developing countries and feels its share of responsibility in addressing global problems that are largely related to poverty. Official Development Assistance (ODA) is a fully-fledged part of the foreign policy of the Czech Republic and contributes to the achievement of its objectives. The Czech Development Agency's (CZDA) core responsibility is to ensure general public support for ODA. The Atlas of Official Development Assistance (AODA) created by the Departments of Development Studies and Geoinformatics, both of Palacký University in Olomouc, brings the new dimensions of geotechnologies and digital cartography into the workspace of the CZDA.

The paper outlines the methodologies followed and technologies used in the process of creating the Atlas of Official Development Assistance as well as the results of teachers' involvement within the process. Secondly the paper shares best practices experienced during the implementation of ArcGIS for Flex as an example of Rich Internet Application (RIA). Thirdly, it demonstrates how web atlas technology can be used to improve general public support for Official Development Assistance.

Keywords: web atlas, development cooperation, ArcGIS for Flex, Atlas of Official Development Assistance

1. Introduction

Introduction

The Czech Republic expresses solidarity with the people in developing countries and feels its share of responsibility in addressing global problems that are largely related to poverty. Official Development Assistance (ODA) is a fully-fledged part of the foreign policy of the Czech Republic and contributes to the achievement of its objectives. The Czech Development Agency's (CZDA) core responsibility is to ensure general public support for ODA. The Atlas of Official Development Assistance (AODA) created by the Departments of Development Studies and Geoinformatics, both of Palacký University in Olomouc, brings the new dimensions of geotechnologies and digital cartography into the workspace of the CZDA.

AODA is a multimedia web atlas application for the ten priority countries receiving Official Development Assistance from the Czech Republic. Using the Atlas, all Czech institutions interested in international development cooperation, as well as high-school teachers (which are the target groups) can obtain access to many thematic maps (physical, socio-economic, sectional and focused on the territorial priorities of Czech ODA). They are also able to get basic information on individual countries and relevant Czech projects funded by CZDA.

In the Czech Republic a comprehensive application, which characterises priority countries and projects, did not exist for many decades. Palacký University in Olomouc builds awareness of international cooperation not only in students and teachers, but also in the wider public, through diverse information sources and studies which have an emphasis on attractive and user-friendly graphical user interfaces.

AODA is the first web-based multimedia product aimed at awareness of, and education and support for official development assistance in the Czech Republic. Through the Atlas all target groups of users (students, teachers, the general public) can be involved, either passively by mastering knowledge about the problems of developing countries, or actively by using the information gained in the planning and implementation of development projects.

Although many web atlas developments have taken place, a number of challenges still remain. Exposed to the rapid developments in technology and their extensive applications in the world, the advances in visualisation still lag behind many countries. A gap still exists between research and application areas in the market. Consequently, the economic return from applications or the market is insufficient to maintain sustainable development, while there is not enough funding from organisation or foundation councils.

Additionally, the knowledge divided between cartographers, computer scientists and subject experts, in this case development cooperation workers, causes the web atlas to be more technically oriented than subject oriented. Finally, the communication between map designer and atlas users needs to be strengthened because there is no good map without an understanding of what users need from an atlas.

In the Czech Republic a comprehensive application which characterizes priority countries and projects did not exist for many decades. Palacký University (Olomouc, Czech Republic) builds awareness of international cooperation not only in students and teachers but also in the wider public by diverse information sources and studies which have an emphasis on attractive and user-friendly graphical user interface (Voženílek, 2002).

The research and its goals

One of the main objectives of systematic research in the field of international development cooperation at Palacký University in Olomouc is to make information about the priority foreign countries Development Cooperation available through a thematic web atlas. It also includes access to multimedia methodological materials on international development cooperation of the Czech Republic for secondary school teachers.

The aim of the GIS research at Palacký University is to complete an Atlas of Official Development Assistance (AODA), a multimedia web atlas application for priority countries in the International Development Cooperation of the Czech Republic. Using the Atlas, all Czech institutions with interest in international development cooperation (which is the target group of users) can obtain access to many thematic maps (physical, socio-economic, sectional and focused on territorial priorities of the Czech ODA). They also are able to get basic information on individual countries and relevant Czech projects. The Atlas is in the Czech language and its English version is being discussed.

The academic aim of the development part of the AODA, conducted by the Department of Development Studies is to deliver a basic socio-economic analysis of each country, a description of selected projects of the Czech ODA and toolkits for high-school teachers. The technological aspects of the Atlas (web framework and cartographic visualisation) have been developed by Department of Geoinformatics.

The projects depicted in AODA are selected in order to provide both sectoral and geographical diversity. Besides providing all relevant information about national ODA to the Czech general public, the Atlas concept also

shows the importance, challenges and forms of poverty eradication in the developing countries from the Czech national perspective.

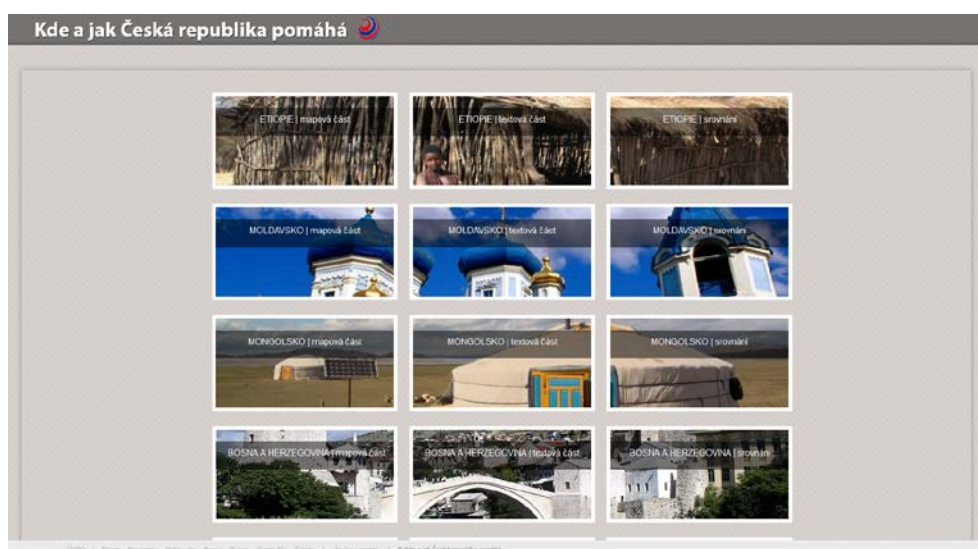


Fig. 1 The homepage of the Atlas of Official Development Assistance is designed as a divider into theoretical part, map application and comparison part for each country.

Why we chose web atlas?

AODA is conceived as a multimedia web atlas application. An atlas could be presented in the traditional form of a book (analog), but new technologies have expanded the presentation options to generate map collections. There are examples of the main advantages of digital web form:

- easy access - maps are accessible through the web environment at any time and are provided free of charge
- interactive control - users can use tools such as zoom, pan, switching layers etc.
- multimedia elements and attractiveness - use of modern and attractive features for expression of real objects on maps
- a large amount of information - maps can include a lot of additional information in the form of graphs, tables, charts, text labels, etc.

- the possibility of extending and updating - possibility of extending the content of a web atlas, adding new information, defining new themes

The web form can be used to present collections of maps but the binding is digital rather than physical. As the possibilities for atlas presentation have expanded to include non-traditional media, the opportunities for innovative mapping and display are increased (Pun-Cheng & Shea, 2003). In recent years, the development of web atlases has been very rapid. The practical achievements include:

- improvements in the technological process of web atlas production, i.e. wider functionality of map servers,
- the establishment of production management, i.e. a new section in national mapping agencies responsible for web atlas administration,
- developing a large web atlas engineering project, i.e. U.S.A., Switzerland, Canada, Sweden, Germany,
- establishing engineering standards and technical criteria.

A web atlas is a digital visualised medium incorporating a visual interface and tools to visualise, analyse and explore the spatial phenomena and temporal processes, by linking a geo-database with cartographic models (Den Worm, 2000). With the development of computer mapping, GIS, computer graphics, wide world web, artificial intelligence, virtual reality and cognitive science, user-adaptive interaction is being brought into web atlas design, development and implementation (Kang & Shneiderman, 2006). Palacky University in Olomouc has very good facilities for creating a web atlas. There are well-equipped laboratories (workstations with GIS applications, servers), people with experience with large research agenda, including several atlas projects (Landscape Atlas of the Czech Republic, Climatic Atlas of the Czech Republic, Atlas of Phenologica Conditions of Czechia etc.), and frequent demands from various subjects concerning all fields of geoinformatics (spatial database, process modelling, map reviewing, etc.).

AODA concept and content

AODA aims to increase interest in and support from the general public, students and teachers of secondary schools in the area of International Development Cooperation. The Atlas is focused not only on the basic physical-

geographical and socio-economic characteristics, but it also presents the development indicators, development opportunities and threats to individual countries, including sectoral and territorial priorities of the Czech ODA. The AODA concept follows the theory of multimedia atlas by Borchert (1999).

The Atlas is divided into map and text parts that are interactively interconnected with an emphasis on the spatial localization of individual projects. In addition, the user can use a function which can integrate data in three map windows and watch different thematic layers simultaneously.

The Atlas is designed not only for the general public, but also for teachers at schools and universities, as a simple and user-friendly tool that can be used when teaching different courses. The Atlas can also be an inspiration for both recipient countries and donor countries. Teachers can download worksheets for their lectures, including maps and pre-designed tests.


The atlas is made up of 10 separate sections for each priority country (Afghanistan, Bosnia and Herzegovina, Ethiopia, Moldova, Mongolia, Georgia, Cambodia, Kosovo, Palestinian territories and Serbia). Each section is designed as a series of thematic maps produced in a sufficiently detailed scale. For each country there are available about 50 thematic layers. For example choropleth maps of natality, mortality, GDP and other social-economical values. The atlas is created as an online application with full interactive functionality. Its modularity and the possibility of immediate updating and adding content is the main advantage. There is an idea of printing a shorter version of the atlas, which still needs to be put into practice.

ETIOPIE

Charakteristika státu

Etiopie, oficiálním názvem Etioeská federativní demokratická republika, je vnitrozemský stát nacházející se v oblasti východní Afriky nazývané Africký roh. Sousedí na severu s Eritrií, na východě s Dáburtskem a Somálskem, na jihu s Keňou a se Súdánek a jižním Súdánek na západě. Etiopie přišla o své poloběží v roce 1993 po vyhlášení nezávislosti Eritrie. Rozloha Etiopie je 1 127 127 km² (až třináctkrát více než ČR) a v zemi bydlí 82,1 milionů obyvatel (2011). Hlavním městem je Addis Abeba a úředním jazykem je amharština.


Etiopii dominuje rozsáhlá náhorní plošina nacházející se ve středu země, rozdělená na dvě části Velkou příkopovou propadlinou. Víška plošiny se jednoduše pohybují mezi 1500 a 3000 m n. m., celý masív je charakterizován hornými řebeny rozdělenými hlubokými rokami a říčními údolími, a to převážně v severní části. Plošina se pomalu vlní do nížin na západ do oblasti Súdána a do jihovýchodní části Etiopie chývané Somálie. Nejvyšším bodem je Ras Dašen (Bejeda) s 4820 metry nad mořem. Naopak nejnižším bodem je Danakilská prolákina dosahující 115 metrů pod hladinu moře, jedná se také o jedno z nejteplejších míst na světě. Vzhledem ke geologické aktivitě Velké příkopové propadliny je v její blízkosti možný častější výskyt zemětřesení a sopečné činnosti. Obdělává se zhruba 17 % půdy, přestože pocit půdy pouštěné k orbě je vyšší. V důsledku intenzivní deforestace rodufektů, 96% les se zalesněním rovná křídle 13 až 15 % území. Zhruba je zastoupeno 200 rozmanitých druhů ptáků.




Název: Etioeská federativní demokratická republika
Hlavní město: Addis Abeba
Rozloha: 1 127 127 km² (až 14krát větší než ČR)
Pačet obyvatel: asi 82,1 mil. (cca 6krát více než v ČR)
Jazyk: amharština
Náboženství: Etioeská ortodoxní církev (43,5 % populace), 63,6m (33,9 %), protestantismus (18 %), tradiční náboženství (2,6 %), křesťanství (0,7 %), ostatní 0,7 %
Státní zřízení: Federativní parlamentní republika

Musika k náboženství


Vybrané projekty (11)




VÝVOJOVÝ DATABÁZE CI DATA




PŘÍKLAD ZDROJŮ VOD V ETIOPII SE ZÁMĚŘENÍM NA OBLASTI POSTIŽENÉ SUCHEM




VÝVOJOVÉ ŽÁDÁNÍ SKOL V OBLASTI AMASSA



CENTRUM MODERNÍCH VÝVOJOVÝCH METOD V AMASSE

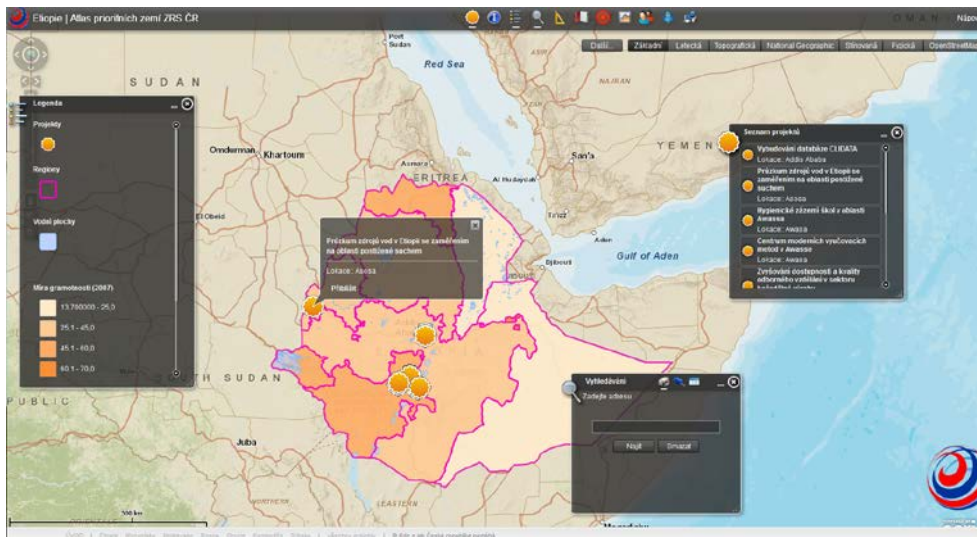


HUMANITÁRNÍ POMOC V OBLASTI ALABA PITNÁ VODA A HYGIENA



ZVÝŠOVÁNÍ DOSTUPNOSTI A KVALITY ODBORNÉHO VZDĚLÁNÍ V SEKTORU KOZEDELNÍ VÝROBY

Fig. 2 The description of each country provides basic characteristics appended by flag and multimedia elements such an anthem.



The screenshot shows the AODA web application interface. The main element is a map of Ethiopia with several data overlays. On the left, there is a legend for 'Míra gramotnosti (2010)' with a color scale from light yellow (11.70000 - 25.0) to dark orange (65.1 - 70.0). A 'Průběh státní vod v Etiopii se zaměřením na oblast postihované suchem' panel is overlaid on the map, showing a pink shaded area. On the right, a 'Seznam projektů' panel lists several projects with their locations: 'Vytváření databáze CI DATA' (Addis Abeba), 'Přístup zdrojů vod v Etiopii se zaměřením na oblast postihované suchem' (Addis Abeba), 'Vývoje žadání skol v oblasti Amassa' (Amassa), 'Centrum moderních vývojech metod a inovací' (Amassa), and 'Zvyšování dostupnosti a kvality odborného vzdělání v sektoru kozeďelny výroby' (Amassa). At the bottom, there is a 'Vytváření Zvolte schůzi' panel with 'Název' and 'Okamžik' fields.

Fig. 3. The web AODA application shows the chart map of unemployment in Ethiopia in 2010.

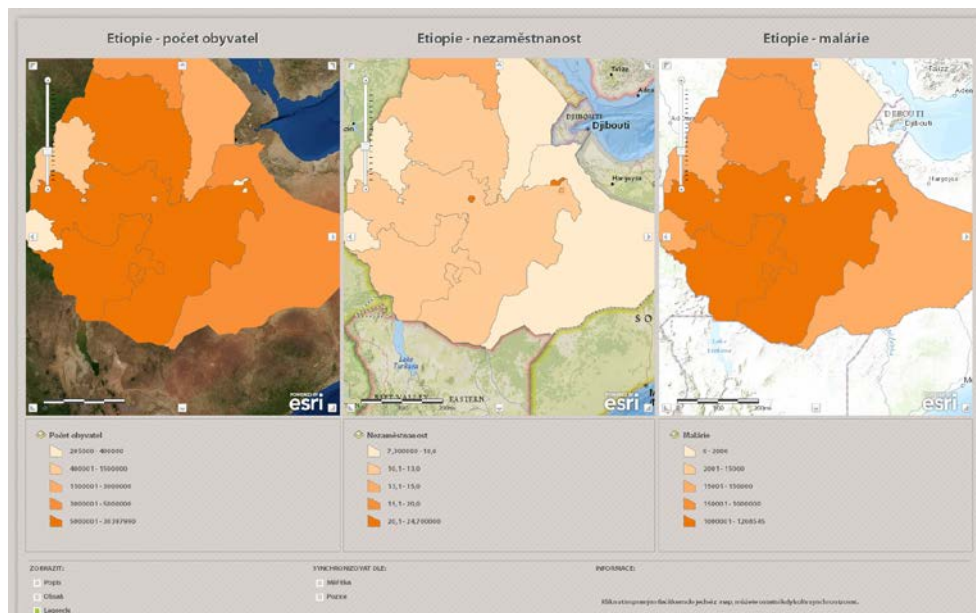


Fig. 4 With comparison function, the user can compare three different layers/maps synchronized by both place and scale.

The Atlas compilation

The data, software and technological conditions of the Atlas are as follows:

- The background data - Ten basic layers for each country in *.shp data format, free available on <http://www.diva-gis.org/gdata>.
- The attribute data - 40 new layers created to present the statistical indicators for selected countries from different regions.
- Data processing - The software product ArcGIS10 was used to create the resulting data sets.
- Publishing data - Map documents in *. mxd format were created and published using ArcGIS Server as a public service.
- The application - Interactive map application based on ArcGIS technology Viewer for Flex and add widgets.

The AODA has been developed in several steps:

Data collecting - An important step at the beginning of the atlas creation was to ensure the availability of the data from the selected countries. In the first part the embassies and other offices of individual countries have been

asked for collaboration. In the second part of data collecting all free and requested data have been gathered. After using various sources, all collected data have been verified to ensure the accuracy of topographic and thematic components.

Data pre-processing in GIS - All collected data organised in layers and databases have been modified and arranged for further needs. For example, the data in different coordinate system or separated layers have been edited for unified cartographic representation (shapes, colour appearance and legend). Unification into the same format has been processed in GIS (geographic information system), mainly in ArcGIS software (Esri). It allows the opportunity to prepare data more accurately due to Web Map Services (WMS) features. Moreover the statistical data values were joined with topology and visualized according to all cartographic rules (Ware, 2004). Finally, all data are ready for both current and further publishing in the correct cartography form.

Text component of the Atlas - The text part of the Atlas is very important for general atlas use. The text component of the Atlas consists of basic information about individual countries, such as characteristics of country, capital, language, population and other basic information. There is also a flag of the selected country and the user can hear the national anthem. Every country also has information about the selected development project – a brief description and link to the project implementer. The text component of the Atlas is compiled in clear and user-friendly form and provides the necessary information suitable for use with the map parts of the Atlas.

Developing the web interface integrating multimedia atlas elements. The main part of the AODA project is a set of interactively linked multimedia elements. Beside the textual information about each country, included audio characteristics are also included. At the beginning of the country characteristic the anthem is inserted. The anthem file is ready to play in the web browser by interactive audio player, no additional plugin or download is required. Especially for educational reasons, the records are in typical and official language and voices for each country. Promotional video spots about countries are very popular with foreign users. This kind of video is located on the YouTube channel and can be freely shared. The animations bring additional dimension to two dimensional maps. Due to technology based on the RIA concept all animation has been implemented into the map framework. Especially in the map layers where the time component plays a dominant role (typically the changes in ethnic structure, changes of state borders, etc.), this approach is more effective and provides higher information than static maps.

Uploading the Atlas to server - When the whole project was successfully tested and finally updated, the Atlas files were uploaded to the public server of the Department of Geoinformatics, where the Atlas is freely available for users all over the world.

Rich Internet Application

AODA is based on the concept of Rich Internet Application (RIA). RIA represents the current trend in publishing spatial outputs via the Internet. In fact RIAs is the thin client web application with desktop functionality (Meier et al., 2008). Thus, it contributes desktop tools and customs to web applications and ensures higher user-friendliness. In principle, RIAs is an Internet application that does not strictly stick to the traditional request/response paradigm. The conventional web pages are created by (X)HTML code on the client's side, which is directly interpreted by a web browser. Each interaction with a "classical" page means sending a new request to the server, then the answer is returned as the source code of a new page. This does not apply to RIA.

There are several RIA key characteristics. Direct interaction - RIA uses a wider spectrum of control elements which makes higher efficiency and user-friendliness while traditional web applications provide user-interaction limited to several basic control elements (i.e. checkboxes, radio buttons and form fields). In RIA, users can, for example, directly edit page elements or change them using drag&drop tools and also perform operations such as gradually going through maps and other images. RIA contains complementary technologies such as real-time streaming, high-performance client-side virtual machines and local caching mechanisms that can reduce latency (waiting time) and speed up response. Better feedback - The ability to change a portion of a web page without reloading makes it possible for RIA to provide the user with quicker and more accurate feedback, real-time confirmation of actions and choices, as well as detailed information and error messages. Impact on performance - Depending on the application and network connection, RIA applications are more efficient than classical ones (Meier et al., 2008).

The real RIA solution started with the Flex technology by Adobe. The technology has been under development since 2004 and only received the publicity it deserved in 2007, when it was issued (in version 2) as open source. The basic idea of Flex is the use of the Flash technology for the user interface. Thanks to a toolbox based on the Eclipse environment (also known as IDE) it is easy to prepare an interactive user interface that runs in any web browser with Flash support.

The worldwide leader in GIS software, Esri company, developed own Flex client called "ArcGIS for Flex". It is based on the ArcGIS server, with the aim of creating a highly interactive Web map application that supports the display of spatial data, interactive querying, data extraction and editing on the screen, geocoding, printing, etc. ArcGIS for Flex is a ready-to-deploy application, which is designed for developers who want to customize the appearance, functionality, and content of their mapping applications. The developers can combine GIS-based Web services from the ArcGIS Server with other Web content, which can be displayed in dynamic mapping applications over the Web or on the desktop. Users can transform their local data into a visually rich interactive map, query and display GIS data features and attributes, locate addresses, identify features, and perform complex spatial analytics.

AODA in the use of Official Development Assistance

One of the very important parts of the ODA is in working with the general public in the donor country, to ensure a positive perception of the Official Development Aid as well as sustainable development (UNWCED, 1987). The Czech Republic has continued with its ODA following on from the previous activities of Czechoslovakia till 1989. In that time Czech ODA was affected by the logic of the Cold War and the bi-polar division of the world. In that time, the only ODA was with "non-European socialist" countries and countries of "special interest". Two countries in the South-East Asian region in the Czech ODA are the remains of the cooperation from these times.

With membership of the OECD and the European Union in 1995, and 2004 respectively, the ODA of the Czech Republic increased and currently the country is aiming at 0,13% of the GDP yearly.

As one of the target groups of the project is high-school teachers, the toolkit is also a fundamental part of the atlas. The toolkit is designed to help teachers incorporate basic information about the ODA into the school curricula and provide students basic answers to the question "How does the Czech Republic fight global poverty in developing countries?"

The toolkit consists of a detailed socio-economic analysis of the country, accompanied with maps, pictures and leading questions, which can be used in the classroom. Every toolkit also has a section with further references and links. The toolkits are freely available on the webpage of the Atlas.

The methodological guideline was compiled for educators. It is related to the Atlas content (10 countries) in the form of methodological toolkits. Besides the toolkits the authors are developing a consulting toolkit.

Discussions and conclusions

In today's world, digital solutions have become an educational environment for schools and the general public in their daily work and are therefore superb tools for the dissemination of information about the Official Development Assistance of the Czech Republic.

The importance of technology in every aspect of atlas making does not diminish the essential role that the cartographer plays. Maps are drawn by people, not computers. The content of the graphics must be kept paramount, the technical aspects are secondary. Computers cannot replace the cartographic knowledge and skill required to make good maps. So even with the increased capabilities of technology in the cartographer's workplace, it is still ultimately the cartographer who is responsible for the beauty and accuracy of the map, and who can take pride in a job well done.

The compiled Atlas of the Official Development Assistance is the first web-based multimedia product aimed at awareness, education and support for international development assistance in the Czech Republic. Through the Atlas all target groups of users, including students, teachers and the general public are involved passively by mastering knowledge about the problems of developing countries and/or actively by using the information in the planning and implementation of development projects. Currently, the Atlas is freely available online.

Secondary schools teachers and students can use it while studying different subjects. By accessing multimedia methodological documents about Czech Official Development Assistance to secondary school teachers, the AODA facilitates the difficult acquisition of new and progressive teaching materials. On the other hand, the general public interested in Czech ODA can find useful information about how the Czech government supports our priority countries. As with every project, there are strong and weak sides to the application. The primary challenge was data acquisition for selected countries. The fact that some of the projects were implemented a decade ago significantly increased the difficulty of the data collection. In some cases even the Czech consulates do not possess adequate and up-to-date information.

Another major challenge was to convince students and teachers to actually use the atlas in their classes. There are still a fair amount of Czech teachers resisting the use of digital technologies in their teaching.

From the technical point of view, the main constraint was interoperability. The spatial part of the Atlas requires Adobe Flash plug-in in order to launch and some mobile devices do not support Flash technology. It means that

users with mobile devices are currently not able to use the map part of the atlas.

Although many web atlas developments have taken place, a number of challenges still remain. Exposed to rapid developments in technology and their extensive applications in the world, advances in visualisation still lag behind many countries. The gap still exists between research and application areas to the market. Consequently, the economic return from applications or marketing is insufficient to maintain sustainable development, where there is not enough funding from organization or foundation councils. Additionally, the knowledge divide between cartographers and computer scientists, causes the atlas to be more paper map oriented or more technically oriented. Finally, communications between map designer and atlas users needs to be strengthened because there is no good map without understanding what users need from the atlas (Voženilek, 2005).

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