

Geoinformatika *Geoinformatics*

Geographic information infrastructure – towards interoperability of public data

Giedrė Beconytė

Vilnius University

E-mail: giedre.beconyte@gf.vu.lt

Cindy Pubellier

GeoLines France

E-mail: cindypubellier@fastem.com

INTRODUCTION

The central government's radical E-Government programme in Lithuania aims to reform the way in which government conducts business at all levels, in part by applying the IT lessons learned by industry. E-Government is all about best value. This in part is realised through building open, coordinated data stores that all applications can access with controlled privileges providing support to join-up information for analysis and services. In many cases the necessary infrastructure already exists in the core systems used in the public sector today. Development of explicit geographic information policy is a part of the national strategy to promote information-based society. Spatial data infrastructure based on information technology is a knowledge-gathering activity by its geographic nature. It is one of the effective components of the physical and economic infrastructure ensuring stable and balanced development of the economy and its efficient functioning (Feasibility Study, 2004).

As about 80–90% of all the public sector information contain a geographic component, building a successful Lithuanian Geographic Information Infrastructure (LGII) is a fundamental pre-requisite for the development and implementation of this policy, for stimulating the private (value added) sector and for improving services to the citizens in general. Implementation of the LGII is a major undertaking that requires coordination across a number of areas. The main goal of the project started in 2004 is to make harmonized and high quality geographic infor-

mation readily available for formulating, implementing, monitoring and evaluating community policy and for the citizens to access regional and national spatial information.

THE PROBLEM OF GEOGRAPHIC INFORMATION

The aim of the performed study on intervention needs (Assessment..., 2004) was to clarify what interventions are necessary to achieve this goal and which of them must be given priority seeking to make LGII socio-economically most effective. Intervention needs are based on an understanding of the recent situation and its comparison with the vision of what is still necessary to achieve. Two main conclusions can be drawn from the study:

1. A huge amount of geographic data has been collected in Lithuania both in the public and private sectors (Availability Report, 2004): archives and registers, reference datasets and various thematic geographic databases, statistical data, relevant information (legal acts, standards, methodologies, etc.)

It is needless to say that greater use and better exploitation of this geographic information must be ensured so that theretofore investments pay the dividends.

2. Although attempts have been made to increase the interoperability of existing geographic information systems, use of these data is still very inefficient:

- the reference datasets are largely incomplete, outdated and of insufficient quality due to the lack of financial resources and low capacity;

- there is a duplication of efforts in data collection and maintenance, unavailable data and other problems related with the lack of overall management strategy and coordination (both at national and regional levels);
- sharing and re-use of the data is complicated or even impossible due to incompatible data, lack of metadata, variety of standards and non-communication. Thus, most of the infrastructures function in isolation;
- users have difficulties to access the data they need, mainly because of the above mentioned problems and unclear or unbalanced pricing policy;
- many potential users are not aware of their benefits from using geographic information technologies or are not able to use them, mainly because of the lack of information, resources, competence and skills.

Geographic information is still not widely used for spatial decision support for development projects, including the emerging e-Government and hence the Information Society.

The project team communicated with over 50 organizations of different types approximately representing the structure of the active players in the field of geographic information in Lithuania by sectors. All organizations were asked to complete the questionnaires and provide the inventory of data produced by them. Concerning the main problems hindering the geographic information (GI) technology and its wider use today, the main users of geographic information were asked to specify the reasons and to express their expectations from LGII. The following figure (Fig. 1) illustrates that the respondent companies are suffering from commonly known causes.

It should be mentioned that almost half of the distributed questionnaires were not returned. It might be related with both the lack of awareness of importance of the project and low expectations, especially among the research institutions. On the other hand, live interest in the project was demonstrated by private companies which produce and use geographic data. There was also a fair balance of small and medium-size companies.

STRATEGIC ASPECTS

One cannot expect that spatial data infrastructure will immediately solve all the problems of inefficient management and lack of interoperability. It will rather start with performing the following functions:

- integrate the existing data and make institutional infrastructures interoperable thus facilitating use of geographic information for decision support and value added products/services;
- create prerequisites for full interoperability in the future;
- provide a framework for the further development.

Thus, consulting the major players in geographic information field and integrating different viewpoints was considered one of the most important techniques during the development of the investment project.

The role of geographic information in different sectors was evaluated and proposals were made in order to ensure the maximum usability of existing information and to trigger the geographic information based development of different sectors in the future. The following rules were adopted in order to ensure the success of the LGII feasibility study:

- active participation of key executives, opinion leaders, representative “doers” and others who collectively understand what is needed;
- careful selection of the participants of meetings and interviews;
- early correction of opinions, ideas and activity models;
- open-mindedness and critical evaluation of produced models;
- thorough feedback sessions with major decision makers to identify errors, misunderstandings and inconsistencies.

Interoperability is a critical issue in the context of LGII, since one of its basic doctrines is to keep the data where it is and to provide access to it. Impacts on local organisations are minimised since they can continue using the software and hardware as before.

Summarizing the results of Lithuanian studies and the previous experiences of relevant developments of components for geographic information infrastructures (GINIE, 2002) it should be stressed that important natio-

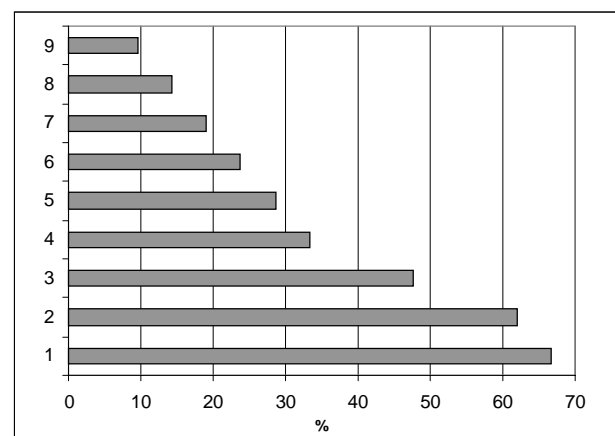


Fig. 1. The main difficulties encountered in activities related with geographic information (% of all respondents)

1 pav. Pagrindinės su geografine informacija susijusių sričių problemos (respondentų procentas)

- 1 – Insufficient financing / nepakankamas finansavimas; 2 – Lack of human resources and skills / žmonių išteklių trūkumas; 3 – Lack of technology / technologijų trūkumas; 4 – Complexity of management / valdymo sudėtingumas; 5 – Lack of information, metadata; complicated exchange / informacijos, metaduomenų trūkumas, sudėtingas apsikeitimas; 6 – Lack of GI policy, imperfection or lack of legal acts / geografinės informacijos strategijos, teisinių aktų netobulumas; 7 – Data incompatibility, lack of standard / duomenų nesuderinamumas, standartų nebuvimas; 8 – High data price / aukšta duomenų kaina; 9 – Poor data quality / bloga duomenų kokybė

nal geographic information infrastructure success factors are:

- active governmental support;
- interaction and coordination of the involved institutions, strong multi-sector coordination;
- overall strategy and early adopted top-down approach;
- decentralization and involvement of the private sector from the outset;
- adopted common standards and regulations;
- clear data policy, licensing framework and access procedures;
- flexibility of the system;
- technical support as well as leadership must be provided;
- implemented quality control procedures;
- transparency implementing the strategy and proper communication to public.

THE GOALS OF THE LGII

As a harmonized spatial data infrastructure that will facilitate the combination of information of various sources and more advanced analysis work, the LGII will stimulate the use of geographic information in different sectors, including those commercially valuable. Some barriers of a wider use of geographic information that can be overtaken by means of LGII were analysed and solutions were proposed (Assessment..., 2004).

It is necessary to emphasise two aspects of LGII at this point:

1. The short-term goals (to be achieved during the time of implementation of the development project – ca. 3 years) manifest in solutions to *increase the use and facilitate the exchange of public sector geographic information already available*. Connecting state registers through their geographic component or ensuring compatibility of large scale (at cadastre or municipality level) and smaller scale (national 1: 50 000 database) data will directly serve this purpose.

2. The long-term goals of LGII are connected to *development of the state in diverse aspects* for many decades in the future. There were three major long-term goals defined:

- to *extend the scope and functionality* of LGII involving more data providers from different sectors and encouraging the partnership of different institutions in development projects using public sector geographic information;
- to build interoperable geographic information systems where they still do not exist and to improve the existing ones, for example, the information system for the National Atlas, health services, schools, utility management, etc. Full interoperability of such systems must be sought in the future, providing the services to fully integrate data from various sources from the local to the European level into coherent seamless datasets supporting the same standards and protocols;

- to encourage the use of geographic information and technologies for decision support at all levels where it is still very limited, for example, health care (relationships between disease and environmental factors, planning emergency services networks, investigation of food-borne disease outbreaks), law enforcement (tracking crime activities, identifying patterns or trends to do preventative measures), environmental management, etc.; up to geographic information for personal mobile devices. This task largely includes capacity building.

THE BENEFITS AND MAJOR TARGET GROUPS

There are four major target groups of the emerging LGII:

1. Governmental institutions.
2. Business sector.
3. Education and research institutions.
4. Non-governmental organisations (NGO) and individual users.

Governmental institutions will be using LGII mainly for *coordination of actions and strategic decision support* where the public sector information is concerned. It is hierarchically organized:

- national government,
- regional government (10 county administrations),
- local government (60 local authorities – city and regional).

Many different state services, centres, agencies and enterprises which are the custodians of national and regional databases also belong to this group. Due to their mandate and active use of geographic information some of them are already among the most important stakeholders of the LGII project.

Active involvement of governmental institutions is crucial for LGII. Its initiative is necessary for implementing policies at various levels and stages, effective production and maintenance of national databases, creating the legal framework for dissemination of data and value added products, etc.

The business sector consists of both state and private enterprises which will most directly *economically* benefit from LGII as they will take advantage of it for:

- data production and marketing
- obtaining geographic data for various applications.

Correspondingly, all business institutions can be grouped according to their main activities:

- producers of geographic data
- producers of derived information and services
- users of geographic data for various applications.

Active participation and investments (staff, methodology, technology) of business institutions which will become the nodes of LGII are necessary to ensure the lasting functioning of the infrastructure. A number of state and private **research institutions** are involved in acquisition of geographic data. Most of them also perform mining of the accumulated data and use the results in scientific research or for other non-commercial purposes. Some of these institutions also create data or derived

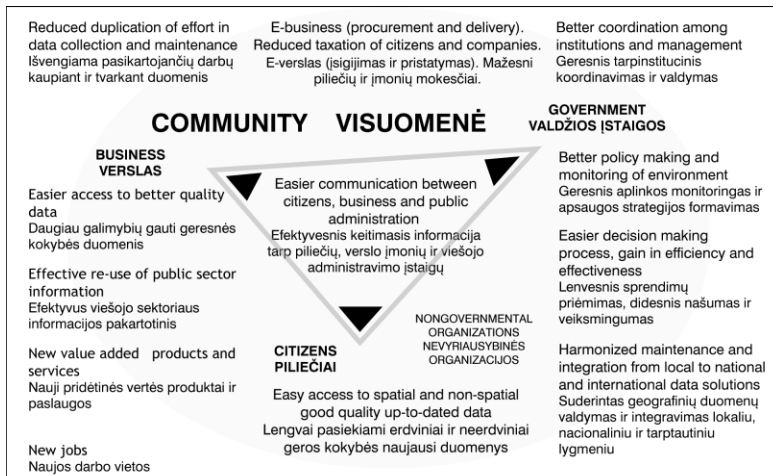


Fig. 2. Forecast benefits from LGII for the community
2 pav. Planuojama LGII nauda bendruomenei

products in response to orders of public agencies or distribute them on their own account.

It is very important to involve education and research institutions in the national geographic data infrastructure for the following reasons:

- they can share high quality and specific data and offer consultancy services on specialised subjects such as geodetic, geophysical surveys;
- they can promote new methods of dissemination and fields of application of geographic information and knowledge, i. e. support the sustainable development of LGII;
- they are responsible for training geographic information professionals – human resources for the future of the infrastructure.

LGII is essentially a *spatial information system* that allows analysis and serves as a basis for different models. Such models, in turn, can be used for some particular actions: planning and management, prediction and assessment, environment protection, energy exploitation and saving, adjusting economic structure, etc. The variety of data flows among the institutions makes information exchange very complicated. Because of such situation citizens are not well informed about the available geographic information and related projects, and data users are often lost when they need to find the data and choose the best dataset or combine it from several sources. Coordination of information flows among institutions must be performed by means of LGII which will regularize the present overabundance of data flows. A model data flow diagram would show LGII as a gateway for an easy access to different data from different sources. Such gateway will be the main service for all the target groups of the project.

It is very difficult to estimate the direct economic benefit for the state from implementing the overall spatial data infrastructure; however, it is closely related with the increased efficiency of most of the public sector activities. The general benefits of LGII for the community are shown in Fig. 2.

It is also difficult to clearly distinguish between the target groups, because some activities (e.g., collection of geographic data) overlap. Therefore, instead of segregated breakdown of the potential users by functions, concentration was made on different types of problems and proposition of solutions which would be significantly facilitated by LGII.

MAJOR INTERVENTIONS

Several types of interventions have been planned regarding the development of the national geographic data infrastructure:

1. Strategic – political actions such as legal regulations, capacity building, promotion, etc. They are mainly necessary to ensure the robustness and sustainability of the infrastructure and serve as a methodological background. Some of them are of crucial importance to LGII – appointment of an authoritative coordinating body, adoption of common high level standards and necessary institutional arrangements. Governmental support is especially sought after for this type of interventions.

2. Interventions related to development of technological infrastructure (interconnected nodes of LGII, spatial data clearinghouse, means for technological interoperability, etc.). These interventions create the necessary technological environment for LGII to function.

3. Interventions for harmonization of geographic information and harmonization of access to it. They are necessary to guarantee the efficiency of the system and namely fill it with good quality data and metadata. Harmonization interventions comprise standardization of geographic data, creating and making available the full system of metadata and, finally, improvement of existing datasets in different aspects.

(to be continued)

ACKNOWLEDGMENTS

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Giedrė Beconytė, Cindy Pubellier

GEOGRAFINĖS INFORMACIJOS INFRASTRUKTŪRA SIEKIANT VIEŠOSIOS INFORMACIJOS INTEROPERABILUMO

S a n t r a u k a

Lietuva daro didelę pažangą plėtodama elektroninę valdžią. Tarp informacinių technologijų programų, prisidedančių prie šios iniciatyvos plėtotės, yra ir Lietuvos geografinės informacijos infrastruktūros (LGII) plėtos programa. Ja siekiama sukurti atvirą tarpusavyje suderintų valstybės geografinių duomenų saugyklą ir elektronines paslaugas, kurios leistų piliečiams, įmonėms ir valdžios institucijoms efektyviai gauti naujausius geografinius duomenis iš pirminių šaltinių. Kadangi 80–90% viešojo sektoriaus informacijos, naudojamos valdymo ir plėtos sprendimams priimti, yra geografiškai susiejama, labai svarbu tinkamai pasirengti LGII kūrimui. 2004 m. buvo atlikta studija siekiant išsiaiškinti pagrindines problemas, susijusias su geografine informacija, taip pat kokių priemonių valstybės mastu turi būti imtasi norint užtikrinti sėkmingą LGII įgyvendinimą, tolesnį funkcionavimą bei plėtrą. Studija rodo, kad, nepaisant didelio sukauptų viešojo ir privataus sektoriaus geografinių duomenų kiekio, jie naudojami nepakankamai dėl kelių priežasčių:

1. Valdymo neefektyvumas. Viešosios informacinės sistemos, kurios turėtų būti susietos geografiniu pagrindu, daugeliu atvejų funkcionuoja izoliuotai, trūksta bendro skirtingų institucijų veiklos geografinės informacijos srityje koordinavimo, nepakankamas geografinių duomenų tarpusavio suderinamumas, todėl dažnai duomenys ir pastangos dubliuojamos kaupiant, saugant ir tvarkant geografines duomenų bazines.

2. Sunkiai pasiekiamą informaciją. Vartotojams sudėtinga rasti, įvertinti ir tarpusavyje derinti reikiamus duomenis – jie

ne iki galo standartizuoti, trūksta metaduomenų ir informacijos apie įvairių institucijų sukauptus geografinius duomenis.

3. Žmonių išteklių ir informavimo problema. Daug potencialių geografinės informacijos vartotojų dar nėra visiškai įsisaunoję jos naudos ir galimybių, geografinė informacija mažai naudojama priimant strateginius sprendimus.

LGII tikimasi bent iš dalies išspręsti šias problemas. Infrastruktūra jungs institucijų geografinės informacijos šaltinius, kurie bus suderinti tarpusavyje (interoperabilūs) ir pasiekiami vartotojams vienoje vietoje – LGII Interneto portale. Siekiant išsiaiškinti vartotojų dabartinius poreikius buvo atlikta apklausa, atskleidusi konkrečias, su geografinių duomenų naudojimu susijusias problemas (1 pav.). Suformuluotos prielaidos, būtinos sėkmingai infrastruktūrai, jungiančiai skirtingus geografinių duomenų tiekėjus su specifiniais jų interesais. Jų laikantis parengtas LGII projektas, numatantis, kad duomenys bus saugomi ir tvarkomi ten, kur jie kaupiami, o infrastruktūrai teikiami kuo mažiau keičiant duomenų teikėjo esamą veiklos modelį. Manoma, kad LGII paskatins geografinių informacinių sistemų kūrimą ir tose Lietuvos įstaigose, kuriose jų kol kas nėra. LGII strategija apima du etapus: a) infrastruktūros fizinį sukūrimą (maždaug per trejus metus) ir jau sukauptų duomenų publikavimą jos portale; b) ilgalaikę LGII plėtos programą skirtingais aspektais: geografinės aprėpties, institucinės partnerystės, duomenų temų įvairovės, funkcionalumo, žmonių išteklių plėtos, elektroninių paslaugų plėtojimo, skatinant geografinės informacijos naudojimą bei LGII integravimą į regionines ir pasaulinę geografinės informacijos infrastruktūras. LGII vizija – visiškai tarpusavyje derantys viešojo sektoriaus geografiniai duomenys, lengvai integruojami su valstybės registrais, taip pat nemaža dalis privataus sektoriaus duomenų, pasiekiami vartotojui kartu nepriklausomai nuo jų šaltinio, temos ar platinimo sąlygų, teikiami naudojant vieną duomenų modelį. Pagrindinės skirtingų poreikių LGII vartotojų grupės yra: valdžios įstaigos, verslo įmonės, mokslo ir mokymo įstaigos, nevyriausybinės organizacijos ir individualūs vartotojai. Sukūrus infrastruktūrą visoms šioms grupėms nauda numatoma iš karto (2 pav.). Pirmajam LGII etapui numatytos trys įgyvendinimo priemonių grupės: *strateginės-politinės* (teisės aktų, standartų priėmimas, institucinis koordinavimas, žmonių išteklių plėtra, viešinimas ir pan.), *technologinės* (fizinės infrastruktūros, interoperabilumą užtikrinančių priemonių, portalo sukūrimas) ir *harmonizavimo* (geografinių duomenų standartizavimas, suderinimas, metaduomenų pateikimas ir kt.).