

Ivana IVÁNOVÁ

STANDARDIZATION OF GEOGRAPHIC INFORMATION

Ivánová, I.: Standardization of geographic information, Kartografické listy 2005, 13, 2 figs., 1 tabs., 7 refs.

Abstract: The standardization of geographic information (GI) becomes an essential activity within using, sharing, interchanging GI. The article shows the importance of this activity through its history and presence within and international, regional and national standardization bodies. Recent standardization activities are shown through the description of the activities of two main standardization international (regional) bodies, which are CEN and ISO. The focus is on the role of the Slovak Republic within the standardization of geographic information.

Keywords: standardization, geographic information, ISO compliant GIS, benefit, CEN, ISO

Introduction

The use of geographic information becomes a part of people's 'normal' life – we can hardly recognize a branch of public activity, which does not need a geographic information at least to describe a plan how to get where we want to do whatever we would like to.

Standardization in the field of geographic information in Europe is a structured framework of standards and guidelines, which specify methodology to define, describe and transfer geographic data and services. This work will be carried out with close cooperation with ISO/TC211 according a Vienna agreement about cooperation with liaison organisations to CEN technical committees to avoid duplicate work. The standards will support the consistent use of geographic information throughout Europe in a manner, which is compatible with international usage. They will support a spatial data infrastructure at all levels in Europe.

It is crucial to mention, before whatever else would be stated, that standards are never published on time – they are either too late or too early. But, it is also important to go on working on standards anyway, because there are some good reasons to implement standards – let me mention few of them: efficiency, quality improvement, knowledge sharing, avoiding of information loss.

For clear understanding of a difference between words "norm" and "standard", with which all of those dealing with geographic information (GI) could meet, there is a brief explanation: In European context, coming from other languages than English, more word "norm (normalization)" is used as a synonym to the English word "standardization", although they might describe different concepts (Aalders 1998). If the both words are used, the word "standard" has a wider meaning. Another explanation of the differences between these two words is, that the word "norm" means more official agreements that are defined, while the word "standard" is used for all types of agreement between users (Aalders 1998). Since the revived CEN/TC287 has an objective of adoption of standards published by ISO, I will use only a word "standard (standardization)" in the following text.

About standardization

Standardization is a development of agreements and rules amongst users to create unity and clarity, where diversity is unwanted (Aalders 1998). Standards are documented agreements by potential users. The process of standardization is sketched on Fig. 1

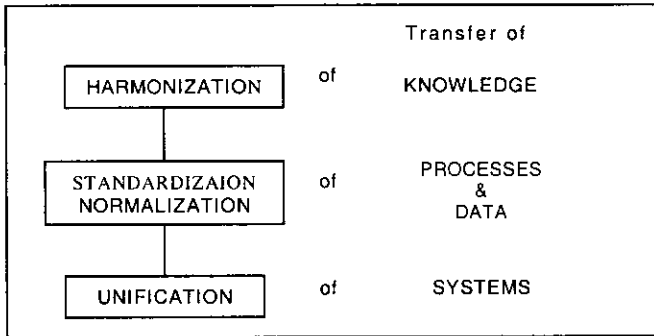


Fig. 1 Process of standardization

Levels in standardization:

- international,
- national,
- domain (ministries, groups of organizations),
- application (within private sector).

Types of standards:

- formal standards (e.g. national: NEN, STN, ANSI...; international: CEN, ISO...),
- industry consortia standards (e.g. UML, XML by Object Management Group; GML by Open Geospatial Consortium),
- professional organisations standards (e.g.: standards by Association for Computing Machinery).

Standard types according levels:

- low level (standards for hardware, physical connections, network communication and management, operating software standards),
- high level (standards for user interface, data format, data transfer, programming and application development, user design standards).

There are two aspects in designing spatial data standards:

- technical (modelling, transfer, format and hardware – for IT experts),
- functional (semantic, modelling, quality and applications – for GI experts).

Economic benefits of standardization

Results of the survey done by DIN (German Institute for Standardization) show strategic significance of standardization (DIN 2005). There are some of the results of the survey. Companies are generally unaware of the strategic significance of standardization – they have no information about how to lower the costs in their companies by using, or directly cooperate in creation of standards. When there is cooperation, it results in advantages regarding costs and competitive status. There was recognized a potential competitive advantage through standards by influencing its content. Amongst others one of the highest positive effects in using international (regional) standards is seen in a supplier – client relationship (Knoop 2004):

- dependence of a business on a single supplier can be reduced by standardization,
- increases confidence and reliability to those using standards,
- standards effect relationship with suppliers more than that with client,
- benefit to the national economy amounts to more than US \$ 15bn per year,
- standards contribute more to economic growth than patents and licences,

- companies that participate actively in standards work have a head start on their competitors in adapting to market demands and new technologies,
- transaction costs are lower when European and International Standards are used,
- research risks and development costs are reduced for companies contributing to the standardization process.

Structure of the standardization organizations – CEN and ISO

In general, there is a different approach in standardization in the two organizations. ISO applies a “process-based” model in a process of creation of standards while CEN applies “object-based” approach. But since, the CEN norms for GI are withdrawn and ISO standards are adopted, the model becomes the same for both organizations with its process-based approach of creation.

Short history of CEN/TC287 Geographic Information

CEN/TC287 (Comité Européen de Normalisation/Technical Committee 287) Geographic Information was established in a year 1991 by AFNOR (Association Française de Normalisation). During the years of 1991 – 1999 CEN/TC287 published 8 norms and 4 committee reports for GI. In a year 1999 CEN/TC287 went dormant. One of the reasons for this decision was the creation of ISO/TC211 Geographic information/Geomatics in a year 1994, where most of the European experts in GI took part in a work on international standards in work groups within this technical committee.

Most of the standards of the ISO 19100 family of standards for GI are published, therefore an obligation for CEN arose to decide if and how should be these standards applied within a European region. The formation of European standards within CEN can be seen in Fig. 2.

Types of documents released by CEN:

1. EN – European Norm
2. CEN/TS – CEN Technical Specification
3. CEN/TR – Technical Report
4. CWA – CEN Workshop Agreement
5. CEN Guide

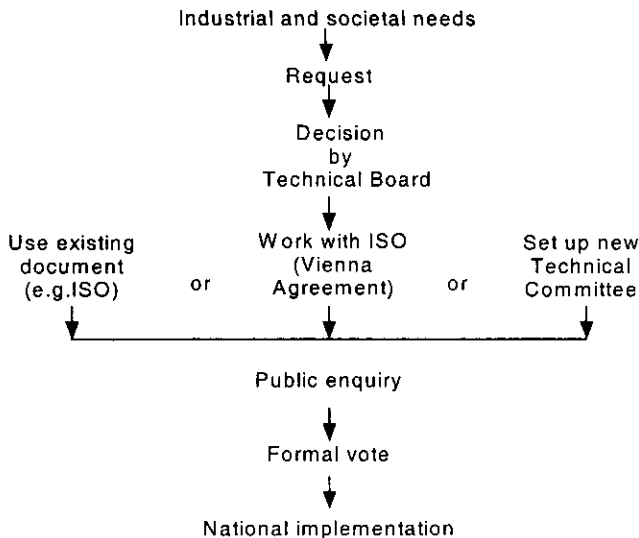


Fig. 2 Formation of European standards within CEN

Short history of ISO/TC211

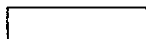
ISO/TC211 (International Organization for Standardization/Technical Committee 211) Geographic information/Geomatics was created in 1994. The driving forces in creation of ISO/TC211 were DGIWG (Digital Geographic Information Working Group of NATO) and national standardization efforts of USA and Canada.

Tab. 1 List of published ISO standards as of 14. 2. 2005

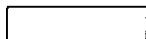
International Standards and Technical Reports	
	ISO 6709:1983 Standard representation of latitude, longitude and altitude for geographic point locations
	*ISO 19101:2002 Geographic information — Reference model
	*ISO 19105:2000 Geographic information — Conformance and testing
	*ISO 19106:2004 Geographic information — Profiles
	ISO 19107:2003 Geographic information — Spatial schema
	*ISO 19108:2002 Geographic information — Temporal schema
	ISO 19110:2005 Geographic information — Methodology for feature cataloguing
	*ISO 19111:2003 Geographic information — Spatial referencing by coordinates
	*ISO 19112:2003 Geographic information — Spatial referencing by geographic identifier
	*ISO 19113:2002 Geographic information — Quality principles
	*ISO 19114:2003 Geographic information — Quality evaluation procedures
	*ISO 19115:2003 Geographic information — Metadata
	ISO 19116:2004 Geographic information — Positioning services
	ISO 19119:2005 Geographic information — Services
	ISO/TR 19120:2001 Geographic information — Functional standards
	ISO/TR 19121:2000 Geographic information — Imagery and gridded data
	ISO/TR 19122:2004 Geographic information/Geomatics — Qualification and certification of personnel
	ISO 19125-1:2004 Geographic information — Simple feature access — Part 1: Common architecture
	ISO 19125-2:2004 Geographic information — Simple feature access — Part 2: SQL option
Final Draft International Standards	
	ISO/FDIS 19109 Geographic information — Rules for application schema
Draft International Standards	
	ISO/DIS 19104 Geographic information — Terminology
	ISO/DIS 19117 Geographic information — Portrayal
	ISO/DIS 19118 Geographic information — Encoding
	ISO/DIS 19123 Geographic information — Schema for coverage geometry and functions
	ISO/DIS 19128 Geographic information — Web Map Server interface
	ISO/DIS 19133 Geographic information — Location based services tracking and navigation
	ISO/DIS 19135 Geographic information — Procedures for registration of items of geographic information
	ISO/DIS 19137 Geographic information — Core profile of the spatial schema



Standards issued as EN ISO 191xx and STN EN ISO 191xx in 2005



Standards to be issued as EN ISO 191xx and STN EN ISO 191xx in 2006



Standards published as ISO/FDIS/DIS only in ISO/TC211

Established program of work of ISO/TC211 was a contribution to the experiences of IHO (International Hydrographic Organization), CEN/TC278 and its GDF (Geographic Data Files) and the program of work of CEN/TC287. Since the ISO/TC211 exists, it became an integration of European and North American experiences with other regions of the world including Asia, Australia and South Africa since joined the committee (Kresse and Fadaie 2004).

The scope of ISO/TC211 is the following:

“To establish a set of standards for Geographic information/Geomatics, which would specify an infrastructure and the required services for the handling of geographic data including management, acquisition, processing, analysis, access, presentation and transfer” (*www.isotc211.org*).

The structure of the ISO/TC211 with all the members can be found at the website of the ISO/TC211 (*www.isotc211.org*). The status of published standards and reports to 14. 2. 2005 see in tab 1. There are more projects and projects proposals on standards for geographic information, which are ongoing in ISO/TC211 – see *www.isotc211.org*. There are many more ongoing projects within ISO/TC211 for geographic information as a new work item proposals, or committee drafts, etc. (see *www.isotc211.org*).

The lifecycle of standards in ISO follows the procedure through several stages:

- 1. Proposal stage** – need for a standard: national standardization organization sends a NWIP (New Work Item Proposal) to ISO, where it goes to voting procedure and when majority of P-members agrees and minimum 5 countries agree to participate, the NWIP is accepted and NWIP Project team is established,
 - 2. Preparatory stage** – TC sets up the WG (Work Group) and its chair, which is to prepare WD (Working Draft) – now, first version of standard is developed,
 - 3. Committee stage** – CD (Committee Draft) from WG which ISO registers, is distributed to all members of the TC – during this stage the standard reaches maturity,
 - 4. Enquiry stage** – CD becomes DIS (Draft International Standard). At this stage ISO circulates the document to all ISO members for voting and comments. DIS becomes FDIS (Final Draft International Standard) **only if** 2/3 of P-members of the TC are in favour and not more than ¼ of total number of votes is negative. If this condition is fulfilled the DIS is returned to TC.
 - 5. Approval stage** – FDIS circulates to all ISO members for voting the final YES/NO for period of 2 months. Technical comments during this period are only registered for consideration during future revision. The condition for approval of FDIS is the same as in enquiry stage, but if major comments are not anticipated ISO skips the approval stage to fasten the procedure.
 - 6. Publication stage** – after small editorial changes ISO publishes the international standard.
- All process can take (and usually takes) 5 years and if there is a need for more time, procedure starts all over again. Revision of IS should be at least every 5 year.

Types of documents published by ISO:

1. ISO Standard
2. ISO/PAS (Publicly Available Specification) – e.g. JAVA platform of Sun Microsystems
3. ISO/TS (Technical Specification)
4. ISO/TR (Technical Report)
5. IWA (International Workshop Agreement)

There are some differences in both of standardization organizations the main is the following – CEN does not allow to have conflicting standards at national level, while ISO does it.

The Slovak Republic is a member country of the European union (EU) since May 2004 and as a member should follow the regulations of the EU in the field of standardization as well. That means, after the resolution number 51 taken by CEN/TC287 on 11. 11. 2003 about withdrawal of existing deliverables, should the Slovak Republic adjust to this decision as a member of EU. This

has been done along with CEN in May and June 2004. The template for the title of standards issued by ISO and adopted by CEN is: "EN ISO 191XX:YYYY Geographic information – *Title of the standard*". When adopted as STN norms they will be "STN EN ISO 191XX:RRRR Geografická informácia – *Názov normy*".

ISO compliant GIS

The following text will show an overview of using ISO 19100 series of standards during all the process of creation of GIS. The purpose of the overview through the various steps in GIS creation is to show the interrelation between standards of the ISO 19100 series. The GIS in the following context is a kind of application schema of spatial information system. The text is composed according (Kresse and Fadaie 2004).

Data capture and data definition:

- ISO does not standardize the data capture for any GIS – it only provides guidelines and metadata elements to describe the origin and the quality of the data (ISO 19113, 19114, 19115, 19115:2),
- in ISO 10109 are all the definitions related to features¹. Listing of all allowed features with all their attributes, operations and associations is a feature catalogue and the complete result (feature definition with feature catalogue) is a data model,
- ISO does not standardize feature catalogues and data models – it provides only guidance for general rules and a catalogue template to support a complete and consistent listing, which is described in ISO 19110,
- the most comprehensive collection of geometry classes for the features and rules how they are related to each other are described in ISO 19107,
- the definition of a coordinate system is in ISO 19111 and the specific registry for coordinate reference systems can be found in ISO 19127,
- ISO 19135 is a guide for registration of all items in geographic information systems.

Data display:

- ISO 19117 is a portrayal specification, which during the output of the feature data is applied to the data stream in order to generate the cartographic representation.

Data exchange:

- ISO does not standardize any exchange format, but data exchange is addressed in the ISO 19118, which recommends, that the exchange format must be built upon a currently widely used XML (extensible Markup Language).
- ISO does not deal with the technical details of two different datasets, which are to exchange data, it only states that the application schema of those two datasets must be alike.

New era of standardization in a field of geographic information in Europe

After discussions in a GIS community the decision for revival of CEN/TC287 was made in the year 2003. CEN/TC287 is under a secretariat of NEN (Netherlands normalisation institute) and Mr. Henri J.G.L. Aalders chairs the TC. The 17th plenary of CEN/TC287 was held in Delft in November 2003, where the TC adjusted its business plan and from where there were some of the important resolutions made.

The scope of CEN/TC 287 was agreed as following: "Standardization in the field of digital geographic information for Europe: the committee will produce a structured framework of standards and guidelines, which specify a methodology to define, describe and transfer geographic data and services. This work will be carried out in close cooperation with ISO/TC 211 in order to

¹ Feature in ISO definition is equal with a definition of object in object-oriented programming languages.

avoid duplication of work. The standards will support the consistent use of geographic information throughout Europe in a manner, which is compatible with international usage. They will support a spatial data infrastructure at all levels in Europe” (Aalders 2004).

At this meeting the CEN/TC287 decided to withdraw all the items published in years 1991-1999, which were 8 norms and 4 committee reports and start a procedure of adopting an ISO 19100 series of standards as European norms. The way of adopting ISO standards as European norm describes is done according a Vienna agreement (see www.cenorm.be).

18th plenary of CEN/TC287

On the 18th plenary of CEN/TC287 the main task for the technical committee occurred and this was the focus on coordination of work together with ISO/TC211. This is not always easy, because of the bureaucracy on both sides. For the better cooperation, the strict following of the rules of Vienna agreement for cooperation has to be kept.

The main task in European standardization activities is to prepare a set of crucial standards to ensure the fluent creation of the ESDI (European Spatial Data Infrastructure). For fulfilling of this task, the working group 1 (WG1 – renamed later to WG5) was created. To help this working group another two groups were established (WG2, WG3).

During the plenary a discussion about using metadata within Europe and harmonization an existing metadata standard for GI, which is ISO 19115 with DublinCore Metadata standard. The question, which rose up is the following: “Will the European profile of the GI metadata cover applications more than in geography field?” The question was left open and the GI community should think about, whether to put GI in the centre of an area of documented information, or not to do so. The discussion came into the centre point when combining a spatial with non-spatial metadata.

Another important discussion arose about use of a conceptual schema language in Europe. And this question came up: “Is it necessary to modify UML for the European profile?” On the plenary, after a short discussion, the previous question was answered: because of the ongoing practice in using UML in modelling, there is no need, will and money to change it for other “EU profile” or investigate in something new. There is already a standard describing how to use UML in GI applications (which is ISO 19103), so the more important task occurs to find an exchange format between various GI applications, which is not solved yet.

The focus of European profile of ISO standards is to find out how to deal with geography data by UML and also think about interoperability of GI applications and not only about GI data exchange.

Advisory group on Outreach (AG on Outreach)

On the first meeting after a revival of CEN/TC287 Ad Hoc Group on Outreach was created. This group had the very first official meeting along with 18th plenary of CEN/TC, where the main tasks of AG on Outreach were specified. The scope of this group is following:

“Promotion in Europe of the use of and education on the results on CEN/TC287 standardization on geographic information.”

To achieve this mission the main strategy was proposed, in which one of the upcoming activities is to establish the connection with the public by developing a public part of the website of CEN/TC287. To strengthen the connection with public willing to use standards in practice should be done also by presenting the work of CEN/TC287 o conferences, or publish reports on it. The author of this article is a member of this group and also by this article would like to contribute to the mission of the AG on Outreach. However, opportunity to raise the profile information on the CEN/TC287’s work through presentations at conferences or other way would be taken as it arose, but it is important to have a little bit more work under CEN/TC287’s belt before being too much active. Next meeting, where the progress will be reviewed will be in July 2005 in Sweden.

Role of the Slovak Republic in a process of standardization within Europe

The Slovak Republic is a member of European union from the 1st may 2004 and from its "new" role except of rights also rules appear. In the field of standardization it is not possible (EU directive) to have national standards in the field, where CEN standards exist. This includes also the field of geographic information. The current situation is the following: after the adoption of European pre-standards to the Slovak standardization system as STNs (Slovak Technical Norms), those had to be withdrawn as well as the European norms from CEN system. The adoption of ISO standards is ongoing and within following months, they will be adopted into the Slovak standardization system. The standard will be adopted in English and having a national preface and terminology translated. Slovak Standards Institute (SUTN) conducts the process of adoption with a cooperation of its technical committee TK89 (Geodesy and Cartography/Geoinformatics).

Conclusion

Standardization in every field of human activity should be considered as something, which does not prescribe particular actions, or rules for "life". The standardization is more "coded knowledge" than a set of restrictions and rules. It should help a communication, to share the knowledge amongst users in particular branch of human activity. All of us are aware of the fact that standards are never on time – either too late or too early, but still, to develop our knowledge it is important to code it as well. After a change of political environment in the east side of the Europe, where the Slovak Republic belongs as well, now it is the time to be an active member in standardization activities within Europe. To lower the possible fear coming from less experience in some field (where field of GI belongs, even if it is still progressing) the fact of revival of CEN/TC287 and starting its activity from a beginning helps. But to be an active participants means also to take part in all activities on the field of standardization, which means also bigger support (financial and professional as well) like it was up to now. To sharing of knowledge is a "two-way road" – it is important to offer also when accepting. The will of work in the Slovak GI environment is great – there is no doubt. All the activities also within Europe (e.g.: INSPIRE) confirm so.

References

- AALDERS, H. (2004). 2004, the beginning of a new era of European standards. In *Sborník konference GIS Ostrava 2004*. http://gis.vsb.cz/GIS_Ostrava/GIS_Ova_2004/Sbornik/Referaty/default.htm (last check 17. 4. 2005)
- AALDERS, H. (1998). GIS standards in CEN and ISO. In *Sborník konference GIS Ostrava*. http://gis.vsb.cz/GIS_Ostrava/GIS_Ova_1998/Sbornik/aalders/aalders.html (17. 4. 2005)
- DIN (2005). *Economic benefits on standardization – Summary of results*. DIN German Institute for Standardization. http://www.normung.din.de/sixcms_upload/media/1350/engl_zusammenfassung.pdf.
- KNOOP, H. (2004). *The CEN Technical Committee 287 and its role for ESDI*. Workshop on SDI & Interoperability for Geoinformation. Greece. <http://gi-gis.jrc.it/ws/interop/agile-cen.pdf> (17.4. 2005)
- KRESSE, W., FADAIE, K.(2004). *ISO Standards for Geographic Information*. Berlin (Springer Verlag). ISBN 3-540-20130-0.
- www.isotc211.org
- www.cenorm.be

R e s u m é

Štandardizácia geografických informácií

Štandardizácia v oblasti geografických informácií (GI) je nevyhnutným prvkom pre budovanie priestorových informačných štruktúr. Základnú databázu pre geografický informačný systém – ZB GIS bude tvoriť základ národnej priestorovej informačnej infraštruktúry. Riadi sa koncepciou (resp. niektorými jej časťami) z roku 2002, ktorá odporúča používať európske normy. Rezort geodézie a kartografie, zodpovedný za tvorbu ZB GIS, je začlenený do medzinárodných aktivít ako je napr. INSPIRE, EuroGlobalMap, a ďalšie, t. j. je povinný sledovať vývoj legislatívy a štandardizácie v oblasti GI.

Príspevok v úvode všeobecne opisuje štandardizáciu a poskytuje prehľad o rôznych druhoch noriem. Používanie noriem je ekonomicky výhodné – šetrí náklady, upevňuje vzťahy medzi používateľmi a producentmi priestorových dát, odstraňuje bariéry pri medzinárodných dohodách. Tieto výhody pomáhajú pri prekonávaní počiatočnej nedôvery pri rozhodovaní sa o používaní noriem.

Štruktúra štandardizačných organizácií CEN a ISO, ako uvádza príspevok, je mierne odlišná. Momentálne prebieha konzultácia sekretariátov oboch organizácií o harmonizácii časového harmonogramu vydávania a preberania štandardov z ISO do sústavy CEN. Štandardizácia v oblasti GI v rámci CEN je iba v počiatkoch. Po vydaní a neskôr zrušení (r. 2004) série predbežných európskych noriem, ktoré boli prevzaté aj do sústavy STN, práca v rámci CEN/TC287 skončila a nasledovala migrácia odborníkov pre GI do pracovných skupín novo vzniknutej (od r. 1994) ISO/TC211. Táto pracuje na viac ako 40 projektoch, z ktorých niektoré sú v rôznych fázach publikované už dnes (pozri tab. 1). Normy série ISO 19100 pokrývajú hlavne oblasť definície dátového modelu GIS, jeho opis, vytvorenie profilu, resp. aplikácie. CEN/TC287 sa po obnovení svojej činnosti rozhodla prevziať normy ISO do svojej sústavy. Preberanie postupuje podľa interných pravidiel CEN, ktoré sú načrtnuté na obr. 2. Slovenská republika (SR) ako riadny člen Európskej únie a CEN je povinná riadiť sa pokynmi CEN v oblasti štandardizácie. Tie neumožňujú mať národné normy v oblasti, kde existujú normy CEN. CEN prevzala do svojej sústavy 9 noriem ISO (pozri tab. 1) a zároveň Slovenský ústav technickej normalizácie (SÚTN) preberá tieto normy do sústavy noriem STN. Ide o nasledujúce normy: EN ISO 19101, EN ISO 19105, EN ISO 19107, EN ISO 19108, EN ISO 19111, EN ISO 19112, EN ISO 19113, EN ISO 19114 a EN ISO 19115 (názvy noriem pozri v tab. 1). Normy STN EN ISO pre GI sa preberajú v anglickom origináli so slovenskou „košielkou“ a slovenskými ekvivalentmi v terminologickej časti.

Posledná časť príspevku je správou z ostatného stretnutia CEN/TC287 v Ispre, ktoré sa konalo v októbri roku 2004. V súčasnosti prebiehajú na pôde CEN/TC287 a jej spolupracujúcich organizácií živé diskusie na rôzne témy súvisiace s globalizáciou trhu GI. Jednou z najhorúcejších je diskusia o tvare, obsahu, publikovaní a výmene metadát. SR je riadny a aktívny člen CEN/TC287 a má svojho zástupcu (v osobe autorky článku) v jeho poradnom orgáne (Advisory Group on Outreach). Je nevyhnutné, aby sa SR zapájala ako do procesu tvorby noriem, tak aj do procesu výmenu znalostí a skúseností v oblasti GI. Na to je však nevyhnutná znalostná, osobnostná, ale aj materiálna spolupráca celej komunity GI na Slovensku.

Príspevok vznikol v rámci riešenia výskumnej úlohy VEGA č. 1/1035/04 „Štandardizácia a interoperabilita geografických informácií“.

Fig. 1 Proces štandardizácie

Fig. 2 Proces vzniku noriem v rámci CEN

Tab 1. Zoznam publikovaných noriem ISO k 14. 2. 2005

Lektoroval:

Ing. Ján PRAVDA, DrSc.,

Geografický ústav SAV, Bratislava