

Metrics of data model for regional territorial planning

Stanislava Simonova, and Dominik Sykora

Abstract— Management processes of strategic regional management rely significantly on map element. Territorial planning data serve as support for management decision making on both higher regional units level and municipality level. Map data and map documents are created based on data provided by organizations with function of data providers. The quality of input data influences the quality of data model, whereas the quality of data model has decisive influence on mapping process and thus also on the quality of decision making itself. That is why it is appropriate to set suitable indicators for the monitoring quality of input data, based on which map data are created. The article addresses possibilities of setting indicators with focus on input data.

Keywords— data modeling, process modeling, regional territorial planning, spatial decision making.

I. INTRODUCTION

SOLVING spatially oriented problems and making spatially influenced decision have been recognized as highly important for several years. The corresponding decision making is considered by solving spatial problems; the interest of managers and users in utilization of spatial information and services increases rapidly. The environment impact assessment [1], environment protection [2] and route planning belong to significant branches of spatial decision making [3].

In the context of territorial planning, organizational units are municipalities, regions or state and on all these levels decision making about territory takes place. Approved documents which decide about the utilization of territory have long-term characteristics, whereas the amount of financial resources in this area is very high. Decision making about territory is influenced not only by the flow of these financial resources, but also development of state, cities and also their citizens. Decision making about region on regional level (and municipality level) proceeds mainly in accordance with territorial-planning documentation which can be supported by territorial study or regulation plan. Designated architect

creates several alternatives of solving particular problem for given documentation and elected institution chooses which alternative will be used. The input for creating solution alternatives are mainly digital geographic data or paper data which are elaborated within other data; data from various information systems (such as data of the Czech Statistical Office) and also hierarchically superior documentation. Opinions and comments of citizens involved, attitudes of involved municipalities, districts and other involved institutions are important for final decision about form of documentation and must be included in the final documentation and, therefore, they become a part of the decision making process [4] [5].

Territorial planning has, above all, regulative function. It mainly sets rules and frameworks for actions of territorial development subjects; it also supports private investments by offering suitable development areas, whereas these private investments are vital for regional prosperity [6]. Territorial planning is a process; it is, therefore, a permanent activity which complexly solves functional usage of territory, objectively and timely coordinates building and other activities influencing development of particular territory. Further, it ensures harmony among all natural, cultural and civilization values within the territory, emphasizes protection of all elements of environment [7]. Goals of territorial planning are delimited by legislative [8]:

- ensuring prerequisites for sustainable territorial development,
- coordination of public and private projects of changes in the territory,
- protection and development of natural, cultural and civilization values of the territory.

Territorial planning evaluates policy of regional development so that balanced relation of territorial conditions is created for favorable environment, economic development and consistency of society of territorial citizens. Territorial planning includes following tasks [7]:

- to find out and evaluate status of the territory; its natural, cultural and civilization values;
- to set concept of territorial development including urbanistic concept with consideration of territorial conditions;
- to check and evaluate necessity of changes within territory, public interest in their execution, their contributions, problems, risks with consideration of

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public health, environment, geological composition of the territory, influence on infrastructure and its economical usage;

- to set urbanistic, architectonic and aesthetic requirements on usage and layout of the territory and its changes mainly in location, layout and realization of buildings;
- to set conditions for making changes within the territory; mainly for location and layout of buildings with consideration of current character and territorial values;
- to check and create territorial conditions for economical investing of resources from public budgets to changes within the territory;
- to create conditions for protection of territory from negative effects of projects within territory and to design compensating measures according to special legal regulations;
- to regulate range of areas for exploiting natural resources.

Territorial policy on the European Union level is coordinated in compliance with strategic document 'European Spatial Development Perspective'. Tools for territorial planning are then delimited by legal norms. 'Territorial-analytic data' can be considered to be the 'default' tool which is also the input for 'Principles of territorial development'.

The process of creating territorial analytic data and also the process of creating the principles of territorial development is represented by repeated instances. Those are creation of significant documents including map data which are used not only by managers for managing the region as a whole, but also by managers within municipalities. That is why it is suitable to use process management tools for managing these processes. The article addresses application of process and data modeling in regional territorial planning with special focus on creation of territorial analytic data.

II. PROCESS MANAGEMENT FOR TERRITORIAL PLANNING

In the area of public administration authorities the process approach is declared within various strategic documents, such as Strategy Smart Administration [9]. However, the reality is different, the role of the process management is underrated often [10] [11]. The goal is to remove redundant and non-effective steps at processes, which are executed in public administration and to create conditions for efficient and rational use of all tools supporting performance of public administration.

A. Tools of territorial planning

The base for process management is process modeling. Modeling business processes is necessary for an enterprise that desires to evaluate, improve, migrate to a different technological platform, automate, and/or document its business processes [12] [13]. Process models are essential information base for monitoring processes output. Process models are essential information base for monitoring processes output.

Actors of territorial planning are:

- public administration: elected representation of territory and its administration,
- specialists: urbanists and architects,
- investors of changes within territory: public and private sector,
- owners of respective real property,
- active users and inhabitants: those who make effort to adjust territory to their needs,
- passive users and inhabitants: those who just adapt to changes.

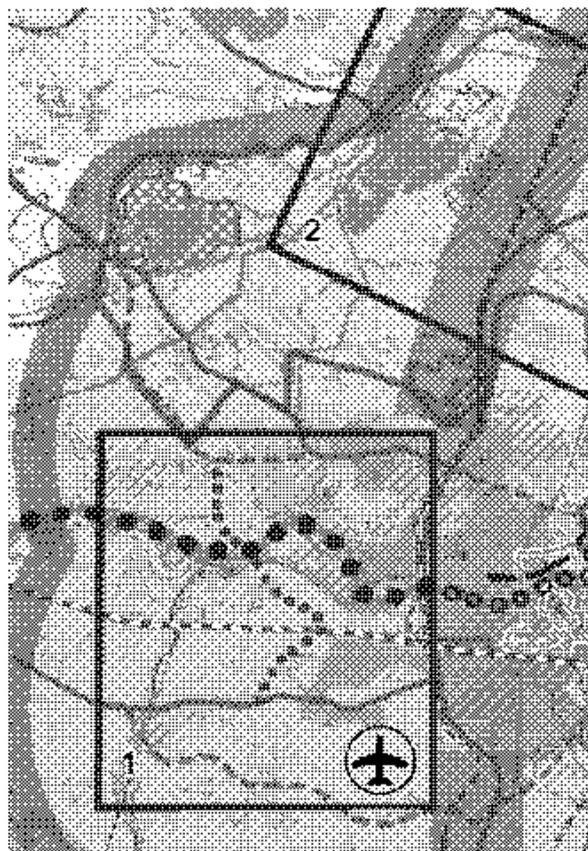


Fig. 1 part of map from set of documents called 'Territorial analytic data' (source: [14])

It is more suitable to stem from legislative delimitation of actors for the need of process models [7] [8]:

- producer of territorial planning documentation or territorial planning data: producers of territorial planning documentation and territorial planning data are institutions of territorial planning; these could be – municipal authorities, regional authorities, the Ministry of Defence and Armed Forces, the Ministry for Regional Development;
- processor: processor is either legal or physical entity which processes territorial planning documentation or territorial planning data based on authorization;
- authorities concerned: public administration authorities concerned are all authorities and institutions whose opinion needs to be obtained so that it is possible to obtain, discuss and consequently accept territorial

planning documentation;

- public: public enters territorial planning process mainly in course of negotiating territorial planning documentation and territorial planning data; building act gives duty to introduce currently processed territorial planning documentation to the public; public contains also real property owners who are concerned with territorial document; it is therefore in interest of the producer for the public to be familiarized comprehensibly with plans and best case scenario – to identify with them;
- council: territorial planning is interfered with elected local administration (municipal authority, regional authority), which above all decides about processing of territorial planning documentation and consequently approves it in individual phases.

The set of territorial planning tools is delimited by legislation. In course of analysis of these tools we can conclude following general characteristics [15]:

- Tool / document consists of a defined set of files, which include both text data and map publications (example – see Figure 1).
- Documents are created and approved by various actors; in some cases of documents it could even be a wide range of actors.
- Documents concur one on another in sense that certain document can be input data for creating another document.
- Documents are created in regular intervals or modified in irregular intervals, whereas some regular intervals are longer (for example in tool ‘Territorial analytic data’ the interval is 2 years).

The initial question was which process of document creation we should focus on and on which process or on which processes it would be suitable to apply methods of process and data modeling.

B. Modeling approach, metrics

Modeling is a thought abstraction, a reproduction of real existing system via special-constructed models [16]. It is necessary to distinguish model content and model tool. Model content is essence of idea / message – what the model creator is trying to take down and express. Model tool is outer form – how will the creator express the content, which expression elements will he/she use to impart his/her thoughts. Models are created by means of special tools, which are diagrams and other expression elements. Methodologies offer various types of models, defined most often in graphical fashion, which means by diagrams. Various SW tools are usually used for modeling, whereas the same diagrams can slightly differ. Nevertheless, for certain types of models we can find appropriate diagrams in most of methodologies.

Business process models were designed to help document, communicate, or improve organization’s business processes. One key factor reported for obtaining a high quality business process models is the active participation of all the

stakeholders that ensures the development of a shared vision of the business processes [17]. The graphical tools of business process modeling are for example [18] [19] (see figure 2) – hierarchical diagram (top-down decomposition of model domain from higher levels to lower ones), diagram of process context (interception of all the significant process contexts) and process map (event-driven process chain diagram; overview of activities induced by events).

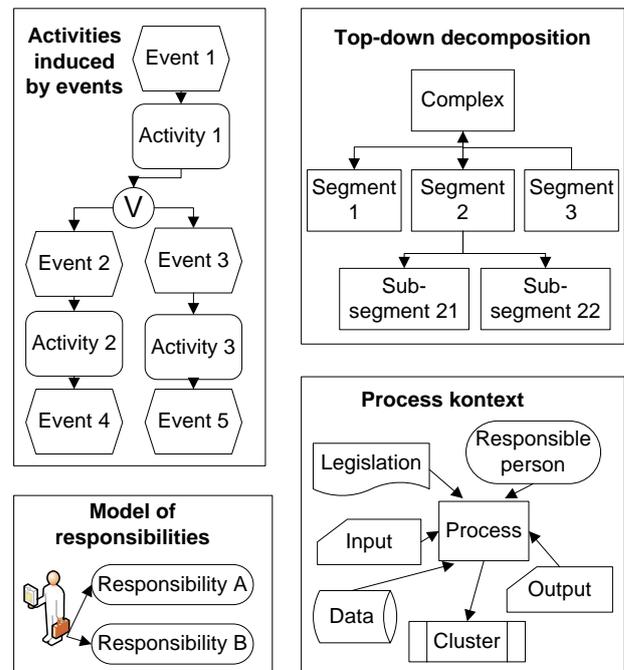


Fig. 2 tools of process modeling

Besides modeling of the process flow, it is efficient to monitor data flows within individual functionalities of the process. The suitable tool for creating such a model is for example data flow diagram [20], by means of which we can capture processes and sub-processes, flows of data and events, data repository and also influence of external actors (see Figure 3).

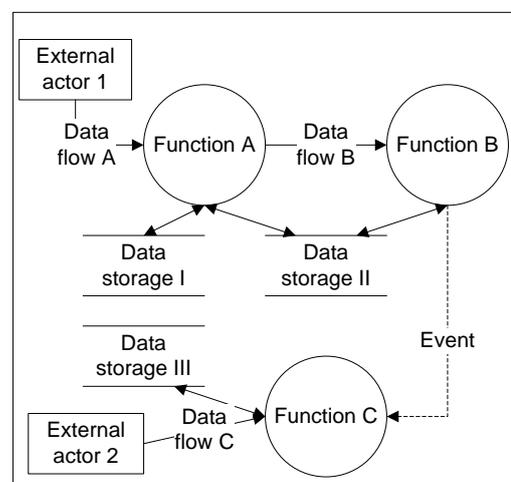


Fig. 3 data flow diagram as a tool of data modeling

Model is not a goal; model is a technique for problem formulation and for communication beyond problem. That is why modeling should not be too much of a burden, should not be too complex activity, but relatively simple and quick formal procedure, which can be applied in actual (demanding) problem solving. From this point of view we cannot use general practices recommended by methodology. Instead we have to choose form suitable types and extents of models, which managers / users should design or co-design.

Simultaneously with the development of models it is necessary to define appropriate metrics. Metrics are used for evaluation and measuring of performance, whether the area is corporate-wide or concrete partial. Metrics is a measurable indicator used for determination of quality, quantity and financial category; it is an indicator of quality in the light of set goals [21] [22] [23]. Objectively measured measures (hard measures) are characterized as objectively and easily measurable indicators. They monitor for example development of corporate goals and they are focused on the output of corporate processes, key activities, or they are focused directly on customer [22] [24]. Subjective measures (soft measures) cannot be measured directly objectively, but they lean on subjective evaluation for example in form of questionnaires.

Determination of set indicators is both a significant and a difficult task in each model creating process. It is a complex task – to find suitable indicators, monitor them and evaluate them. There are two aspects:

- Correct structure of indicators: it is vital to find as many indicators as possible and such indicators, so that their evaluation would have predicative ability – so that the evaluation would really quality or defectiveness of production.
- Objective and subjective indicators: the main question is when and to what extend is it suitable to use subjective indicators, or whether is it more suitable to focus on objective indicators.

III. MODELS AND METRICS FOR SELECTED PROCESS OF REGIONAL TERRITORIAL PLANNING

The procedure of process and data modeling for support of regional territorial planning was divided to following phases:

- Selection of a suitable modeled topical area – selection of a suitable process
- Creation of process models
- Creation of data model
- Setting of metrics.

A. Selection of a suitable modeled topical area

The starting point for creating the process and data models was at first the selection of a suitable model process. As mentioned above, during the analysis of the whole process of territorial planning tools creation, some general characteristics were concluded:

- Tool/document consists of a defined set of files which

include both text data and map publications.

- Documents are created / approved by various actors, in some cases of documents there is a wide range of actors.
- Documents concur one on another in sense that certain document can represent input data for creating another document.
- Documents are created in regular intervals or modified in irregular intervals, whereas some regular intervals are longer.

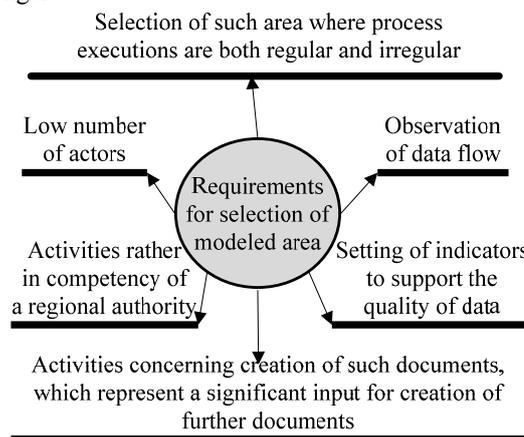


Fig. 4 requirements for selection of modeled area

In order to select a suitable process, the initial requirement was that the process should be in competency of a single public administration authority, for example in competency of a regional authority. Another requirement was to analyze both regular process execution (regularly in certain interval) and irregular process execution (irregularly, according to needs or on demand). Requirements are expressed in Figure 4.

Based on these requirements, a process related to creation of so-called 'Territorial analytic data' was selected. The process can be characterized:

- Actors of the process are external providers of data and the processor (regional authority); of course there are also actors in roles of approvers or subscribers of given data.
- The process is carried out once in two years in order to create new territorial analytic data and several times during this period for update of current territorial analytic data.
- Territorial analytic data are significant input for creation for another significant tool of territorial planning, which is 'Principles of territorial development'.

B. Creation of process models

For mapping of the process of creating territorial analytic data creation of following models was selected – model of process context and model of individual activities within process. It proved suitable to divide monitored topical area into two alternatives. The first alternative represents regular execution (once per two years) in course of creation of new territorial analytic data, whereas this interval is given by

legislation. The other alternative is irregular execution, when data are updated continuously (within given 2-year period). The model of the process context is in Figure 5. Two models of process execution were designed; one model for creation of new territorial analytic data and another model for continuous update of territorial analytic data (see Figure 6).

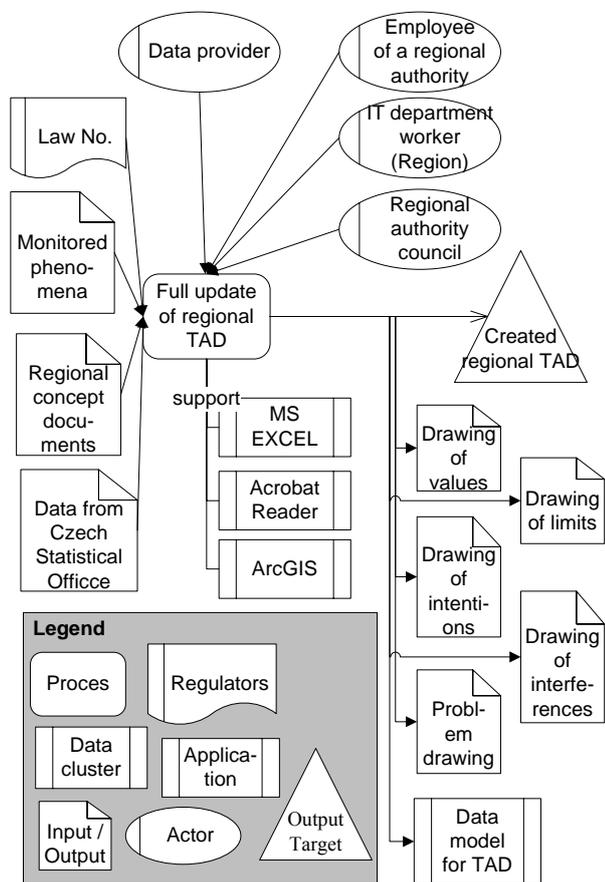


Fig. 5 model of process context (Territorial Analytical Data, TAD)

For mapping these two process alternatives, following characteristics were evaluated:

- Input data:
 - The most risky area in the process is obtaining input data, so-called monitored events.
 - Data from providers are supplied in digital form, but also in paper form.
 - Supplied data do not have unified format (.SHP, .DGN, .PDF, .DOC).
 - Supplied data do not have unified format not only among providers, but also from the same provider. That means that certain providers change format of supplied monitored events in time.
- Output data:
 - The output is also an input to the process of creating the Principles of territorial development.
 - The output is not approved by anyone; regional authority council only takes the documents into account.

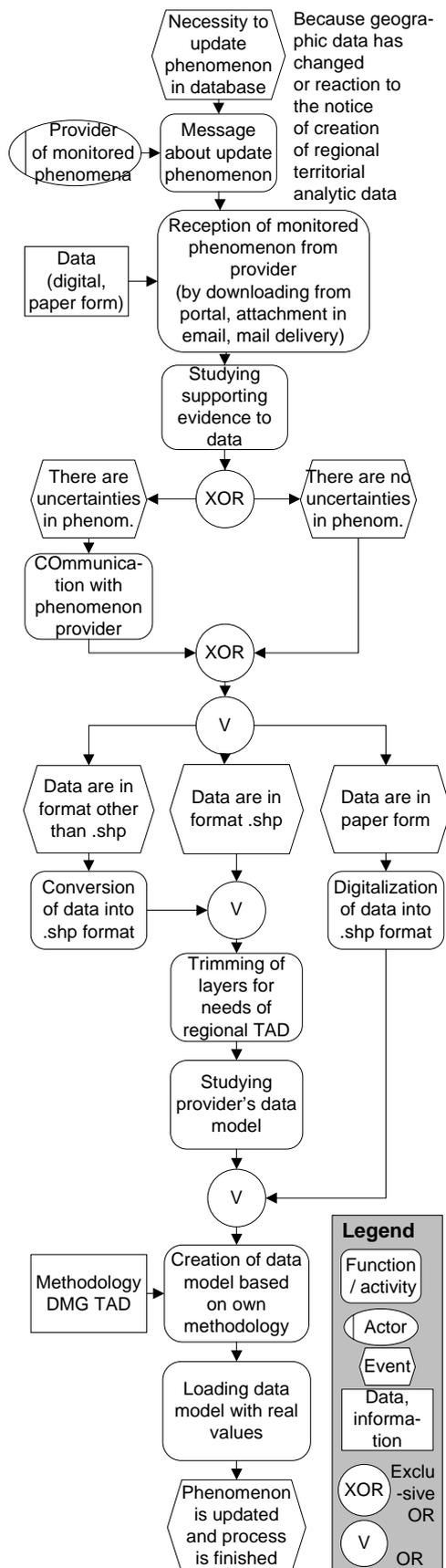


Fig. 6 model of activity flow during the update of Territorial Analytical Data (TAD)

- o The output is not subject to any verification or control, flawless work of processor (of specialists of the regional authority) is relied on.

It was evaluated that the most risky part is obtaining and processing of data; further attention was focused on this very area.

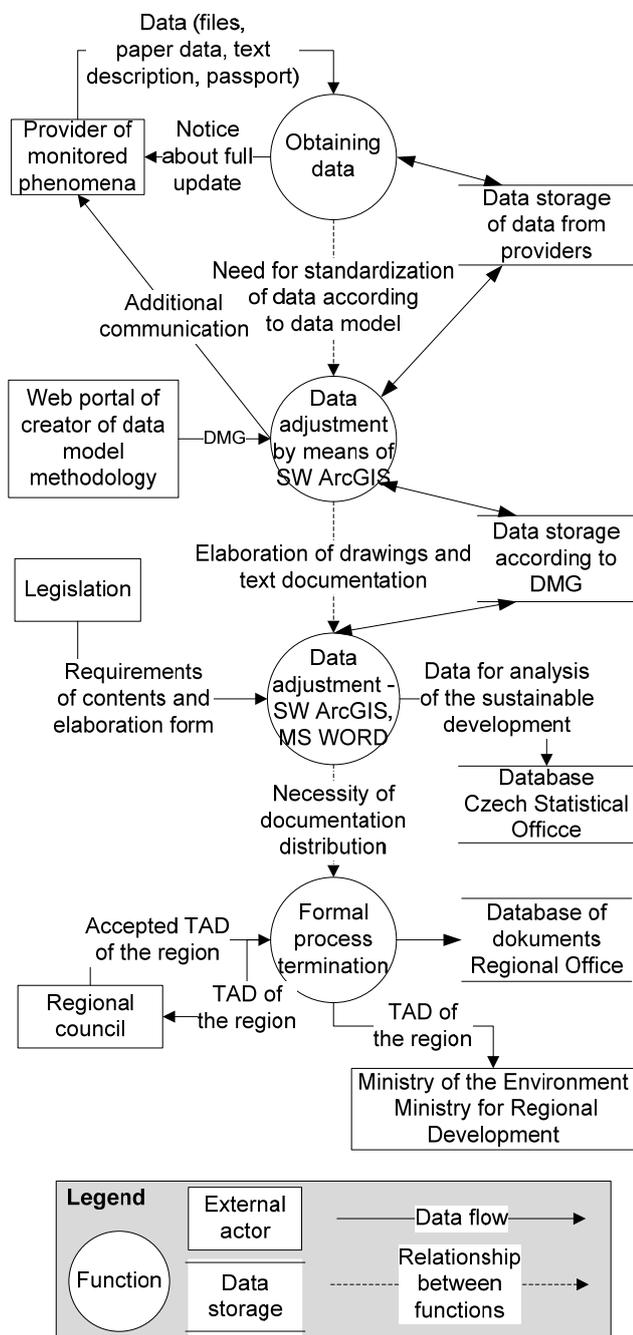


Fig. 7 data flow in course of creation of Territorial Analytical Data (TAD)

C. Data model creation

The process of creation of territorial analytic data takes place in the initial phase of the whole process of tool creation

for territorial planning. Simultaneously, documents of territorial analytic data are a significant input for creation of the Principles of territorial development and, therefore, they influence the quality of other subsequent documents. The quality of documents influences territorial planning in the region, whereas these documents and map publications serve as support for regional decision making of managers and all other stakeholders.

TABLE 1
 DESIGNED INDICATORS FOR MONITORING FUNCTIONALITY 'DATA UPDATE'

Indicator	Measuring unit	Example of measuring
Event tag	code	A073
Event name	text	power line
Format of event from provider	format	.DGN
Reception of message about event update	minute	5 min
Additional communication with event provider in case of uncertainties (by email, phone, personally)	minute	15 min
Finding of respective files and data (for example for finding data in portal); in case of paper data, duration of picking data is indicated	minute	3 min
Conversion of other format to .shp format (e.g. conversion of .dgn or creation of layer according to obtained coordinates ...)	minute	40 min
Study through data model supplied by provider	minute	20 min
Conversion of attribute table in ArcGIS according to DMG	minute	60 min

Input data for the process of creation territorial analytic data are obtained from providers (for example gasworks, power plant and others). These are organizations within the region that provide their monitored events. Organizations are not forced by means of legislation to present their data in certain format, so the characteristics of supplied data are as follows:

- Method of delivering data: portal, email, mail delivery.
- Data format: digital format (SHP and other formats such as .DGN, .PDF, .DOC) or paper format.

The quality of input data, especially unification of input data, is a significant area in the process as well as in data flow (see Figure 7). That is why further attention was focused on functionality 'Data modification'. The goal was to set a suitable set of indicators which could be monitored and evaluated; those indicators should lead to improving the quality of given activity.

D. Setting of indicators

During the analysis of the process and data flow it was stated that activities related to input data represent the greatest potential to process improvement. That is why it was proposed to monitor activity 'Data modification' (see Figure 7).

In course of searching for composition of suitable indicators we found following characteristics:

- Indicators are influenced by the fact that the creator of legislation (the state) is a customer of the process at the same time. Time progress is, therefore, delimited by obligatory timelines.
- Measurable indicators were identified almost exclusively in time units.
- Indicators have to respect the fact that processors of data have more legislation knowledge than technological skills (of maps).

Based on the analysis and consequent consultations with specialists from regional authority, a set of indicators has been determined (see Table 1).

Further process was designed as follows:

- measuring by means of designed indicators will take place,
- suitability of designed indicators will be evaluated and eventual indicators will be amended with additional suggestions,
- new measuring takes place.

These are measuring that will be executed during 2-year period. The expected number of updates is very low (it is presumed that there will be several updates of each event monitored – for example three updates). Nevertheless, even this low number of monitored updates will valuable feedback and allow designing measures to speed up activities monitored.

IV. CONCLUSION

Regional territorial planning is a significant part of management processes on both the level of region as a whole and on the level of individual municipalities. Fundamental tools for support of management decision making are documents and map publications which are created in the process of creation of respective documents (composition of documents is delimited by legislation). Creation of these strategic tools proceeds in certain intervals and certain sequence; that means that a certain created document becomes the input for creation of another subsequent document. The process of creation of these strategic tools is not process-managed but it results from the overall situation in organizations of public administration. Process management of services provided is declared as a priority for public administration on local and European level, but public sector does not apply process management or process modeling yet.

Process analysis and process modeling was focused on the initial phase of the whole process of strategic tools creation – processes related to creation of territorial analytic data. The

reason was to support and monitor the quality of these activities, whereas these strategic documents become a significant input for creation of other subsequent documents. After delimiting process models, it became apparent that it is necessary to monitor in more details the data flowing through the process and stored within the process. That is why respective data model was created. Activities related to obtaining of input data (these are so called monitored events) and their unification in terms of formats have been found to be risk activities. These are activities whose duration extends as a result of incomplete data or heterogeneity of formats. That is why a set of indicators for long-term monitoring and evaluating was designed. The models and conclusions were repeatedly discussed with specialists and managers operating in the area or territorial planning. Further process was designed as follows – measuring by means of designed indicators will take place, then suitability of designed indicators will be evaluated and eventually the indicators will be amended with new proposals and new measuring will take place. The goal of this process is to make activities related to input data more efficient and of better quality.

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