ON THE PROBLEMS OF INTEGRATION OF SPATIAL DATA OF CONSTRUCTION PROCEDURES IN THE CONTEXT OF THE E-GOVERNMENT OF THE CZECH REPUBLIC

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Abstract
An e-government has been under construction under the auspices of the Home Office of the Czech Republic for many years. This system is a complex of application tools, that should make contacts between public and administration authorities easier and more effective. The GeoInfoStartegy has been implemented in this complex since 2014, based on Government Regulation. Its main task was to effective administrate and spatial data guarantee. Every individual information system works well in vertical relation (state – regions – districts – municipality), but isolated without any horizontal relations currently. There is a system, that will integrate individual components of applications system used by authorities in spatial data management, designed in this article. Components of GeoInfoStrategy are ISKN (Information System of Cadastre of Real Estates), system of basic registers, ecpecially RUIAN (Register of Territory Identification, Addresses and Real Estates) and NIPI (National Infrastructure for Spatial Information) and relations among them are very important. Considering the relation with problematics of BIM (Building Information Modeling) is very perspective. The System of Construction´s Register is designed by authors in order to build a tool for digital construction proceedings. Due to unclearly defined inputs, insufficient legal base and inconsistent user´s requirements of the process, it is in general very difficult problem. There is also another point of view that has to be considered, primarily the necessity of international standards observing and also respecting of contemporary systems of e-government.

Keywords: *eGgovernment, spatial data, System of Construction´s Register, BIM*

1. INTRODUCTION

1.1 Definition of the solved problem

In 2018, Resolution No. 629 of the Government of the Czech Republic on the Digital Czech Republic Program [1] and a proposal for amendments to the Statute of the Government Council for the Information Society were adopted. The "Digital Czech Republic" program is a set of concepts ensuring the preconditions for the long-term prosperity of the Czech Republic in the environment of the ongoing digital revolution. Its content can be defined by the term: "Strategy of coordinated and comprehensive digitization of the Czech Republic 2018+". "Digital Czech Republic" covers three main pillars (partial concepts / strategies), which form one logical unit with a large number of internal links, but at the same time in the structure reflect the targeting of different users as well as differences given by the current legislative definition:

1. The Czech Republic in digital Europe (under the responsibility of the Office of the Government).
2. Information concept of the Czech Republic (under the responsibility of the Ministry of the Interior).
3. The concept of Digital Economy and Society (under the responsibility of the Ministry of Industry and Trade).

Within the strategy ad 2) (Information Concept of the Czech Republic), among other things, objective No. 5 is defined - “Effective and centrally coordinated Information and Communication Technologies (ICT) of Public Administration”. The scope of fulfilling this important goal includes in particular the overall management of the implementation of the Information Concept of the Czech Republic (IKČR) and the overall central coordination of the development of eGovernment. One of the sub-objectives is item 5.11 on the title GeoInformation. The aim is to design and implement data policy, ensure interoperability, eliminate duplication and make spatial information owned by the public

administration and in the public interest accessible to friendly public services in the same / similar way as for other reference and authoritative data (e.g. online applications in construction proceedings). It is also necessary to connect central shared spatial information with information in the administration of regional data centers and other systems of local governments, which serve mainly for spatial planning, crisis management and other areas using geoinformation, in the form of Digital Technical Map of the Czech Republic and data sources created BIM - Building Information Modeling. The potential of geoinformation and construction information as open data will be further developed.

1.2 The aim of the paper

Within eGovernment of the Czech Republic, functional agenda information systems are in the vertical line, i.e. state - region - district - ORP (municipality with extended powers) - municipality, but in the horizontal line (systems at the same level) manual or semi-automated information transfer predominates. The same situation is in the process of construction proceedings, in which 2 categories of documents are assessed:

1. textual (justification of the construction plan, comments of the participants, etc.), and
2. graphic (project documentation of the construction).

In accordance with Act No. 183/2006 Coll., On Spatial Planning and Building Regulations (Building Act), the Ministry for Regional Development (MRD) has launched the project "Digitization of Building Management and Spatial Planning" [2], the aim of which is to build a live digital system, which will facilitate the process for all participants in the construction proceedings, as it will no longer be necessary to bypass the authorities, but everything will be handled from the comfort of home.

The aim of this paper is to propose the concept of automated support for digital construction management in the field of assessment of graphic project documentation. From the point of view of the whole concept of digital construction management, it is only a specific partial part, which is, however, the most time-consuming and content-intensive of all related processes..

2 CURRENT STATE OF THE PROBLEM

In order to be able to design the optimal automation of processes within the goal defined in the previous chapter, it was necessary to obtain information about the current state of construction practice in the field of construction management. This information was obtained through interviews with actors from public institutions and experts in the field. The consultations took place at the territorial workplace at the level of the ORP (municipality with extended powers), specifically at the Kuřim Building Authority (Czech Republic). Further consultations concerning construction proceedings from the point of view of public contracting authorities took place in the companies Railway Infrastructure Administration (SŽDC) Brno and Railway Transport Automation (AŽD) Prague. These institutions were selected because they have a rich investment activity in the construction industry both in the Czech Republic and abroad. The aim of the survey was to find out the state of the partial processes related to building permits, to identify critical points and to design suitable automated processing for these procedures..

The investigation revealed that the building authorities III. categories (territorial workplaces at the ORP level) mostly use proprietary software purposefully created by IT companies, e.g. VITA software, s.r.o. The applications have a functional repertoire in accordance with the Building Act and related regulations. Furthermore, they enable partial compatibility with agenda information systems of state administration and self-government through standard or interchangeable formats. The disadvantage of these applications is that they are mostly database or registration, while many analytical functions are not available. Another disadvantage is that these software products were designed relatively in isolation and their analysis took place at the local level, which means that in many cases they are not connected to related structures of eGovernment, GeoInfoStrategy - National Infrastructures for Spatial Information (NIPI), BIM and others. In addition, the SW design is based on a local ontological model and European standards and metainformation are not fully respected as proposed, for example, in [5].

The final decision based on the assessment of textual or graphical documents is thus up to the user - the official. Another problem of the current construction procedure is the communication between the individual participants. This takes place either electronically via data boxes or classically by official letters delivered by the Czech Post. The disadvantage is that the comments of the last participant must be awaited throughout the proceedings, and in the case of communication by letters, the entire construction process is disproportionately prolonged. The situation is even more complicated in the area of assessing graphic materials, i.e. project documentation of a construction. If the documentation is in the form of paper drawings, it is assessed visually, if it is in electronic form (PDF, DWG, etc.), it is viewed by an official on a computer screen. The problem is that with extensive documentation, the entire content does

not fit on the screen in a readable form and it is necessary to view the drawing in sections. In this case, it often happens that the user loses the context of the overall image, which can lead to overlooking critical parts of the drawing. It follows that in the case of extensive electronic documentation, its visual viewing is no longer effective and it is therefore necessary to automate the entire process. This is the issue that our article deals with.

3 MATERIALS AND METHODS

A mixed strategy was chosen for the design of part of the digital construction management, partly from the "top-down" method - in order to respect the integration into superior structures and partly from the bottom-up, which is to ensure the functionality of the proposed application and adapt to end users and their current customs as much as possible. The top-down design was based on the concept of digital building management, which is shown in Fig. 1. In practice, this is the design of the bold block marked in Fig. 1 as "New SW of building authorities".

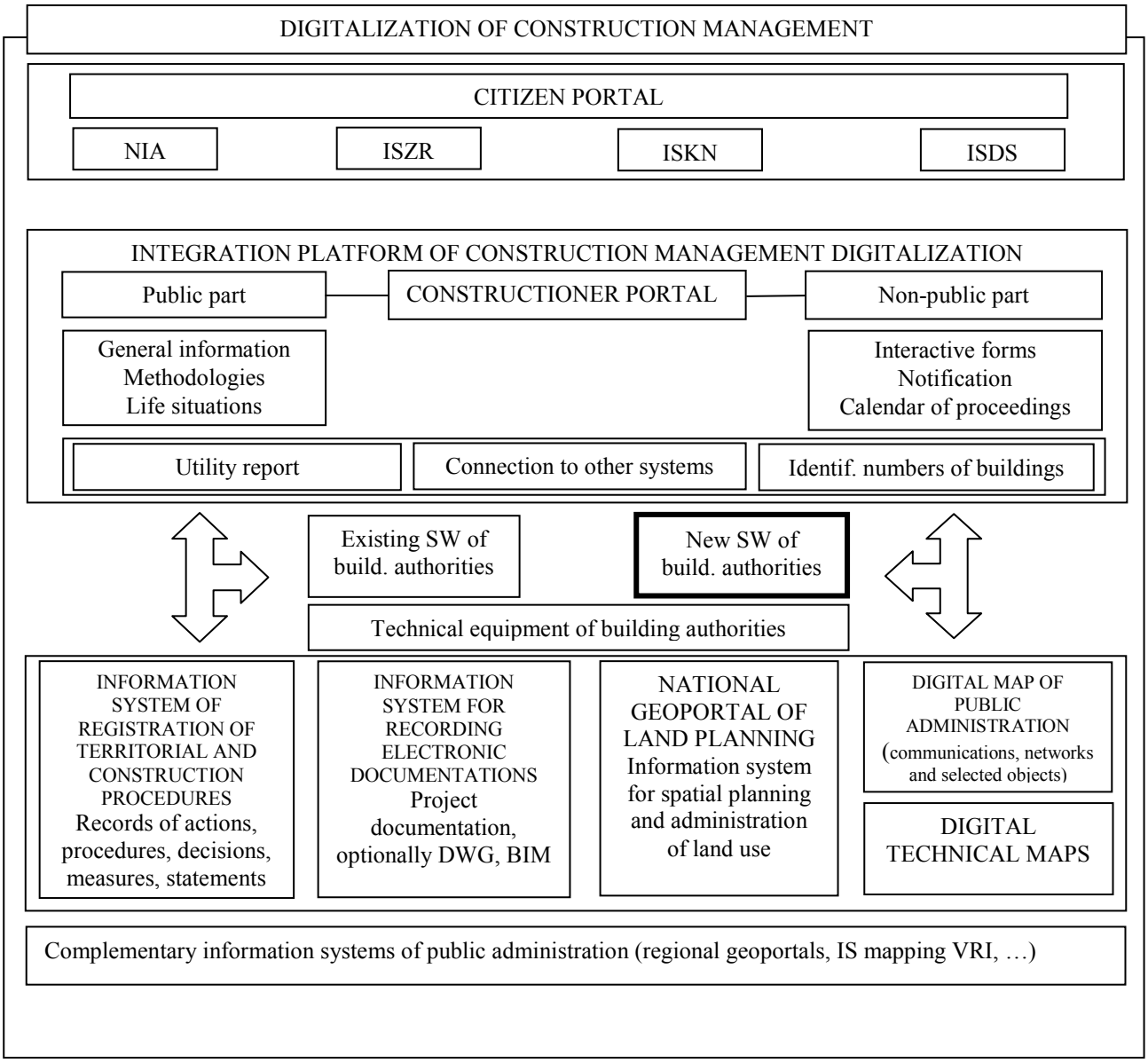

Fig. 1. Concept of digital construction management [3]

Explanatory notes to Fig. 1:

NIA – National point for identification and autentization is information system of public administration supporting proces of electronic identification a autentization by qualified system.

ISZR - Information system of basic registers

ISKN – Real Estate Cadastre Information System

ISDS - The information system of data boxes is established and operated on the basis of Act No. 300/2008 Coll. (CR), on electronic acts and authorized conversion of documents, as amended. Its administrator is the Ministry of the Interior of the Czech Republic. The ISDS operator is the holder of a postal license, Česká pošta, s.p. ISDS is a public administration information system in the sense of Act No. 365/2000 Coll. (CR), on public administration information systems, as amended.

The bottom-up method consisted of a survey of the current state of construction management, which had its basis in interviews with actors of public institutions and experts in the field - see Chap. 2. The actual design of a suitable SW was based on a mathematical model of the entire construction process, which can be expressed in relation:

$$P = f(L, T, C, D, R) \quad (1)$$

where

P is a Boolean function that takes 2 values: 0 = construction is not allowed, 1 = construction is allowed,

L is the location where the building is to be located,

T is the time, i.e. the time when the permit is processed,

C are the comments of the participants in the construction proceedings at time T,

D is the project documentation of the construction,

R is the legislation and regulatory measures in force at time T.

Because according to the goal set in the introductory chapter, the subject of the solution is only the assessment of the graphic part of the construction documentation, we can rewrite equation (1) into the form:

$$P' = f(L, T, D, R) \quad (2)$$

4. DESIGN OF THE POSSIBLE SOLUTION

The concept of the design of a suitable SW for the assessment of the graphic project documentation of the construction is shown in Fig. 2. In the input block in Fig. 2 is a collection of graphic documentation in a suitable format that is compatible for further processing in the concept of digital construction management (Fig. 1). One option is to use the IFC (Industry Foundation Classes) format or a special universal interchange format. It is assumed that the documentation will also include a digital technical map and other relevant documents. Block 2 identifies the entities and attributes of the documentation. It is based on the recommended classification of buildings according to the ISO 12006.2 standard, which divides the elements hierarchically as follows: built space - construction complex - construction entity - construction element - attributes. In block no. 3, spatial analyzes are performed. The functions and values of the parameters of these analyzes are contained in the valid legislation or regulations (block no. 5) and can be implemented in the application, for example, in the form of a text file with a line format:

< key word > <relationship> <value>. E.g. < **distance from the border of the neighboring plot > >= <2m>.**

In the next block No. 4, the inspection is carried out according to legislation and regulations, which can be implemented, for example, by a special script in the GIS / BIM environment. The result is a report on whether or not to recommend a building permit. In case of non-recommendation, the project documentation of the construction is returned for revision.

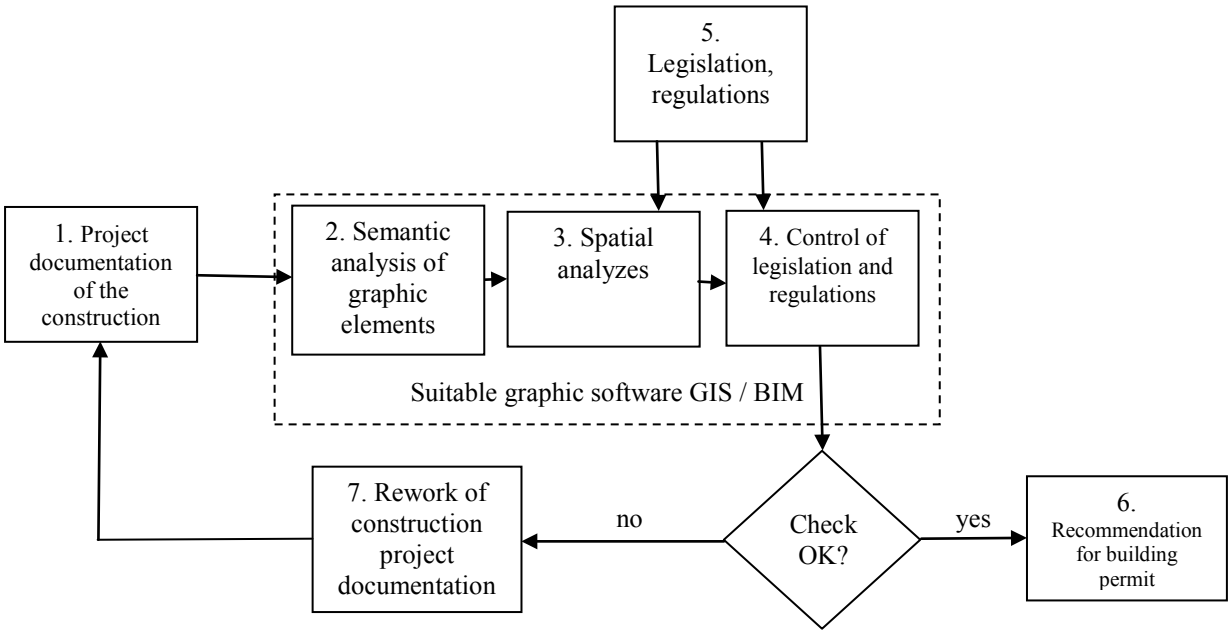

Fig. 2. Digital construction management - assessment of project (graphic) construction documentation

5. CONCLUSION

The article proposed one of the possible variants of applications for automated assessment of graphic project documentation in the process of digital construction management. Currently, several projects are underway, where the issue is addressed. One of them is the project CZ.03.4.74 / 0.0 / 0.0 / 15_025 / 0007522 "Strategy of introducing the methodology of information modeling of buildings for the needs of public contracting authorities". The final decision depends on the results of this and other relevant projects. In practice, 2 possible variants of the solution can be expected [4]:

1. New application SW + HW for building authorities (addressed in our paper).
    a. The advantages of this variant lie in the multi-license and in the unified simple and flexible administration and operation.
    b. The disadvantages of this solution are higher acquisition costs and a new user environment.
2. Use of existing application SW and HW and its modification according to legislative changes
    a. The positive aspects of this variant are the knowledge of the user environment and thus faster adaptation of officials
    b. The downsides are the possible vendor lock and the demanding management and operation of the information infrastructure.

Further research will continue in the design of an algorithm for processing comments from participants in construction proceedings, which were not addressed in this article. It is assumed that these comments will be implemented in the form of forms that can be easily and reliably evaluated automatically, eg by a script, and incorporated into the system design in Fig. 2.

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