



Differentiation of the assessment of identified risks in the process of preparing and creating a municipal land plan

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Abstract

During land planning activities risks arise, the negative impacts of which can affect the quality of life of residents in a municipality over both the short- and long-term. Territorial planning is therefore of great importance when putting forward relevant proposals and coordinating activities that affect the environment, the cultural-historic values of a territory, territorial development and the creation of a landscape in accordance with the principles of permanently sustainable development. The implementation of risk management, with an emphasis on the objective assessment of identified risks, combined with the use of quantitative methods of mathematical statistics – analysis of variance and the characteristics of the variability of risk assessment – in the process of preparing and creating a land plan for incorporation into strategic area management documents, can substantially increase the security of a territory as a whole. Land planning authorities project specific objectives onto the municipal territory and coordinate the public interest. The results of thorough research show differentiation in the assessment of identified risks according to the number of inhabitants in a municipality by the competent land planning authorities. Through the generalization of the results of a case study, appropriate preventive measures are put forward in the conclusion for incorporation into the land planning documentation of a municipality.

Keywords: assessment, risk, risk management, testing, territorial plan.



1 Land planning documentation as a tool for the permanently sustainable development of a municipality

Under permanently sustainable development we understand a targeted, long-term, complex process which affects all aspects of life (cultural, social, economic, environmental), at all levels (local, regional, global), focused on the model of a community (city, region, country, international community), which meets the material, social needs and interests of the people, whilst eliminating or significantly reducing interventions which may potentially threaten, damage or destroy conditions and forms of life, and increase the safety of citizens, reasonably using its resources and protecting its cultural and natural heritage [1].

Land planning is based on the integration of knowledge of several scientific disciplines (philosophy, sociology, history, archaeology, ethnography, architectural and urban planning, ecology and other natural science disciplines). The land planning process should involve interested civic associations and non-governmental organizations [2]. The role is to ensure the optimum use of land and the feasible funding of the arrangement, processing and implementation of the land planning documentation. This documentation should be the result of the combined direct demands of all interested entities (architects, economists, sociologists, ecologists, investors, and especially citizens) and subject to the actual conditions of the land. This includes unsolved long-term issues of land ownership [3].

Land registries in the Slovak Republic are currently (with some exceptions) unable to fulfil their legal role with regards to land and property policy due to procedural and staffing issues. The recovery in house construction, the restoration of cultural monuments and the building of public facilities largely depends on enhancing the attractiveness of this sector for private investors, with appropriate motivation and support from the State and local governments. The same is true for financial institutions, as well as for construction and investment companies. These entities primarily follow their business plans. The construction and restoration business must therefore become a profitable activity with stable conditions [4].

The safety of a specific area is threatened by various crisis phenomena that occur within a territory. Based on the determination and selection of specific crisis phenomena that affect a specified area, it is possible to put forward proposals for preventive measures that will increase the level of safety in an identified territory [5].

2 Survey methodology and the application of “analysis of variance” on risk assessment in the process of making a municipal land plan

This study focuses on the risks that may arise in the process of preparing and creating land planning documentation for a municipality. Persons responsible for land planning in municipalities were asked in a questionnaire to assess the



potential risks in the Slovak Republic. The aim was to carry out a risk analysis on the procurement of a land plan by small municipalities with up to 1,000 inhabitants, medium-sized municipalities with 1,001–2,000 inhabitants and larger municipalities with over 2,000 inhabitants, in the Slovak Republic. A partial objective was to compare the differences in the assessment of risks among groups, according to the criterion of population. Each group of municipalities included a representative number of 40 assessments by persons responsible for land planning.

In this study logical research and the comparative method were applied. The analytic-synthetic method was used for examining the individual instruments of spatial management and the method of induction and deduction for drawing the conclusions. The principle of the research methodology was based on the multi-level comprehensive analysis of activities and factors influencing the development of a settlement structure. The actual processing was divided into three developmental stages:

- analysis of theoretical knowledge and practical experience compatible with the implementation of selected spatial management tools and their impact on the spatial development of settlement structures;
- analysis, quantification and the use of qualitative methods in the assessment of identified risks in the process of procuring land planning documentation in the context of sustainable development and systems for planning mechanisms;
- summarization of conclusions for the practical application of progressive approaches to the assessment of the developmental potential of a settlement formation.

A comprehensive survey was conducted within the framework of the project *KEGA No. 005 DTI-4-2014 "Sector Integration of Spatial Impacts of Safety Management of Environmental Risks"*. The survey was conducted in the period March–June 2015. The survey sample consisted of 120 respondents who were responsible for land planning in the municipalities of the Trenčín Region of the Slovak Republic. Data collection was conducted electronically through an online survey and in written form as a standardized questionnaire. This is the so-called exploratory method, which means that the data collected was primary data. The procedure for the online survey was as follows:

- the questionnaire in its final form was programmed into web format and put on the Internet;
- after the successful testing of the questionnaire, the respondents were addressed through an email which contained a link to the survey, including login information;
- during the on-line survey it was possible to establish the status of the survey, the repletion of quotas or running statistics; data collection ceased once the sample size and quotas were met;
- collected data were checked with regards to their consistency, reliability and the logical reference of the answer; wrong answers (dialogues) were



deleted. We took the statistical signs of respondents into consideration and processed them subsequently in a statistical programme.

The importance of the method of “analysis of variance” for assessing the risks associated with the preparation and creation of land planning documentation for a municipality in the Slovak Republic by the relevant authority responsible for land planning, according to the criterion of population, depends on whether the assessments of the levels of the identified risks by the relevant authority/person are comparable. The level of risk for an identified risk, as assessed by the competent authorities for land planning, were expressed on a scale of 1 to 10 in terms of the probability of the risk occurring and the potential negative consequences thereof. The lowest risk exposure and smallest overall damage was expressed by the number 1. The largest risk and total losses was expressed by the number 10. In this context the term damage was understood to mean the sum of the direct damage (the duration of the period for the procurement of the land plan) and indirect damage (e.g. depopulation into larger municipalities). The processing of the mathematical method of “analysis of variance” is numerically demanding and was therefore conducted with the support of the statistical software Statgraphics Centurion XVII [6].

In interviews with the persons responsible for land planning in the municipalities of the Trenčín Region of the Slovak Republic, the following risks were identified with regards to the process of preparing and creating land planning documentation:

1. financial – associated with the lack of financial resources;
2. procurement – associated with the selection of a competent person for the procurement of land planning documentation for a municipality;
3. professional – associated with the inadequate skills of professionals in the procurement of land planning sources;
4. time – associated with the time required for the preparation and procurement of a land plan, land planning documents and other relevant sources;
5. interest – associated with the political links of interest groups and their interest in the functional use of the municipal territory;
6. administrative – linked to procedural, project and administrative errors in the procurement process of land planning documents;
7. personnel – associated with unqualified persons being responsible for land planning issues.

The mathematical-statistical method of “analysis of variance” consists of the following stages:

- calculation of point selection characteristics (mean value, variance) of the levels of risks in the case study of the municipalities in the Trenčín Region;

- verification of the conditions imposed on the execution and determination of the suitability of the use of the parametric or non-parametric test for the levels of the identified risks;
- testing of variances in the levels of identified risks according to the criterion of population, using the parametric F- test and the non-parametric Kruskal–Wallis test;
- determination of whether the mean values of the levels of identified risks in the procurement process of a land plan are comparable between the municipalities according to the chosen criteria;
- identification of the estimated 95% confidence interval for the sampling characteristics of the most significant risks that occur in the process of preparing and creating a land plan.

3 Analysis of variance of the assessment of identified risks by land planning authorities

According to Šimák [7], the mathematical expression of risk is represented by the level of risk. This level of risk is the product of the potential likelihood of a crisis phenomenon and the possible repercussions thereof. The basic point estimates of the characteristics of the level and variability thereof were calculated on the basis of the assessments of the individual risks as made by the land planning authorities in the case study. They are:

- μ – mean value of the risk assessment by the persons responsible for land planning in a municipality;
- σ^2 – variance of the risk assessment by the persons responsible for land planning in a municipality.

Table 1: Main characteristics of the level and variability of the assessment of identified risks by the persons responsible for land planning in a municipality.

Identified risks	Municipalities with over 2,001 inhabitants		Municipalities with 1,001–2,000 inhabitants		Municipalities with up to 1,000 inhabitants	
	μ	σ^2	μ	σ^2	μ	σ^2
1	87.84	14.15	86.19	11.17	91.66	16.02
2	44.42	9.02	39.71	7.08	37.41	14.97
3	76.64	8.79	71.97	6.54	79.81	16.94
4	81.91	7.84	80.89	9.17	85.17	10.45
5	28.74	4.46	30.77	7.88	31.51	6.79
6	42.71	7.81	29.81	6.72	40.28	8.14
7	25.74	5.45	21.2	10.81	23.98	11.92

The point estimates of the characteristics of the level and variability of the assessments of risk show that the most significant risk that municipalities have to deal with is the risk associated with insufficient funds. The average level of the assessments made by the persons responsible for land planning is 88.56. The main reasons cited are the lack of an increase, or no increase, in municipal budgets and the continued increase in responsibilities that require funding. The least significant risk is considered to be the interest risk. The average mean value of the rate of interest risk by the persons responsible for land planning is 30.34. For the aforementioned two risks the level of risk is considered to be homogeneous. Significant differences between groups of municipalities, according to population, are estimated based on sample characteristics with the following risks: risks associated with lack of skills of professionals in procuring land planning document; risks related to procedural, project and administrative errors in the procurement process of land planning documents; risks associated with unqualified persons being responsible for land planning issues.

The subjective statistical assumptions that were made on the basis of the knowledge of the basic sample characteristics can be verified using the objective method of mathematical statistics. To carry out tests on the mean values of the levels of risks in particular groups, according to the criterion of population, the parametric F- test and the non-parametric Kruskal-Wallis test were used. The parametric test can be undertaken subject to two basic conditions being fulfilled:

- homoscedasticity – the identity of variances in the levels of the identified risks by the land planning authorities, or municipalities in the Slovak Republic, in groups according to the chosen criterion of population. The Bartlett test was conducted to verify homoscedasticity at a significance level of 0.05. The resulting p-values for the identified risks were: financial – 0.257; procurement – 0.146; professional – 0.309; time – 0.094; interest – 0.161; administrative – 0.639; personnel – 0.801;
- normal distribution of the levels of risks in selected groups of municipalities that were evaluated by the persons responsible for land planning issues in the Slovak Republic.

The test results for homoscedasticity using the Bartlett's test confirmed that there are identical variances in the levels of identified risks at a significance level of 0.05 i.e. all the risks fulfil this condition. The results of the Pearson χ^2 test for the fulfilment of the condition of the probabilistic model of normal distribution show that at a significance level of 0.05 the financial (1), professional (3), administrative (6) and personnel (7) risks fulfilled all the prerequisites to perform the parametric F-test. In contrast, the p-values of the procurement (2), time (4) and interest (5) risks were lower than the significance level of 0.05. As a result, we reject the assumption of normal distribution or identical variances in the levels of these risks. These risks fulfilled the conditions for carrying out the non-parametric testing of the mathematical-statistical method of analysis of variance.

Prior to actually testing the homogeneous assessment of risks by municipalities, interval estimates are made of the characteristics of the level and

variability of those risks that municipalities perceive as the biggest problems. The interval estimates for the key risks are given in Tables 2 and 3, whereby:

- μ_l – lower limit of interval estimate of the mean value of the assessment of the identified risks by the persons responsible for land planning in a municipality with a probability of 0.95;
- μ_u – upper limit of interval estimate of the mean value of the assessment of the identified risks by the persons responsible for land planning in a municipality with a probability of 0.95.

* σ_l^2 – lower limit of interval estimate of variance of the assessment of the identified risks by the persons responsible for land planning in a municipality with a probability of 0.95; σ_u^2 – upper limit of interval estimate of variance of the assessment of the identified risks by the persons responsible for land planning in a municipality with a probability of 0.95.

We performed the parametric testing of the mean values of the assessment of risk rate among the selected groups of municipalities using the F – test. The resulting p-values for the identified risks are as follows: financial risk – 0.117; professional – 0.339; administrative – 0.027; personnel – 0.015. We carried out the non-parametric testing of the medians of the assessed levels of risks among the selected groups of municipalities using the Kruskal-Wallis test. The resulting p-values for the identified risks are as follows: procurement – 0.026; time – 0.306; interest – 0.004. On the basis of the application of the

Table 2: Confidence intervals of the mean value for the identified risks by the persons responsible for land planning in a municipality (respondent) with a probability of 0.95.

Respondent	Risk	95% confidence interval of the mean value	
		μ_l	μ_u
Municipalities with over 2,001 inhabitants	Financial	85.35	90.03
	Professional	74.81	78.96
	Time	79.78	84.42
Municipalities with 1,001–2,000 inhabitants	Financial	84.51	89.34
	Professional	69.67	74.28
	Time	79.73	84.41
Municipalities with up to 1,000 inhabitants	Financial	89.86	94.62
	Professional	77.26	82.20
	Time	83.01	87.76

Table 3: Confidence intervals of variances for identified risks by persons responsible for land planning in a municipality (respondents) with a probability of 0.95.

Respondent	Risk	95% confidence interval of variance	
		σ_l^2 *	σ_u^2 *
Municipalities with over 2,001 inhabitants	Financial	12.85	15.76
	Professional	7.49	9.65
	Time	6.59	8.47
Municipalities with 1,001–2,000 inhabitants	Financial	10.5	12.71
	Professional	5.32	7.85
	Time	8.34	10.28
Municipalities with up to 1,000 inhabitants	Financial	14.85	17.33
	Professional	15.14	17.66
	Time	9.48	11.31

mathematical-statistical method of analysis of variance to the case study it is possible to state that the results of the F-test and Kruskal-Wallis test show that it is possible to accept, with a confidence level of 95%, statistical assumptions on the comparability of the assessments made by the persons responsible for land planning in municipalities, in selected groups for the financial, professional and time risks. On the basis of a representative statistical sample from the survey there are no statistically significant differences between the values for the levels of these identified risks. On the contrary, for the other risks there are significant differences in the assessments made of their levels with regards to the criterion of population of a municipality.

4 Survey assessment and discussion

The allocation of funds to municipalities is one of their most significant sources of income. Each municipality should take measures to ensure that their budgets gradually increase future funding. This can be achieved by renting out residential and/or business premises owned by a municipality, by the rental of equipment and machinery, or through their own business activities. The differences between regions in the level of the quality of life are noticeable and it is therefore not sufficient for the State to allocate funds to municipalities only on the basis of the criterion of the population of a municipality. Land plans are a tool that can influence all the activities and initiatives of a municipality's citizens,

entrepreneurs and investors alike in harmony with the environment, cultural monuments and traditions.

5 Conclusion

A land plan is a significant and important document for providing spatial guidance on the functional use of territory in a municipality. It is a prerequisite for enhancing the quality of life of a municipality's inhabitants. Within this context quality of life must be understood to be interdisciplinary in nature and viewed in the broadest sense possible, from critical elements of infrastructure through to the demographic curve of the population, their involvement, to the feeling of safe cohabitation of residents. In this paper, on the basis of a survey conducted of persons responsible for land planning in a municipality, we identified the risks, the consequences of which could negatively affect the process of preparing and creating land planning documentation. Using the mathematical-statistical method of analysis of variance we came to the conclusion that in all the groups of municipalities, according to the criterion of population, the financial, time and professional risks were assessed as comparable and pose the greatest threats. A municipality consists of inhabitants. A citizen has a legal right to be adequately informed of the management activities and the context of decision-making processes and activities. They have the right to present their views and comments. This makes them an equal partner to all the entities involved in these processes. The application of participative methods and tools increases the feeling of control over the environment, autonomy, legal capacity and responsibility; it reduces alienation, anonymity and the feeling of insignificance; ultimately, participation increases the identification of citizens with the space in which they live.

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