Methodology for conducting and analyzing land surveying examinations

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Abstract. Geoscience does not investigate the methods of producing land surveyors in the framework of court cases and reviews produced after the analysis of this expertise type. The article proposes the author's methods of this field of study: test, technological methods and method of typical errors, which are developed and justified. The paper analyzes the errors of 176 land surveyors and provides statistics of such errors. They are classified into design errors, procedural errors, and errors of a special technical nature. The article analyzes the meaning of each error type (and introduces the concept of gross and minor errors). It proposes the author's method of producing reviews of land surveyors which is a technological method. It is reviewed in detail; it is indicated that it is in the testing stage and has received a positive response. The study suggests the formation of reliable complete scientific research in the framework of the expertise in land disputes, which leads to more fair and well-grounded court decisions.

1. Introduction
Currently, there is a relevant common topic for both earth science and procedural law – the production of land surveyors. They are necessary when the court is considering a case, the correct resolution of which requires special knowledge in various fields of science, technology, art, and craft. Land management is one of the areas of earth sciences (scientific field of study 25.00.26 - Land management, cadastre and land monitoring). Consequently, the forensic land management examination can be considered as an applied scientific research.

At the same time, the procedural legislation does not provide for such a method of protection as challenging the examination, and therefore the court often takes into account its results, regardless of how much it meets the criteria of reliability, completeness, scientific nature and other characteristics required by law. This is due to the fact that the court cannot independently assess the quality of the examination since it does not have special knowledge.

In this regard, one can use a peer review. To conduct such a review, the interested party provides an analysis of the forensic examination available in the case by a person with special knowledge in the field of earth sciences. The Land Survey Forensic Review is an official review containing an objective analysis and professional assessment of the study submitted in writing.

The authors of this article believe that land management expertise and peer review of this kind of expertise lies in the field of knowledge of the earth sciences. Therefore, when referring to this sphere as legal (procedural) one, the meaning of the expertise itself is distorted, and errors in the application of special knowledge are easily predicted.
2. Classification of errors in land surveying examinations
As part of the reviews, the article examined 176 expert conclusions of a land management nature and proposed to classify errors made by experts while providing such examinations.

| Error type                        | Subtype of error              | Approximate content of errors                                                                                                                                                                                                 |
|-----------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Errors in design                  | Those that do not distort the | Typos, misspellings, incorrect spelling of words (spelling), inconsistent sentence structure (semantic), punctuation, - those as a result of which the general idea does not change |
|                                  | meaning of the study          |                                                                                       |                                                                                       |
|                                  | Those that distort research   | Lack of references to used literature; lack of information about the expert required by law; lack of research parts; incomprehensible expression of thought in the text; and others that change or distort the meaning of the study. |
| Logical errors                    |                               |                                                                                                                                                                                                                           |
| Procedural errors                 | Small                         | The absence of a mark in the text on the parts of the study, the presence of which is required by law (there are methods, principles, etc.), there is no statement of the procedure for carrying out work, etc. |
|                                  | Rough                         | Absence of an expert's signature in the required places; no expert subscription; violation of the principle of independence in obtaining results; disclosure of confidentiality and others prohibited by procedural legislation. |
| Errors of a special technical     | Small                         | Lack of information about current verification and certification of equipment; failure to indicate the permissible error and the absence of calculations of the error when obtaining the results; non-description of the scale of the image; non-indication of symbols. |
| nature                            | Rough                         | Failure to use the recommended points of the geodetic and support network; lack of information about geodetic constructions; use of unacceptable “substrates”: topographic, cartographic and other basis, not presented by the court and not obtained by the expert independently; lack of justification of the relevant options (for example, when designing a section of land plots), making measurements with errors (for example, inadmissible construction methods) and others. |

Having studied the presence of errors in the listed 176 land management examinations, the authors presented the results in the form of a diagram (Fig. 1).
Figure 1. Statistics of errors in the investigated 176 land surveying examinations

The most dangerous in this context is a very large percentage of gross technical errors (every third conclusion) and the presence of a large number of logical errors.

The authors believe that such an abundance of errors is due to the absence in earth science of a formed or discussed approach to the production of land surveyors in court cases.

3. Proposals for improving the production of expertise

It seems that there are three directions in which it is necessary to carry out the prevention of such problems:

- Regulation and control of the training of forensic experts in land management. Currently, examinations are mainly prepared by cadastral engineers with a bachelor's or master's special education, the level of which does not always allow for a high-quality examination. Of course, technical experts, as a rule, make stylistic or other design mistakes (they were encountered in 174 out of 176 examinations). However, they should not make gross technical mistakes, since the court cannot make them without the participation of a specialist.

- Development of an independent direction of research in the geosciences related to land surveying expertise. There is no independent regulation of the production of measurements while conducting a research in the framework of forensic examination, and the expert can use the latest and accepted achievements of the scientific community. So, there is an ambiguous dialogue about the applicability of the RTK survey mode in cadastral works. Although it has shown its applicability in practice, it is not fully regulated by current regulations and cannot be used in cadastral works. Hence, it is questionable that every expert who has the status of a cadastral engineer can use a mode in the production of expert examinations that has received recognition in applied and theoretical science but is not described normatively.

- Development of research methods applicable to certain areas of court issues: to establish easements, to design a section of land plots, to resolve issues of unauthorized occupation and other disputes.

The authors believe that the consistency of research production can reduce the number of errors of all types, except speech. Thus, following a certain algorithm, the expert acquires the general logic of research. For example, it was previously proposed to study boundary plans, the control of which is carried out within the framework of forensic examination, to use one of three methods: based on testing (the test is drawn up based on the normative recommendations for the boundary plan), on the technology of production of the boundary plan (the study is carried out proceeding from the stages of preparation of the boundary plan), on typical errors (the verification system is based on the most...
typical errors for certain types of boundary plans according to Rosreestr data for the last 2 years). At the same time, studies of specific boundary plans in practice (the analysis was carried out by bachelor students in the preparation of final qualification works) showed the greatest efficiency of the test method in this type of expertise.

At the same time, the review of land surveying expertise can be efficiently carried out by a technological method.

4. Technological method for reviewing land management expertise.
The technological method assumes that the author of the review has an idea of the algorithm for the production of land management expertise, which will result in reliable, complete, and verifiable data. So, below is the algorithm for the examination in the dispute over the occupation of the owner's boundaries. As a rule, the court poses two main questions before the experts (in different wording): “What is the actual land use of adjacent plots? What is the difference between the data on the actual land use of adjacent plots from the data of the Unified State Register of Real Estate?”) The expert is required to answer them objectively, without giving legal assessments of the situation.

The general technology for the production of this kind of expertise should be carried out according to the algorithm “hypothesis - empirical research (preparatory stage, stage of information collection, processing, and unification) - comparison - conclusions”.

They are described in more detail in Table 2.

Table2. Algorithm for the production of expertise in a dispute over the occupation of the owner's boundaries

| Research phase | Study content |
|----------------|---------------|
| Hypothesis     | Formed on the basis of the question posed by the court to the expert of the land management profile |
| Empirical research at the preparatory stage | Study of case materials (details may be available in relation to each case) and publicly available sources (public cadastral map). Obtaining publicly available data on the geodetic base for making measurements. |
| The stage of collection, processing, and unification of information | Making measurements of actual land use by making geodetic and satellite measurements; data processing and description of the studies performed |
| Comparison and Analysis Stage | At this stage, the data from the Unified State Register of Real Estate is compared with the data on the ground. Self-grippers, their size are analyzed, comparison is made with the root-mean-square error. Intermediate conclusions are drawn. |
| Conclusions     | Based on the intermediate conclusions, a conclusion is formulated based on the question of the court. |

In the absence of an expert's awareness of the presence of an algorithm in the research structure, it must be present based on the very nature of any research. However, in a number of examinations, there is a lack of entire stages or a change in the order of their presentation. In the first case, we are talking about gross violations, and in the second, the task of the reviewer is, among other things, to recognize the research stage.

Thus, when reviewing this kind of expertise, the reviewer analyzes each stage for errors. If the structure of the study is violated, the reviewer mentions the presence of a logical error.

When conducting peer review as an independent research by the technological method, its form becomes systematic and covers all reasoning and data obtained by an expert land surveyor.

Currently, the authors are in the process of testing this method of reviewing. 5 prepared reviews received a positive response from the court (4 reviews pointed to gross errors of experts, one to their absence) and the other four indicated cases were sent for re-examination.

Thus, this method has now proven its efficiency.
5. Conclusion.
In the geosciences, there is a need to study land surveying examinations and reviews of them as an independent direction. Currently, there is no formed or discussed approach to the production of land surveying expertise in court cases.

Errors in land surveying examinations can be divided into errors in registration, procedural errors, and errors of a special technical nature. There are also gross errors and minor (small) errors in their structure.

The authors propose to widely use the technological method for the production of reviews of land surveying expertise.

References
[1] Saenko Y V 2019 Problems of forensic expertise in determining the boundaries of land plots. Ways to solve them INTEREXPO GeoSibir-2019 (Novosibirsk: SGUGiT).
[2] Avrunev E I, Parkhomenko I V, Akaev R A 2018 Application of RTK mode when performing cadastral works in relation to real estate objects in the city (Novosibirsk: SGUGiT).
[3] Avrunev E I, Giniyatov I A 2018 Fundamentals of scientific research: analysis of the quality of cadastral works in relation to land plots (Novosibirsk: SGUGiT).
[4] Parkhomenko D V, Parkhomenko I V 2019 Methods of control and forensic examination of boundary plans Bulletin of SSUGiT 24 (4) 286-295.