Foreign experience and technologies in the formation of a state cadastral database of buildings and structures

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Abstract. This article describes the scope of the cadastral system and relevant information technologies of France, Germany, Great Britain, and Sweden along with the possibilities of their application in the Republic of Uzbekistan.

1 Introduction

Improving the technology of the formation of a state cadastral database of buildings and structures in Uzbekistan requires the study and research of best international practices in the sphere. In the process of scientific research, it was found that in developed countries, buildings and structures are maintained as part of the state cadastre and real estate cadastre. Therefore, first of all, it is necessary to study the cadastral system of foreign countries. It is known that the cadastral systems of all countries cover such issues as three characteristics, fiscal (economic, tax), legal and multi-purpose.

The study of the cadastral system of developed countries shows that the registration of structures and buildings (objects) initially covered only fiscal (economic, tax) and legal issues, but today it also includes multi-purpose issues. In particular, the cadastre for fiscal purposes is mainly based on the collection of property taxes depending on the characteristics of real property and the conditions of their use, and the tax rate for the property is determined on the basis of the price of the object. The legal purpose is to protect the rights of the owner. Such a cadastre ensures the quality of transactions, inheritances, gifts, and others.

Maintaining a multi-purpose cadastre requires the maintenance of a single system of state cadastres, which includes various parameters, namely economic, social, legal, environmental, geographical, and so on. In this case, the registration consists of various information, environment, infrastructure, socio-cultural, and others. Maintaining this type of multi-purpose cadastre requires the use of modern information systems and technologies. Indeed, the development of modern automated land information systems will allow closer coordination of the activities of organizations responsible for the formation of the cadastral database. This increases the level of information reliability.

Studies conducted on the example of Western European and Scandinavian countries show that if the cadastral data is unclear, or disputed, or if there is a necessity to determine the borders of the property due to the division of the territory into different properties, this process is called demarcation.

These steps are performed by the Land Management Service. The current cadastre plans of real estate consist of various structures:

half of them, mostly in rural areas, still use old plans from the Napoleonic era as well as the 1930s-1960s. The database is usually not clear enough and there are random errors;

the other half is new plans, which are debated 'regularly' because they meet official technical standards and are known for their high accuracy of cartographic imagery, but the data are insufficient to address some specific needs;

The area of the land plot presented in the cadastre is mainly derived from the graphical calculations performed after the measurements and defined in the plan. Their boundaries are not clear as the actual condition of the plot has not been studied.

Therefore, in a number of countries, the necessary information for multi-purpose is concentrated in a single information system, or the exchange of information among different systems is established.

2 Materials and methods

2.1 Study Area

The southern Aral Sea Based on foreign experience, it was found that the modern digital cadastral database is mainly concentrated in the real estate cadastre. It is therefore expedient to study the foreign cadastral system. In particular, according to O.V.Ilina and S.R.Ijendeeva, in many countries the legal regulation of cadastral work is different, but it can be divided into several main groups:

- Napoleon (France, Italy, Belgium, Spain, Greece, and other countries in western, southern, and southwestern Europe);
- German (Germany, Switzerland, or Austria);
- English (Atlantic: UK, USA, partly Canada, Australia, and some other countries;
- Scandinavian (Denmark, Finland, Norway, Iceland, Sweden) [1].

2.2 Research methodology

Based on the above considerations, it is possible to analyze the cadastral system in each group of cadastral management. In particular, based on the study of the French cadastral system itself, it is possible to get an idea of the cadastral system of several countries relevant to the Napoleonic group.

The Napoleonic cadastre is used in the countries of Western and Southern Europe (France, Italy, Spain, Belgium, the Netherlands, Greece, etc.). the main objective cadastre - taxation of property. The cadastre consists of cartographic and documentary parts. The foundation of the cadastre was laid on September 15, 1807. The cadastre and register of rights are subordinate to the Ministry of National Economy and Finance and are conducted separately [2].

Although France is the historical homeland of the modern cadastral system, today it cannot be cited as an example of cadastral management. Since its primary purpose was to tax real estate, an information system based on the register of property owners was formed and property rights were granted through them.

Over the years, the negative consequences of reforms in cadastral improvement have led to the unreliability of cadastral information, namely land ownership is reflected in the cadastre, but the local boundaries of land plots do not often correspond to cadastral plans. More precisely, there are constant changes in the location of the land plot and the boundaries of the cadastral plan, therefore, it seems to keep uncertainty. While this

situation has a partial impact on taxation, it has often led to objections in legal matters. That is why in France the cadastre is not accepted as a legal document.

These days, the cadastral system in France, as a thematic plan, is maintained by the state land cadastre organization under the auspices of the tax authorities of the General Directorate of Finance. French cadastral database is mainly based on "Parcell data". This information is available in electronic, raster, and vector forms. In France, graphic data is displayed in cadastral plans, in which the boundaries of the land plot are graphically aligned. The plans will mainly show the number of land plots that are the basis for land ownership.

The plans themselves do not provide information on the owner of the property or all plots of land in a single possession. Although the buildings in the plan indicate the size of the plot of land and the place name of the property to which it belongs, the boundaries of the plots in the cadastre are often vague and may even disappear in some cases. In addition, the French cadastre does not specify clear boundaries between real estate. This, in turn, indicates that it does not draw a clear conclusion about the legal boundaries of the property. It is done only by land formation.

In many cases, the cadastre resolves a number of issues related to real estate but does not resolve border disputes. It is, therefore, possible to object to the cadastral plans of France.

If the cadastral information is uncertain, or controversial, or it is necessary to determine the boundaries of the property due to the division of the plot into different properties, this process is called delimitation.

The French Land Registry is a public register that allows identification to certify landed property in any territory of the country, in any of its municipalities [3].

That is why today French cadastral information cannot be viewed objectively. In addition, French cadastral information does not contain state property. This is because the basis of the French cadastre was originally based on the fiscal issue, including the fact that if the state is considered the owner of real property, it naturally does not pay taxes, which in turn means that state property is not included in the real estate register. This indicates that the French cadastral information is incomplete.

In the 1990s, the cadastre was digitized by the Minister of Finance, who was in charge of the cadastral system [4]. As a result, today the French cadastre is fully digitized and geospatial information is placed in the geoportal using modern technologies. Through this reform, the French state also has a cadastre based on a geographic information system that meets German and Swiss standards.

Analyzing the cadastral system relevant to the German group, we can see that the basis of this direction is also the formation of the Napoleonic cadastre. That is why the German cadastre was initially focused on the fiscal issue. But later it was formed and became a legally oriented cadastre. Unlike other countries, this development was the first step in forming a cadastral system. The German cadastre differs from the Napoleonic cadastre in that the boundaries of land plots are defined with high precision and the protection of registered rights by the state is guaranteed.

In Germany, in the 1930s, work began on a multi-purpose cadastre on the basis of an automated system, and in the 1990s, an information system was established to address various issues in land use and land management. This database was aimed at improving the tax system based on cartographic bases. Today, the German cadastre can be used as a basis and model for the cadastral system of other developing countries. After all, the German cadastre reliably maintains information on the boundaries and rights of land and real estate, fully covering three areas: fiscal, legal, and multi-purpose.

Germany, which has extensive experience in state registration and application of geodata through the use of modern information technology, today has introduced a new

stage of the cadastral system. This system combines three information systems to ensure the objectivity of the information, which is shown in the following Figure 1:

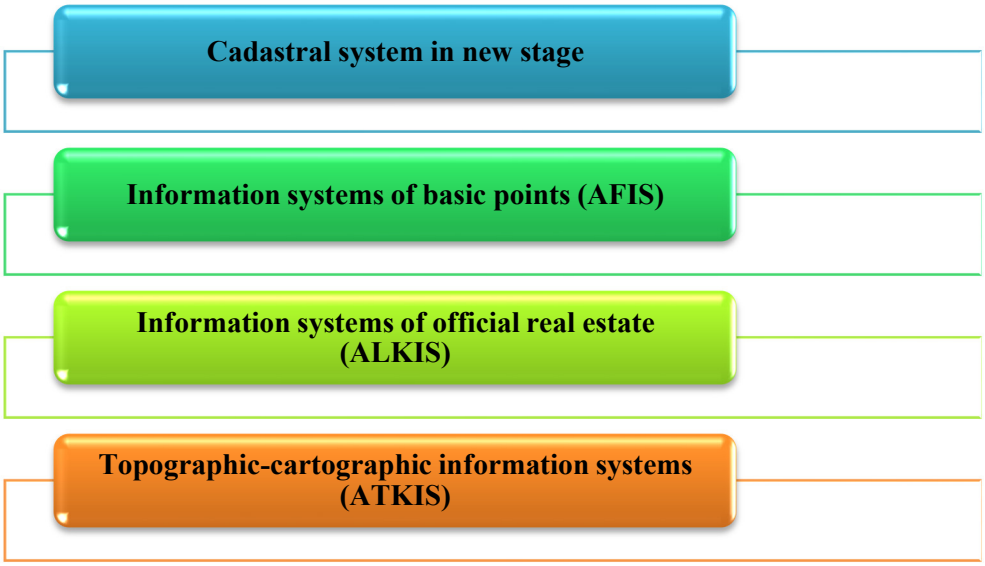

Fig. 1. New cadastral system of Germany.

To clarify the above Figure, AFIS (Amtliches Fest point information system) is called the official base information system. It contains digital documents of the base points: location, height, and other information.

ALKIS (Amtliches Liegenschafts cadaster information system) is called the official real estate cadastre information system. This system contains digital cadastral documents: real estate and building maps and land book documents.

On the map of real estate and buildings plot boundaries, turning angles, their number, district boundaries, geodetic control points, boundaries of houses and buildings, house number, street names, results of the official assessment of land, topographic features of the area, eg trees, bike paths, shores, and others. Information on the owner of the real estate in the land book documents, the share of land ownership, location of the land plot, area, the purpose of use, results of the official land assessment, cadastral map number, numbers of geodetic plans, number of the property in the land book and others.

ATKIS (Amtliclies Topographisch-Kartographisches Informationssystem) is called the official topographic-cartographic information system, and it is a digital document of topographic information: the representation of place details using different models. These include digital orthographic photographs, a digital model of the surface, a digital model of the location (landscape), and digital topographic maps.

The process of land registration is done by local courts. The maintenance and organization of the real estate cadastre are carried out in the federal states of Germany in accordance with the three-stage system of geodetic and cadastral services:

- the supreme body of geodesy and cadastre (Ministry of State Power) – prepares legislation, resolves administrative issues, and acts as the highest supervisory body;
- high-level geodetic and cadastral body (Department) – they supervise cadastral and geodetic organizations, as well as licensed agencies;
- low-level geodetic and cadastral agencies deal with issues related to the territory of the region or city and maintain and constantly update the real estate cadastre.

The level of reliability of information depends mainly on the lower level because at this level the basic data are made using cadastral photography. Unlike the French cadastre, cadastral photography is performed by licensed officials, not land inspectors or land cadastre specialists. Legal issues are notarized. This, in turn, indicates that in Germany, cadastral documents are considered legal documents.

The concept of cadastre like the French registration system does not exist at all in Britain. The land resource management system is called Her Majesty Land Register [5]. In particular, this department is the organization that maintains the register of property rights. The registration will contain data on the state registration of rights to all real estate in the kingdom.

Primary registration of rights to objects is carried out during the period of real estate transactions. Therefore, real estate for which no action has been taken may not be state-registered.

Information on state registration in the UK is digitized and accessible. The required information on the object can be obtained by entering the address of a single real estate or a special identification number.

The main feature of the real estate registration applied in the UK is the distribution of functions between the competent authorities for registration of property rights and geodetic, and cartographic services, which record land data.

In the UK, the registration information of real estate is formed on the basis of data from organizations such as the National Geodesy Agency, the Registration Service, and the National Bureau of Estimation. On the basis of the services of the National Geodetic Agency, a cartographic basis for cadastral registration is formed. The land registration service registers the rights to land and real estate. Estimation for the purpose of taxing real estate is carried out by the National Bureau of Estimation.

The reliability of the information on the registered objects depends first on the National Geodesy Agency and then on the registration service. Because the register data is initially formed on large-scale cadastral maps.

The Royal Register is regulated and subordinated to the Ministry of Justice. It will consist of three official registers. These are the land register, the register of owners, and the register of restrictions.

The main function of registers is to provide a simple, reliable procedure for asserting property rights, with minimal fiscal functions.

It should be noted that the main property tax is called ‘business tax’, in which the tax is paid not by the owner, but by the person who actually uses the property. Another unique case is that the registration process guarantees property rights but does not guarantee the boundaries of that property. This indicates that other states are separated from the registration system.

Based on the analysis of the Swedish cadastre, it was found that the cadastral work carried out in this country today is highly developed and consists of a register of land and real estate. It is run by the National Land Service and is called ‘Lantmäteriet’ in Swedish.

An important feature of the Swedish cadastral system is its clear organizational structure. At the same time, the National Land Service is a state body of the Ministry of Finance, which performs functions defined by the government, including the implementation of the national mapping program, control of the national cadastral program, regulation of geodesy, topography, cadastre, and land use, collects digital data and distributes. Its activities mainly cover three areas. It can be seen in the diagram below.

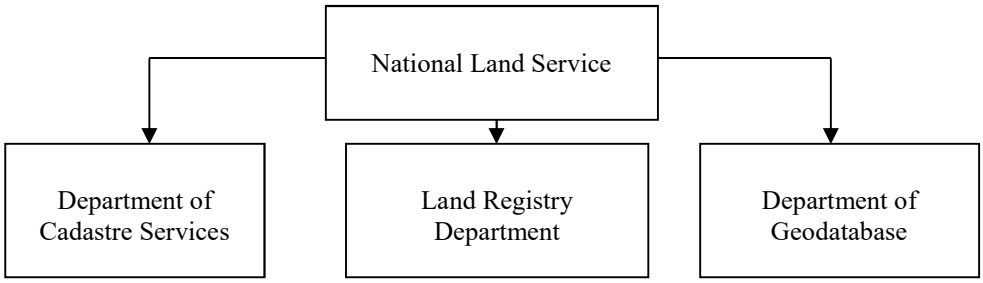

Fig. 2. Swedish cadastre organizational structure.

The Department of Cadastral Services is responsible for the distribution of property: in other words, it decides on the change of new property units and existing boundaries. This department is also responsible for making decisions on joint ownership, servitude, and other property rights.

The Land Registry Department reviews decide and register property documents, mortgages, land leases, and other rights, which are then registered in the Real Estate Register.

The Department of Geodatabase collects, stores, and updates information on Swedish land resources and properties. In particular, it provides this information to the public and private sectors. The database established on the basis of the above system allows the provision of highly reliable data to consumers in a fast and high-quality way. In this respect, the Swedish cadastre differs from the system of other states.

3 Results and discussion

Based on the results of the analysis, conclusions were reached in the implementation of the experience of developed countries in maintaining the cadastral system in Uzbekistan (Table 1). It is observed that the cadastre of buildings and structures conducted in Uzbekistan at the present time, in a certain sense, performs the registration and evaluation of objects based on the point of view of their belonging to the territory of a certain land territory. This method necessarily requires determining the value of the land plot.

Because the current laws and regulations in Uzbekistan stipulate the privatization of non-agricultural land. The development of this process requires that the cadastre of buildings and structures should be carried out in harmony with the land cadastre.

Table 1. Conclusions in the implementation of the experience of developed countries in maintaining the cadastral system in Uzbekistan.

№	Country	The positive characteristics	The negative characteristics
1	France	- registration is fully digitized, all information on real estate of legal entities and individuals paying property tax is fully formed; - using high-resolution cartography data, a geoportal was formed that even included	- their boundaries are not clear as the actual condition of the plot has not been studied. Therefore, cadastral information cannot be viewed objectively; - cadastral documents are not accepted as legal documents; - state property is not included in the

		maps from the Napoleonic era.	register of real estate.
2	Germany	- the boundaries of land plots are determined with high accuracy; - registered rights are guaranteed by the state; - In contrast to the French cadastral system, cadastral photography is carried out by licensed officials, not land inspectors or land cadastre specialists; - cadastral documents are accepted as legal documents; - all geospatial information is placed in the geoportal.	- does not comply with the legislation of Uzbekistan due to the combined registration of land and real estate. Because the registration of the land plot is carried out by the Cadastre Agency, and the buildings and structures are carried out by the Ministry of Construction.
3	Great Britain	Digitization of cadastral maps is carried out at a high level.	Primary registration is carried out at the time of the transaction with real estate, it is not registered unless there are transactions related to real estate (purchase, gift, inheritance, etc.). Naturally, no tax is levied on unregistered objects.
4	Sweden	- formation of cadastral documents is formed by a cadastral specialist based on the data of geodesists and cartographers. Basically, a map of objects is formed in a three-dimensional format.	The legislation of Uzbekistan differs in that the documents of the land plot are registered separately from the real estate.

These issues lead to rational solutions based on the experience of the developed countries mentioned above. In contrast to Uzbekistan, in Western European countries, cadastres of land and building are implemented harmoniously, that is, as real estate cadastres.

Thus, in the near future, it can be considered a reasonable and promising state event to conduct the cadastres of land and buildings in Uzbekistan as part of the real estate cadastre. Only then will the privatized land and building-structure objects have a total amount and value. This creates opportunities to apply advanced foreign experiences directly or indirectly in the conditions of Uzbekistan.

4 Conclusions

As a result of the research, the scope of the cadastral system and relevant information technologies of France, Germany, Great Britain, and Sweden along with possibilities of their application in the Republic of Uzbekistan have been analyzed. We consider that it is expedient to improve the cadastre of buildings and structures in Uzbekistan, based on the experience of countries with advanced experience in this sphere. On the basis of in-depth scientific and methodological analysis of the positive, and negative characteristics and

differences of cadastral work of foreign countries may possibly give positive results in the application in the Republic of Uzbekistan.

As a result of the research, the following opinions and recommendations are noted:

- Implementation of measures of French parceled land can be the basis for creating an online land balance in the "Geoportal" in Uzbekistan;
- Electronic maps in a 3D format combining land and real estate objects introduced in the Scandinavian countries provide the possibility of keeping reliable information and multi-purpose cadastre;
- cadastral listing of land and immovable property objects in the cross-section of a single land plot makes it possible to determine the value of the single property tax in reliable ways;
- training cadastral experts on the cadastre of buildings and structures help to create reliable and transparent information.

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