DIGITAL SOLUTIONS FOR THE ADMINISTRATION OF LAND MANAGEMENT PROCESSES IN THE REPUBLIC OF BULGARIA

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Abstract

Due to errors in the administration of processes and delayed digitalization of management processes related to land, as well as a subsidy policy based on outdated data, the confrontation of individual subsectors in the Bulgarian agricultural business is constantly growing. A large part of the information systems, and especially the information, were available at different times to individual economic entities. For the most part, large farmers started the digitalization of their business long before the state administration. The possession of information has created serious advantages. The consolidation of agriculture, and hence all the negative consequences, is also due to this fact. Late implementation of digital solutions for management of agricultural business leads to a decrease in its efficiency. The digitalization of land administration processes by the state has been implemented in slower timeframes, with untimely implementation of effective solutions. Making management decisions "piecemeal", without connection between individual applications and data, leads to the collection of incomplete and unreliable information, as a result, the agricultural business in Bulgaria has a relatively slow development. It is necessary to build a comprehensive management vision based on information systems and a secure mechanism for control of deviations, and the institutional framework and digital solutions to be synchronized before their design and timely implemented after a thorough analysis, including forecasting the financial economic results of their implementation.

At this stage in Bulgaria, digital solutions for control and management by the state are characterized by catch-up, not anticipatory development. The role of the state as an administrator of the relations between owners and users of agricultural land and owning the overall information about the state of the land resource should be a leading one to achieve effective support for access to information and digital solutions. The digitalization of land administration processes by the state is successful and timely when there is a connection between the individual applications and data, and the information collected is complete and reliable.

Keywords: digital solutions, land management, process administration, problems, solutions *JEL code* – *Q01*, *Q15*, *Q13*

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Introduction

Today, in the context of an increasingly intensive transformation of economic systems and an increasing need for sustainable development of the agricultural sector, the driving forces and real expectations are aimed at meeting the objectives set in the reformed Common Agricultural Policy for the period 2023-2027. The task of sustainable development is, through the joint use of innovative technological solutions and public policies, to ensure the economic viability of environmentally friendly, natural resources and the environment, agriculture. (Nikolova, 2022) (Башев, Х., Н. Котева, Д. Митова и др., 2019). Investments in the agricultural sector for the acquisition of tangible fixed assets are mainly aimed at modernization of farms; environmental protection; animal welfare; renovation of equipment and introduction of new technologies, etc. . Effective management of land resources is an important condition for the economic prosperity of any company unit associated with ownership of agricultural assets. (M3X, www.mzh.government.bg, 2023)(Николова, 2019).

In order to administer the processes of land management, it is an indisputable necessity for the accelerated development of an important and priority sector, such as the agricultural sector. They are a prerequisite for slowing down the negative economic and social processes, the demographic structure and the trend of rural depopulation (Николова М. , 2021). In most cases, the areas with the least usable agricultural area operate with the relatively largest number of farms that cultivate mainly their own land. This requires digital technologies to be tailored to the scale of the business. In small areas, the use of expensive software solutions is unprofitable and the information is insufficient to make informed decisions. In the Bulgarian scientific literature there are a number of publications on the state and challenges in the development of land relations, on the agricultural land market, but there are no in-depth studies on the problems of restoring land ownership and administering the relationship between: *owner-user-state and the introduction of optimal digital management solutions*.

In view of the above, **the object of study** in this paper is the state and potential for applicability of digital solutions in land management relationships. **The main research objective is the main research objective for the implementation of digital solutions for agricultural land management and the role of the state for their selection and timely implementation. The main research goal on the potential of digital solutions is outlined by studying negative practices in land management and formulating conclusions and recommendations for improving the administration of processes.** The specific tasks for the implementation of the research objective are:

- ✓ a survey on the process of 'land restoration' and substantial deviations in establishing ownership;
- ✓ analyzing the digital solutions used for different types of land (urbanized, forest and agricultural), the terms of their implementation in order to establish the degree of deviations from the actual ones.

The study is based on two types of data: official institutional data and own, collected through face-to-face interviews, site visits and archival records from a consulting organization. The research methods used include general scientific research methods, empirical-theoretical and logical-theoretical methods, as well as analytical tools: analysis and summary of specialized literature and a schematic method for presenting characteristics and trends.

Analysis of the problems in restoring land ownership in Bulgaria

Sustainable land management in the Bulgarian economy is undoubtedly an important factor for the implementation of innovative digital solutions. For this purpose, a clear vision of ownership is needed, as well as optimization of the state tools for the introduction of existing mechanisms. In the dynamic conditions of the Bulgarian economy and the search for opportunities to increase sustainability in land resource management, the *main problems They find expression in two directions*:

- how digital technologies are used to restore ownership;
- determining the terms, methodology and scope for the implementation of technical solutions for agricultural and urbanized areas and forestry.

Digital technologies in the restoration of property in chronological order

The restoration of property in Bulgaria begins with the law Ownership and Use of Agricultural Land (M3, 1991). In the recovery procedures are created *Land Separation Plans* and *Property Maps* in existing or recoverable old real boundaries with the relevant registers. Their content was subsequently transferred in digital form and was called *Map of restored property* (KBC) for agricultural and forest areas. The first discrepancy between the need and the actions of the process management policy is that the Bulgarian coordinate system KS70, based on the Russian KC63, which were previously used for military purposes (scheme 1), is used for land mapping.



Scheme 1. Map of Bulgarian coordinate system KS70 Source: (Йовев, 2013)

The problem is that the KS1970, **represents a planar coordinate system** and the country is divided into 4 zones: K3, K5, K7 and K9. The coordinates are in millions of meters, as *In the north-south direction there is an overlap of about 40 km*. The basis of the KC70 is the "XC50 old" instead of the updated one. Besides the planar coordinate system, overlapping and erroneous data in the delineation of properties above 50 cm, the mapping was carried out by poorly qualified employees. Apart from this, there are geographical data for parts of Bulgaria that are in other coordinate systems (1930, 1950, Sofia, etc.). CC 70 is used in the issuance of sketches and other documents by municipal administrations, cadastre offices and municipal agricultural offices (OCD) and despite the short-comings it has been used for over 20 years. Meanwhile, the Ministry of Territorial Development and Construction in 1995 issued *Instruction for determining the coordinates of geodetic points by GPS* (MTPC, 1995). Since 1999, the use of the WGS84 planar coordinate system (UTM) began to be imposed in practice, in whose zone 35 the whole country can be collected with minimal errors.

After the entry of our country into the European Union (EU) was introduced *Bulgarian Geodetic System 2005* (BGS 2005). Unlike WGS84, the base ellipsoid is GRS-80. A standard UTM projection is applied to it. Unfortunately, the digital solutions used were not quickly changed enough to use this standard and a year later the Ministry of Regional Development and Public Works (MRDPW) issued (MPPE, 2010)Instruction, for the determination of geodetic points using GNSS and declares ,,all geodetic systems other than BGS 2005 and WGS84" to be local .(MPPE, 2011)

The restoration of the ownership of the land **leads to the creation of** *the Map of Restored Property (KBC)* – tabular and graphical data for all agricultural properties

in Bulgaria. The defining components are: Ekate, property identifier, area, land category, area, bordering properties, method of permanent use, owner. After the restoration of ownership, the Ministry of Agriculture (MoH) assigns the updating of the maps and part of the registers to them to private geodetic "maintenance companies" in GIS (cartographic) format. Full information and documents about the land are serviced by the OSZ, but in tabular form (with software product IMCO-3, under DOS). The problem in this period is the lack of synchronization between the "maintenance company" and the OSZ (graphic and tabular part), offline work on deadlines inconsistent with agrotechnical activities. Statutory division or correction of information about an agricultural property goes through a long procedure and sometimes the data in the OCD are not updated. As a result, there is a discrepancy between the data in the OSZ and KBC in terms of ownership, merger and division of properties. By 2015, the OSZ was working with technologically obsolete programs under DOS. For the graphic part for the needs of the OSZ, in the period (2002-2004) was assigned the development of a graphical module under Windows, as the software product CadiS remains the property of the developer and the Ministry of Health has the right of use for a certain period. Accordingly, information about agricultural properties and owners is held by a private company that dictates the terms and sets the rules.

Upon Bulgaria's accession to the EU, an Integrated System of Administration and Control (IACS) was created, based on another Geographic Information System (GIS) of Technologica. (https://technologica.com/, 1990)This allows for the same official information at the level of state administration to exist 3 different systems, which not only have no connection with each other, but also have a discrepancy in the maintained data. The reason is that the data is updated between different systems, through intermediate files and often at the discretion of a specific employee of the OSZ, a system operator. The data is on local computers and Their inconsistency can be caused even by a damaged computer. Typical for this period is that the systems are local, each service maintains certain lands, with a different update period and often even with non-matching data from nomenclatures. A typical example is the term "locality", which, in addition to being written on the territory of two neighboring lands in different ways, is often written in the database of 1 and also land in several ways. In a period of about 5 years there is another problem - CadiS the area of the properties is calculated on the basis of graphic data, which differ from the official figure for area in the documents and tabular information about the property in the register (the error is from 0.05% i.e. up to 2 m^2 of a property, but with over 3.6 million properties could be substantial).

Agricultural land in Bulgaria is categorized into 10 bonite categories according to Ordinance 261 of the Council of Ministers of 1996, updated in 2018. (M3XF, 2018). The expertise of the category is carried out by the Institute of Soil Science "Nikola Pushkarov", Agricultural Academy – Sofia. In our opinion, the primary

assessment of the category was carried out in too short a time, which leads to numerous errors. For example, in the hilly regions it is almost unlikely that there is a 2nd category of land, but according to statistical documents such a category exists. The methodology also includes old crops that are no longer grown in our country. Moreover, under different climatic conditions and varying degrees of human intervention, a change in the category of land may occur. However, subsequent reassessment is carried out at the request of the owner and after payment. All this leads to

Problems in determining the deadlines for implementation of technical solutions for agricultural, urbanized areas and forestry

substantial discrepancies between the land data in the registers and the actual state.

The first Cadastre Act in Bulgaria was established in 1908 and has been repeatedly amended. The Unified Cadastre Act was adopted in 1979. A new Cadastre Act complying with the restoration of ownership entered into force in 2001 with a changed name. (Закон за кадастъра и имотния регистър, 2023)

The Geodesy, Cartography and Cadastre Agency, 2000, plays an important role in determining the possible deadlines for the implementation of technical solutions. According to the planned plans, all agricultural land should be covered by the Cadastre by 2012. This deadline is not only not met, but the process of transferring the management of agricultural land to the Cadastre only then begins. *After 2018, over 90% of the agricultural land has already been transferred to the Cadastre*. While the properties in KBC are identified by 6 digits, in the Cadastre they are 8. Due to the fact that a different technical solution is used to create the cadastral map, when converting from old to new numbers for 10% of the properties there is no correspondence between the numbers.

The mapping and inclusion in Cadastre of the urbanized territories began almost simultaneously with KBC, as early as the 1990s, but was carried out according to different rules and procedures, with different technical means. This leads to a discrepancy between the boundaries of settlements and agricultural lands, there is overlapping of maps, a significant discrepancy in information between them, etc. It turns out like this, that the information about agricultural land is reflected in KBC, at a later time cadastral maps of the settlement are created, in a subsequent period the KBC is drawn with another technical solution, after which the Cadastre of the settlement is updated again, etc. (diagrams 3 and 4). Given that the process is controlled by different ministries, teams and different procedures, the information between the urbanized and agricultural territories does not correspond to each other. For example, different digital solutions are used for coverage in the Cadastre: in Ruse - MCad, for Sofia - MCad, CadiS, ArcGIS. In fact, the transfer from paper to digital media is done piecemeal, through various digitization systems, with a serious time difference, on the basis of which multiple overlaps and discrepancies of information occur.



Figure 3. PIC Map by CadiS Source: CadiS Annex (ECT, 2008)



Figure 4. PIC Map with Google Maps Source: Appendix Bank Properties (http://propertybank.eu/, 2011)

With the Ordinance on the Structure of forests and forest land and the hunting and economic regions shall determine the conditions, order, ways, methods and mechanism for conducting the inventory of forests and lands of the forest fund, the development of forestry and hunting projects, plans and programs under the Forests Act and the Hunting and Game Protection Act. In Art. 2. of the Ordinance says that "Forestry and hunting projects, plans and programs shall be prepared on the basis of adopted nomenclature, structure and format of the database operating in the environment of Relatifndl Datadase Management Systems ((M3F, 2004)RDBMS), respectively – geographic information systems and allowing combined analyzes and random reports, as well as visualization and printing of thematic maps at the request of the user. "Accordingly, when mapping the forest fund, there is overlapping of boundaries and discrepancies with maps and registers for agricultural land and this is typical at the level of administrative management. Users are the next entity to influence the blurring of boundaries between agricultural land and forestry. In some places, users leave some of the agricultural territories to become afforested, usually because of the mismanagement of unattractive properties. In order to prevent erosion, for environmental and other reasons, it is administratively planned to create tree belts in agricultural land. In other cases, unscrupulous users, for financial gain, unregulated cut down the tree belts and sow them with agricultural crops. And this changes the general structure of the soil, ecosystem characteristics, leads to adverse climatic changes and others. Unfortunately, this is a common practice.

Summarizing the gaps in the technical solutions in the delineation of property boundaries, they are: use of insufficiently perfect coordinate system in mapping agricultural land; lack of a unified vision for the implementation of GIS systems and various solutions for mapping agricultural land, forest and urban area, which leads to overlaps and inaccuracies; The change of the regulatory framework and the technical solutions are not considered in depth and connectivity.

Administration of the relationship between owners and users and existing digital management solutions

The land restoration process creates two main entities – owners and users. Relationships are established between them that directly affect the way the land is managed. Administering these relationships without digital technology is virtually impossible. Therefore, the evolutionary development of relationships and digital technologies need to go hand in hand.

Retrospective analysis of the first digital solutions for property management, rent relationships and administrative documentation in Bulgarian agricultural companies

The study on the development and implementation of digital solutions includes the opinion of experts and developers of software solutions, as well as direct interviews with tenants, chairmen of cooperatives. Data was collected through visits to specialized exhibitions related to agribusiness (AGRA Plovdiv, Dobrich Fair, BATA Agro) for the period 2002-2022.

The first digital solutions for process management in agricultural companies emerged in the period **1995-2000**. There are software applications that maintain electronic registers of lessors, properties with their characteristics and rent calculations. These programs are under DOS, usually on assignment of a particular tenant or agricultural cooperative and calculate the rent with regional scope – the software program "Rent" of a Silistra company, software solutions with partial functionality in Haskovo and Plovdiv, software product "Cooperative 21" with regional coverage Ruse and Svishtov.

In **2004** the Bulgarian market includes the software system *AGROSYSTEMS* (successor of ,,Cooperative 21"). Unlike the above described software applications, it not only calculates possible variants of rents, works simultaneously in several agricultural periods, serves all administrative reports. In the following years, it became a specialized ERP for agribusiness, with server installations, the ability to work remotely through VPN, multiple users and access rights. In 2012, it manages the processing processes of over 10% of Bulgaria's arable land.

The third period (2007-2012) is characterized by a shift in the focus of digital solutions for agribusiness management more in generating administrative documents than in servicing the business itself. Some of the software applications are dropped because they are not updated as software and fail to serve their users in a timely manner. Of the above software applications, in the long run only AGROSYSTEMS "survives", and in 2008 the team offers the software product *Tenant-bg* – simpler, designed for the "smaller", type "family businesses". In the same period, the unfair competition of *AgroOffice began*, by imitation of foreign brands and products.

Bulgaria's accession to the EU is the beginning of the first mass measures to support the introduction of innovations in agribusiness. Unfortunately, due to the lack of purely administrative capacity to assess innovation, many good solutions were rejected for funding

from the State Fund Agriculture (SFA) and the opinion was imposed that *digitalization was only to ,, serve the connection with the state administration* ". Meanwhile, tenants, cooperatives and small LPs use information for identification of properties and their technical characteristics on paper or electronic carrier, without a real idea of where they are located. This necessitates the emergence of graphic modules to the information systems serving tenants and the VP.

In 2009 a module "Maps" at AGROSYSTEMS was developed for comparison between the graphic delineation of the properties, physical location and rents (% of average yield). The graphic module works in symbiosis with the other modules of Agrosystems, and in 2010 a similar solution was sold under the brand Tenantar BG and Agromanager BG (scheme 5). Characteristic of them is the fact that the "graphical information" is used from the zem file, which is transformed on the map, but the documentary (tabular data) is used as data. The information about the owners of the property is separated so as not to misuse the personal data.

Due to the fact that the CAD uses the software product *CadiS*, a large number of tenants and VP's prefer to purchase it in order to match their cards with those in the OCD. Logically, later (in 2015) the module "Rents" of CadiS appeared.

At the same time (2012) "orthophoto shooting" is already applied for the needs of IACS, but the linking of information cannot be used by ordinary users, but is available only to the MAF (MAF). Due to their monopoly position for access to information, "selling information" practices are emerging.



Figure 5. Map of KWS várhu BingMaps with contracts for rent/lease and selected property Source: software product (*Arpocucmemu*, 2009)

In 2012, the Agrooffice Maps module **appeared**, **but due to the wrong method-ology**, **the errors in the conversion of graphic outlines are greater than CadiS**,

Agrosystems and Tenant Farm. Another problem is the use of "import" of data from Usage Contracts. In 2016, the rights to Agrooffice were acquired by Yara Bulgaria.

The fourth stage (after 2012) includes a "new awakening" for digital solutions:

- ✓ Helios Soft Ltd. with the product "Evrozem" a "hybrid" copy of Leased Contracts BG and Agrooffice, and later a module "outlines" and mobile solutions, including the prohibited practice of selling information about owners;
- Technofarm Company, 2014 a system for creating agreements for agricultural land (GIS), but also related to the ownership and use of agricultural land;
- ✓ NIK offers navigation for agricultural machinery. The navigation systems, complete with the "Agrotasker" of VA Consult Ltd. and the "Agronomist Module" (part of Agrosystems), allow for two-way transfer of information from the software to navigation and vice versa. In 2022, NIK buys the entire hardware and software business for Bulgaria and Romania of YARA. At the moment, A large part of the software and hardware solutions for agricultural property management in Bulgaria is owned by NIK.
- ✓ *Farmnet365*, with representative Universal NVG since 2016, offers a version in Bulgarian. The solution is based on GIS, but has no access to information about properties in Bulgaria.
- ✓ "MCAD" is the best mapping software developed specifically for land separationand compatible with the system used by MAF for "tabular data" by IMCO 3. The latter has its customers so far mainly geodetic companies and "maintenance companies".

Consolidation by use against consolidation by ownership

After the land reform, our country is among those with the lowest average amount of land ownership – **86% of the properties are under 10 acres** (http://propertybank.eu/, 2011). At the same time, the land is cultivated in large blocks of tens – up to thousands of acres. **The consolidation** is a redistribution of agricultural land in order for owners or users to obtain consolidated properties in one or more places.

✓ Consolidation by use. The first attempt to regulate the consolidation in Bulgaria was the bill on land grouping introduced in 1908, which remained unconsidered. The first practical experiments were in 1911 in the village of Madan (Montana region). The current current law law on on Usage consolidations is under art. 37 of (LFA). By law, tenants are required to make (M3, Закон за собствеността и ползването на земеделските земи, 2015) Land Use Agreement On all lands in which they work, but initially have no technical ability, partial agreements are made and separately the areas are calculated. This necessitates the emergence of software for carrying out voluntary agreements based on graphical information and electronic registers (scheme 6).



Scheme 6. Cards by use (consolidations) Source: (https://www.bgfermer.bg/Article/4242368, 2023)

Property information, along with the owners' data, is stored and processed in ZEM files. In order to prepare an agreement, the boundaries of the property properties are compared with the created "arrays by use", which requires software solutions to look for a way to work, observing the law. Due to the inconsistency of the data exchange formats of the state administration and the companies preparing the agreements, in some lands it is impossible to carry out voluntary agreements with any other technical means than CadiS. Initially, the OSD must control the process, but the digital agreement must load the official property data with their arable parts for the specific agricultural year, as well as the data of the users. The OSC is not allowed to provide some of this information. As a result, software applications are technically workable, but can not get up-to-date data to work with, which leads to many errors in the period 2012-2016. The problem forces the Ministry of Health to create a structure for data exchange based on SHP format – agreements in electronic form.

Unfortunately, in the rules for the drafting of the agreements are added additional "restrictions" by the state, which distort the market of agricultural land and the determination of rents. For example, the term "uncultivated part of the property" is introduced, which is not actually maintained by the OSZ, but is relied on to be recalculated on the basis of the created "legitimate layer" and "permanent grass layer" for the needs of the IACS. Since these "layers" are constantly changing, and by 2022 they are determined for the most part manually by an operator, the possibility of making mistakes is relatively large. This benefits both unscrupulous users indicating cultivation of unused areas and owners (funds) who buy land at very low prices on the grounds that it is uncultivated. The second known scheme are the so-called "draughtsmen" – companies that "take advantage" of the information and the errors in the system and declare that they cultivate land that they do not actually cultivate, but receive subsidies for it. **Digital solutions for creating voluntary usage agreements.** For this purpose, a technical tool is needed, such as specialized modules to existing digital solutions – **Agrosystems, Imoti Bank**, CadiS. Logically, in the coming years both **Techno Farm** and **Agro Office** offer software products for voluntary agreements. Since 2012, the OSD has been carrying out service agreements with CadiS, which allows discrepancies in the data. In addition, due to the need to convert from one coordinate system to another, for specific lands, technical errors are obtained, which in some places lead to a 15% "increase" of the cultivated area. After the rework of CadiS in 2012-13, this problem was fixed. Currently, the process of creating voluntary use agreements is regulated with the mandatory use of **CadiS**.

✓ Ownership consolidations. It is mainly carried out by large funds, such as Special Investment Purpose Joint Stock Company (REIT). Similar are: ELANA (ELARG), RosAgroFund, Staven and others. These funds invest in the purchase of land and respectively their management is different from other landowners. They have much greater financial and managerial resources and in order to satisfy the requirements of their shareholders they must use high-end digital solutions – Xerox, Microsoft Vision, or own improvements of Agrosystems, Agro Office, Imoti Bank. In the period 2000-2015 there is a serious *conflict between Funds and Tenants, as the funds actually destroy small businesses – small tenants and agricultural cooperatives that are not flexible enough in the use of digital solutions*. On the other hand, the intertwining of capital and interests leads to a symbiosis between large tenants and funds. Often, large companies artificially create unrelated companies in order to be able to receive maximum subsidies. This requires everyone to modern digital solutions for management of agricultural processes to create modules type "Holding Management".

Legal and technical prerequisites for "land theft" (white spots)

The so-called "White spots" is regulated in the Agricultural Land Ownership and Use Act (LEAPA). In cases where the owner is not interested in his land, it is allocated ex officio to farmers who profit from it. The basis on which the regime is based is laid in 2002 in the Agricultural Land Use Act. The regime was introduced immediately after our accession to the EU, with an official goal being to reduce uncultivated land. A disguised goal is to find a mechanism by which to entitle persons who are not owners or tenants to receive a document from the state, that they can process it and receive subsidies. The problem is that even if the owner wants to cultivate the land or does not want to distribute it ex officio, he must annually submit a declaration to the General Insurance and Geodesy at the location of the property. This regime has no equivalent in another EU Member State, it is the result of lobbying by large farmers. There are risks for the owners of "white spots" who are entitled to receive rent ("average rent payment for the respective land"), but after a complex procedure in the OCD at the location of the property; tenants can deliberately not conclude contracts with the owners and "twist their hands" for the price of rent; "trading" with information; concluding "fictitious contracts"

in "unclaimed properties". In any case, the regime is to the detriment of the small owner, who is even likely to lose his land. The property law entitles anyone who has "in good faith" 10 years of someone else's property to acquire it as an owner (this does not apply to properties held as white spots on the basis of orders under Art. 37c, para. 4).

Conclusion

At this stage in Bulgaria, digital solutions for control and management by the state are characterized by catch-up, not anticipatory development. The role of the state as an administrator of the relations between owners and users of agricultural land and owning the overall information about the state of the land resource should be a leading one to achieve effective support for access to information and digital solutions. The digitalization of land administration processes by the state is successful and timely when there is a connection between the individual applications and data, and the information collected is complete and reliable. To minimize negative practices, a comprehensive management vision based on information systems and a secure mechanism for control of deviations should be built. It is imperative that the institutional framework and digital solutions be synchronized before their design and timely implementation after a thorough analysis, including forecasting the financial economic results of their implementation.

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