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BUILDING A DATABASE FOR FINANCIAL MANAGEMENT OF LAND IN NINHHIEP COMMUNE, GIALAM DISTRICT, HANOI CITY

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ABSTRACT

Gialam district is one of the gateways into Hanoi capital, where urbanization is actively progressing. As a result of urbanization, in recent years, land market in Gialam has been booming. Therefore, in order to avoid possible financial losses on land use, it is necessary to improve the cadastral management system. A cadastral database has been developed for Ninhhiep commune, Gialam district based on GIS technology, which includes spatial data (landuse maps) and their attributes (detailed information of land owner, land category, land price and legal status of 3494 land parcels). This properly and carefully developed cadastral database allows users to g*et al*l necessary information (referring map and its attributes) for every land parcel in the area. Therefore, while using this cadastral database, users can get recorded land use status, land use ID and its area, and land use owner's financial responsibility. This cadastral database also allows users to get necessary information for preparing financial reports on land use and to develop a land price map. It can also support land use owners to clarify their financial responsibility. In order to enable timely update land use information, WebGIS technology was integrated in the database to allow users to get necessary land use information through internet (with limited access to secure this cadastral database) using smart phones. The result of the present study is practically significant in the era of the development of information technology for management activities in general and for cadastral management in particular.

Keywords: Cadastral management, database, land use, land price, financial management of land.

Xây dựng cơ sở dữ liệu phục vụ công tác quản lý tài chính về đất đai tại xã Ninh Hiệp, huyện Gia Lâm, thành phố Hà Nội

TÓM TẮT

Huyện Gia Lâm là cửa ngõ vào thủ đô Hà Nội đang trong quá trình đô thị hóa. Trong những năm gần đây, thị trường đất đai ở Gia Lâm trở nên sôi động nên công tác quản lý đất đai cần được đẩy mạnh nhằm tránh tổn thất về tài chính đất đai. Với sự trợ giúp của công nghệ GIS, các nhà nghiên cứu đã xây dựng cơ sở dữ liệu, bao gồm cơ sở dữ liệu dữ liệu không gian (bản đồ thửa đất) và dữ liệu thuộc tính bao gồm các thông tin về chủ sử dụng đất, loại đất, giá đất và tình trạng pháp lý cho 3494 thửa đất. Dữ liệu không gian và dữ liệu thuộc tính của thửa đất đã được xây dựng một cách đầy đủ,chi tiết, đồng nhất, trung thực và có một liên kết Web tốt. Sau khi hoàn thành cơ sở dữ liệu, cơ sở dữ liệu có thể hiển thị các thông tin thuộc tính như: tình trạng sử dụng đất, mã thửa đất và diện tích, cũng như tình trạng của các nghĩa vụ tài chính; cho phép Tìm kiếm, tổng hợp thông tin tài chính về đất đai; Hỗ trợ thủ tục kê khai các nghĩa vụ tài chính về đất đai; Xây dựng bản đồ giá đất; Để cập nhật cơ sở dữ liệu của bất kỳ thay đổi một cách kịp thời. Nghiên cứu cũng sử dụng công nghệ WebGIS để đưa toàn bộ thông tin về cơ sở dữ liệu trên internet (có phân quyền bảo mật) để cung cấp thông tin về cơ sở dữ liệu và sử dụng điện thoại thông minh là một công cụ phổ biến để có thể truy cập cơ sở dữ liệu. Đây là một nghiên cứu có ý nghĩa thiết thực trong kỷ nguyên phát triển công nghệ thông tin cho tất cả các ngành nói chung và quản lý đất đai nói riêng.

Từ khóa: Cơ sở dữ liệu, giá đất, quản lý tài chính về đất đai, quản lý đất đai, sử dụng đất.

1. INTRODUCTION

Information technology is rapidly growing and it is predicted to continue the growing trend in the future. Information technology helps to solve a wide range of complicated socio-economic issues, thus, it is considered as an inevitable instrument for management. In order to meet the management requirements and exploit this advanced technology in land management, it requires strong changes in organizing as well as in improving quality of cadastral information.

At present, there are lots of gaps and obstacles in financial management of land, causing losses of large revenues for the state. The current manually paper-based data organisation, achieve and management system hardly meet the requirement of fast solving question-answer demands, causing difficulties in analysis and synthesis of information related to financial management of land. Therefore, cadastral management sector needs land related information and accurate data in a scientific arrangement for different purposes.

Ninhhiep is a commune of Gialam district, Hanoi City. Similar to other communes in the district, baseline survey data, paper-based maps, log-books, and record books are not unified and cumbersomely archived, leading to difficulty in information retrieval and obstacles in land management in general and financial management of land in particular. Therefore, building a database that serves the financial management of land in the commune and its expansion to a district-wide database for financial management of land in the future is an urgent need.

2. MATERIALS AND METHODS

2.1. Study area

Ninhhiep commune was selected for the present study. It is located in the northeast of Gialam district, about 18 km from the center of Hanoi. The commune has a very convenient geographic location, convenient transportation, and an eventful commodities exchange point in a stable political, cultural, and social status with good economic development. Land use and management, especially financial management of land should be strict monitored in order to generate income source for the state budget.

2.2. Methods

In the present study, cadastral maps of Ninhhiep commune were collected and used as a source of spatial data of the database. Cadastral documents including logbooks, cadastral books, logbooks of landuse right certificates (LURCs), monitoring books of land use changes, current status of land use in 2016, the decision announcing land price in 2014 by Hanoi People's Committee, and other cadaster-related information on the study area were collected from government agencies at different levels. These data were then used as a source of attribute data of the database.

Cadastral maps were then edited in MicroStation software and exported to Shapefiles in ArcGIS. 18 fields of the attribute database were created and information of all land parcels were added.

A number of applications based on the established database were then deployed using functions of ArcGIS such as mapping, calculating, analyzing and searching data.

Finally, ArcGIS Online and ArcGIS Server software were used to publish the database online. The new Web-page Application Builder was used to create a website for database sharing.

3. RESULTS

3.1. Spatial Database

In order to undertake spatial data, the collected cadastral maps were edited using MicroStation software to create a general cadastral map for Ninhhiep commune. The map was then exported to ArcGIS Desktop for editing to create the spatial database of the study area.

Research object has been classified into specific layers and transferred in Geodatabase on ArcCatalog for storing.

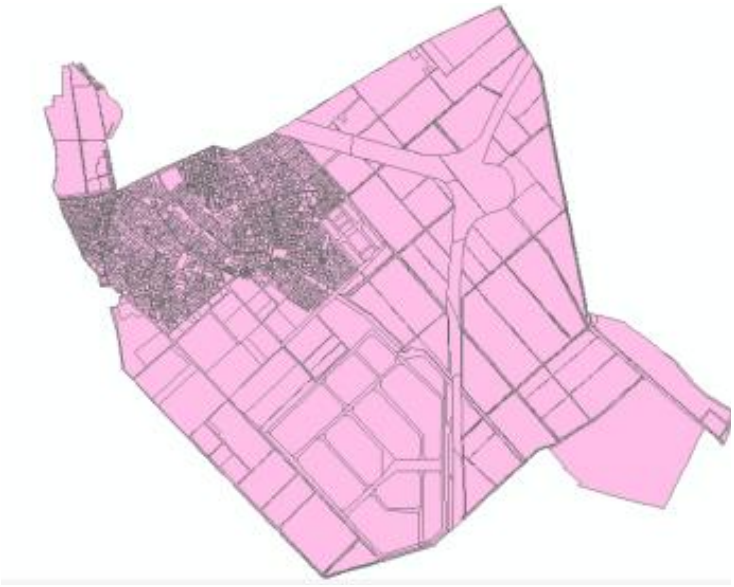

Figure 1. Database for land parcels in shape file *.shp

Table 1. Attribute data of land parcel layer

Field name	Field type	Remark
CHUSD	Text (50)	Name of the land use owner
NAMSINH	Float	Date of birth of the land use owner
TENDUONG	Text (50)	Street name
DIACHI	Text (40)	Address of the land parcel
VITRI	Float	Location of the land parcel
TOBANDO	Short Integer	Map number
THUASO	Text (3)	Land parcel number
DIENTICH	Float	Land parcel area
TINHTRANG	Text (40)	land use rights status
SO_GCN	Text (20)	Land use right Certificate number
NAMCAP	Text (10)	Issue date of Land use right Certificate
GIADATQD	Short Integer	Land price according to State Regulation [3]
NGUONGOC	Text (50)	History of land parcel
MDSD	Text (30)	ID of land parcel
LOAIDAT	Text (30)	Land use type
NVTC	Text (40)	Financial obligation status
NVTC_NO	Text (10)	Type of financial obligation in debt
GHI_CHU	Text (70)	Other remarks if neccesary

The data of the land parcels after converting are line data. Therefore, these data on the land parcels were converted to polygons using the Feature to Polygon tool in ArcToolbox. The resultant polygon data were then used to create the spatial database of Ninhhiep Commune (Figure 1).

3.2. Attribute database

The data collected included cadastral maps, books of accounts, logbooks for LURCs, cadastral books, land use monitoring books, registration and declaration books for landuse (LU) owners classified per street of the town, decisions on issuing LURCs, etc. These data were then

aggregated according to the data fields with each row storing attribute information of a parcel. In total, 18 data fields were created and attribute data of 3494 parcels of land in Ninhhiep commune were built (Table 1).

3.3. Application of the database for financial management of land in Ninhhiep commune

3.3.1. Look-up information on financial status of a land parcel

User of the database can look up (retrieve) information on a land parcel, or in other words, look up information by an independent value. The information can be looked up, such as map No., land parcel No., land use owner, and land use purpose, etc.

With the functions of searching and inputting information of land parcel, the retrieval result is the image of the land parcel on the map and its attribute data.

3.3.2. Information retrieval and aggregation on land finance

Using the attribute selection function, database users are able to search and aggregate all available financial data of all land parcels in the commune quickly and accurately in a few simple steps. This function significantly enhances the effectiveness of financial management of land in the area compared to the previous manual management (Figure 2).

3.3.3. Support in identifying financial land receipts

From the present land-price database, the amount of money to be paid by the land users to the state in the performance of financial obligations are calculated using query function and calculating function in combination with formulas for calculating financial obligations [4, 5], for instance:

- Calculation of land use fee must be paid upon receipt of a certificate of land use right:

*Land use fee (VND) = land area (m^2) * land price (VND/m^2)*

- Calculation of personal income tax upon receipt of a certificate of land use right or land use right transfer (in the case income from land is unidentifiable)

Personal income tax (VND) = 2% land price (VND/m^2) * land area (m^2)*

- Calculation of the registration fee upon receipt of a certificate of land use right or transfer of land use right

*Registration fee = 0.5% * land price (VND/m^2) * land area (m^2)*

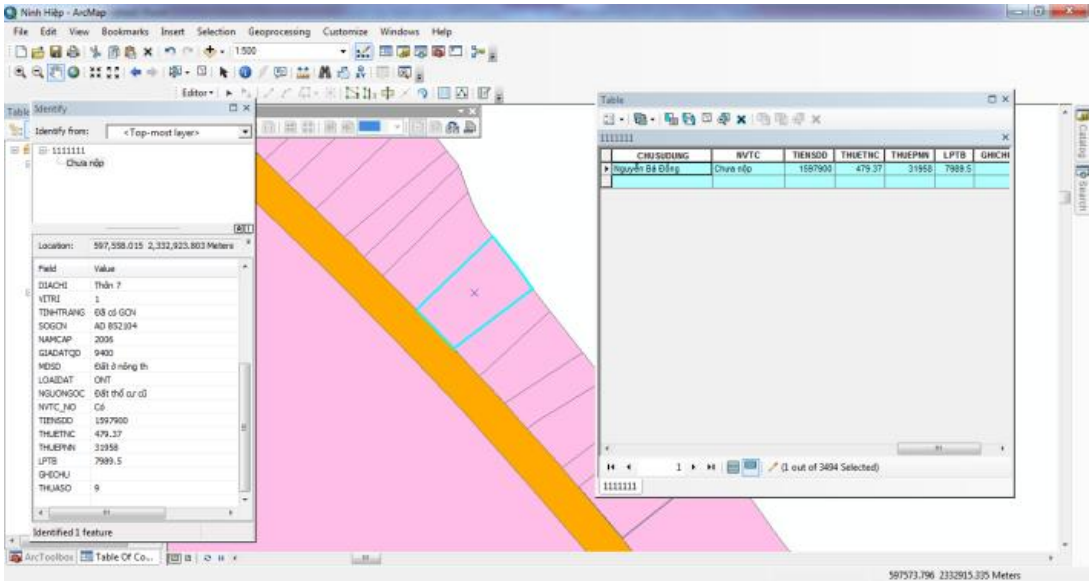

Figure 2. Land plot No. 9 on Map No. 1

- Calculation of annual tax of land use

*Tax of non-agricultural land (VND) = taxable price (VND) * tax rate (%),*

where taxable price (VND) = land price (VND/m^2) * land area (m^2)

To calculate non-agricultural land use tax that must be paid by an individual household for each parcel of land, we simply created a field "ThuePNN" and use the calculation tool in ArcGIS to retrieve data from related fields and then set up a calculation formula. The tax is then determined, for instance, households with unpaid lanuse tax (Figure 3) or financial obligation on land transfer (Figure 4).

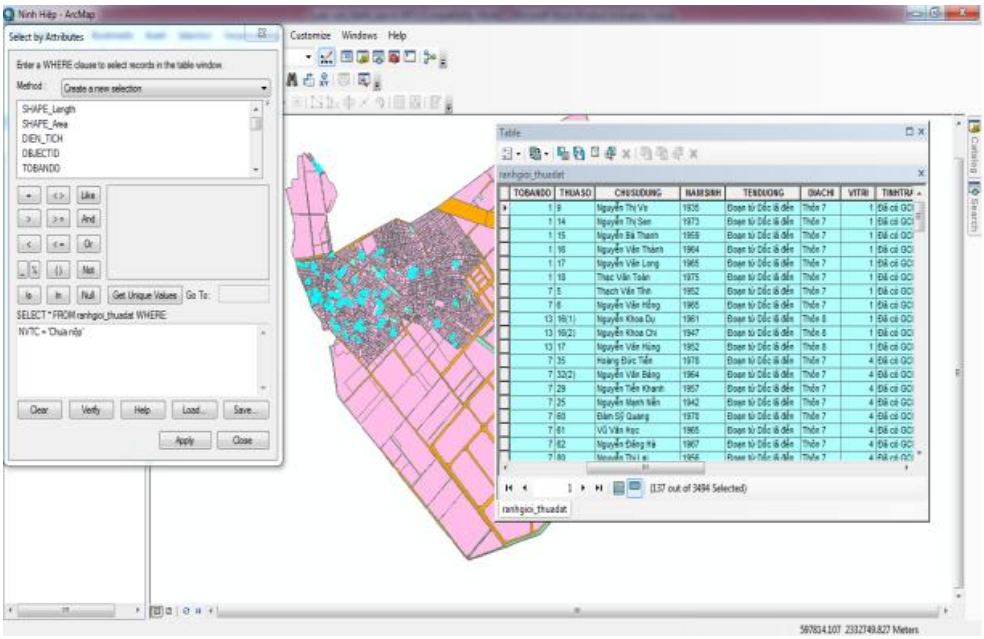

Figure 3. Households owing LU tax

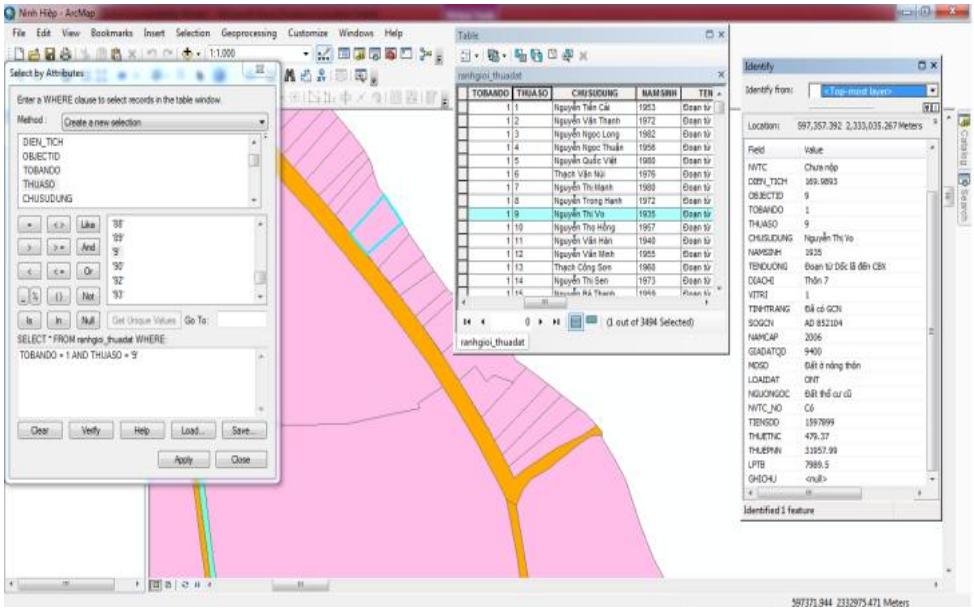

Figure 4. Financial obligation on land transfer from Mrs. Nguyen Thi Vo to Mr. Nguyen Ba Dong

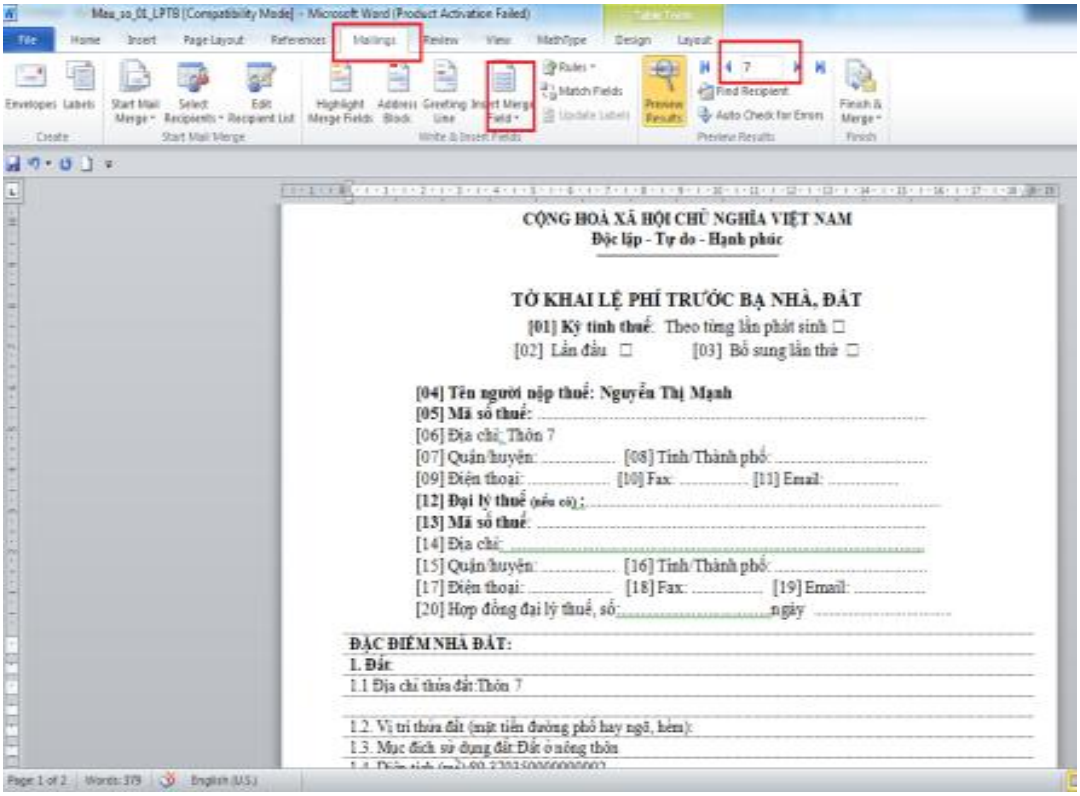

Figure 5. Result of land transferring fee declaration

3.3.4. Support procedures for declaration of financial obligations on land

With the complete database system created after the above mentioned database building process, using the Mail Merge feature of Microsoft Word with a few simple operations, a complete documentation set for people can be generated. This contributes to a reform of administrative procedures and to improving the efficiency of the service of the natural resources and environmental management.

3.3.5. Land price mapping

A land price map of Ninhhiep Commune was produced and colors were used to represent different land price ranges.

The highest land price is 9.4 million VND/m^2 at the location No 1 from La Slope to Canh Buom Xanh Eco Area

The lowest land price is 4.54 million VND/m^2 at location No 4 from Canh Buom Xanh Ecotourism site to the end of Ninh Hiep commune.

Average land price in Ninh Hiep commune is about VND 6.97 million per square meter.

3.3.6. Other functions of the database system

In addition to the above described applications, the database also enables land managers to perform business tasks quickly, such as calculation of the area of land loss when performing land clearance (Figure 6) and calculation of compensation for households (Figure 7). Data managers are also more likely to promptly update land changes as well as financial information on land to ensure that the land database is always accurate.

3.4. Sharing database on WebGIS

3.4.1. Sharing database on ArcGIS Online

To share the database on WebGIS, an account of ArcGIS Online was created and maps generated from ArcGIS Desktop were shared on ArcGIS Online. From here, spatial data and attribute data are managed and stored in the My Content section of ArcGIS Online

(Figure 8). Data on the Web is secured by specific access permission.

3.4.2. Developing a website which provides database for Ninhhiep commune

From the database that has been shared on ArcGIS Online, users build their own websites for managing and manipulating data through the preconfigured ArcGIS Online functions [2]. This also helps users to manage the database more scientifically and to create data links with other websites (Figure 9).

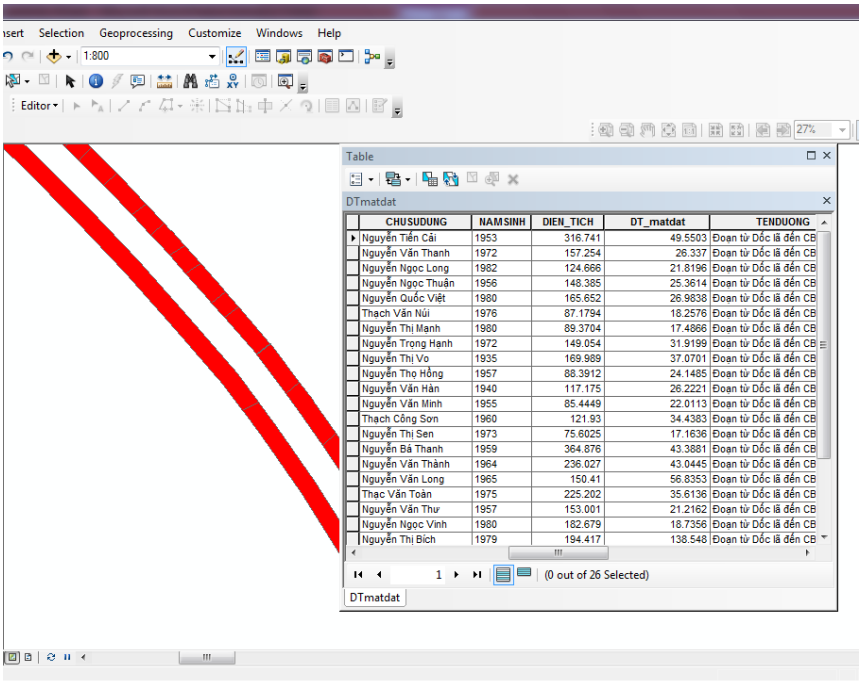

Figure 6. The area of land loss when performing land clearance

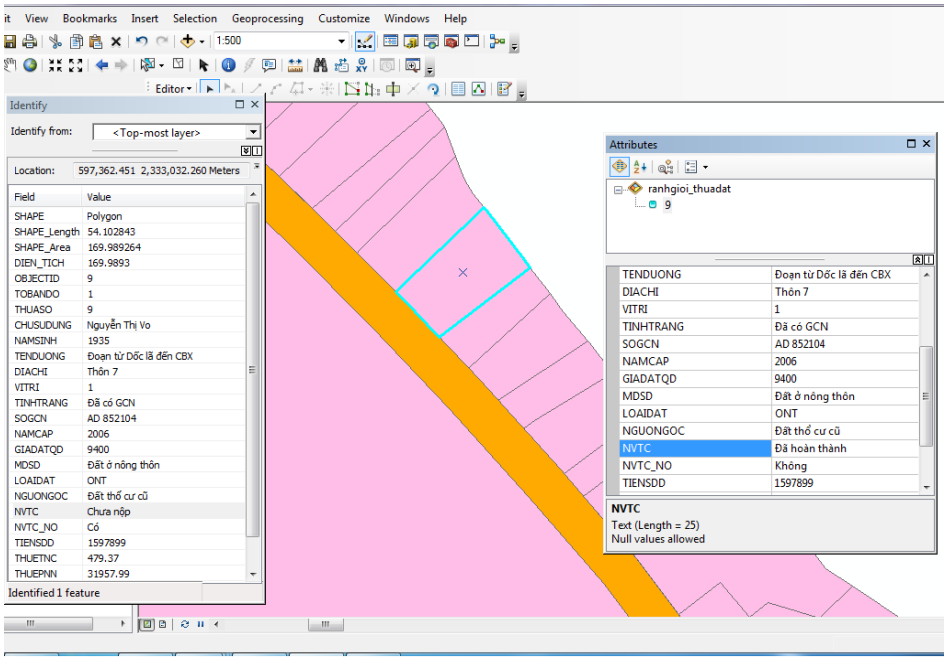

Figure 7. Update financial information on land plot No. 16

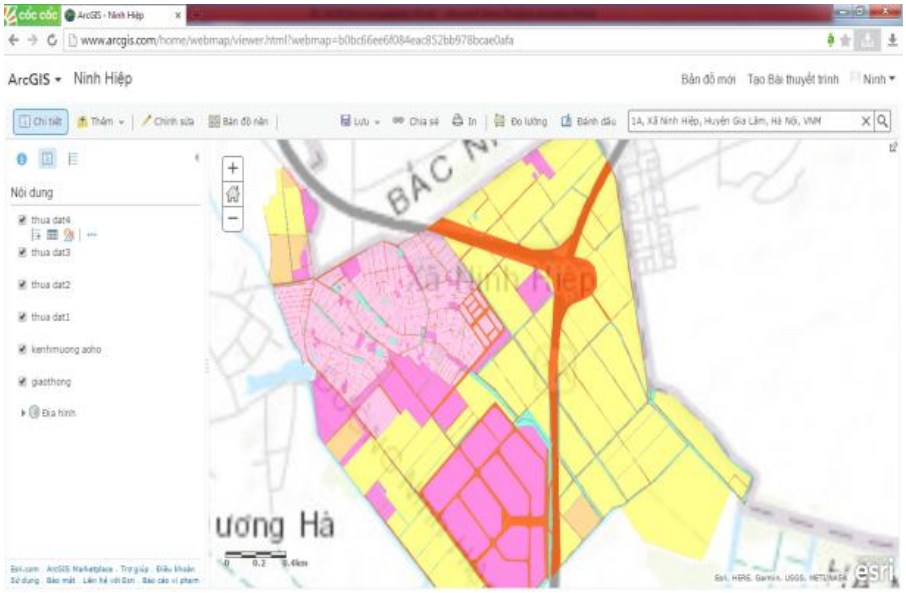

Figure 8. Data on land price is stored on My Content section

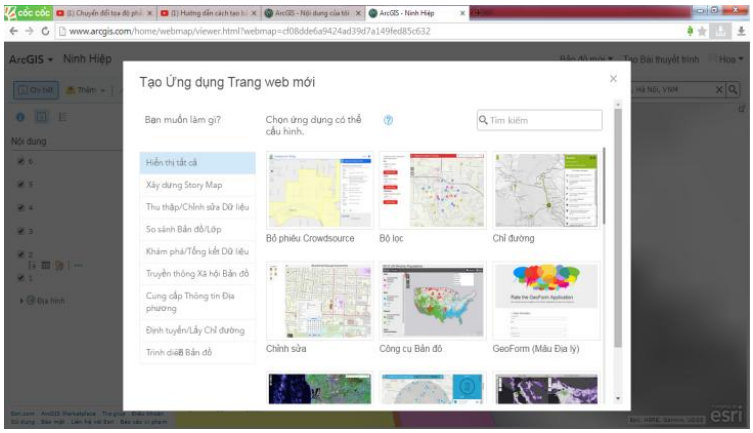

Figure 9. Create application on website

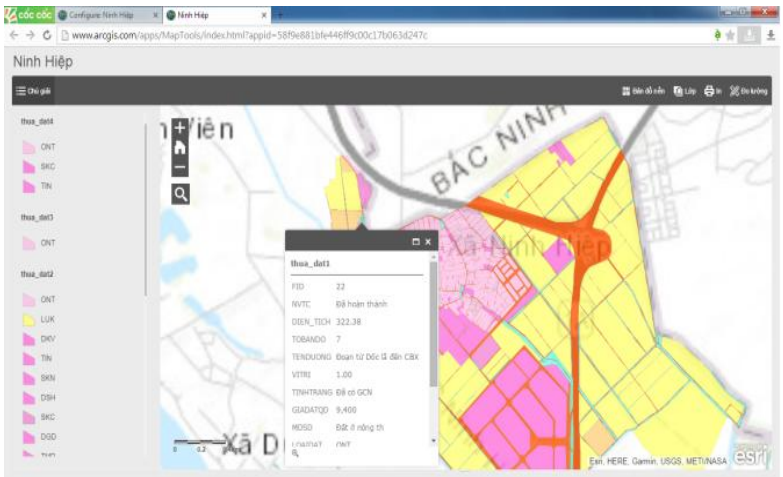

Figure 10. Image of main Website with Cadastral database of Ninhhiep commune

After completing the setup of necessary items in the website, the process of building a simple WebGIS database based on ArcGIS Online technology has been completed. Figure 12 shows the interface of the website. Shortcut keys were displayed on the website interface to help users find information, classify information layers, and retrieve information. Data administrators can update information, modify, edit, print, and create maps for presentations directly on the web, and then export them to Microsoft PowerPoint for presentation when needed.

It has been proven from research and application that WebGIS is a modern technology with many advantages and having ability to bring high efficiency to the management of land information, helping implement issues related to land allocation, land lease, land use right transfer, and land use purpose conversion. This is the basis and foundation for the establishment of legal relationships between the state and land users. A number of studies on the applications of WebGIS in land information management have been conducted (Vo Quoc Anh *et al.*, 2014; Vu Hoang Thuong, 2015). It should be noted that the input database system should be standardized based on thematic layers of land information. This is the most important stage in the process of creating the precision of handling, integration and spatial analysis of data to produce the output. The research subject concerns individual land parcels so that the motto of "grasp firmly, manage tightly" the current situation and changes of land use can be achieved. From that, managers can catch up with land developments and make appropriate and sound decisions.

4. CONCLUSIONS

The database for Ninhhiep commune was completely and synchronously constructed, detailing each parcel of land. This database includes spatial data (land parcel maps with 3494 parcels) and attribute data with 18 fields describing land users, land parcels, land prices, and legal status of land parcels. The database for Ninhhiep commune could be used to serve a number of tasks in financial management of land in the commune such as defining financial obligations of land users, summing up status of financial obligation fulfillment, calculating annual land use tax as well as other financial obligations when land users perform their rights, creating a map of land price and some other relevant applications during the implementation of land management at grass-root level.

During the course of use, when there is a change in the status of land parcels, both in terms of morphology and properties, the database can be quickly updated.

Database on the Website is stored and secured on ESRI cloud computing technology to avoid attacks from malicious programs. However, in order to access the ArcGIS Online application, an account provided by ESRI is required. ArcGIS Online allows the use of a non-commercial account during a 60-day trial period so many of its functions could not be fully exploited. To use the database effectively for financial management of land in the study area, investment on material facilities and personnel training from the goverment are strongly recommended.

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