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DESCRIPTION OF THE DATABASE DEVELOPMENT METHODOLOGY FOR CREATING A DIGITAL PORTAL FOR FARM HOLDINGS

Many farms face many problems when selling their products. Here are the main ones: low product prices; lack of access to markets; transportation costs and logistics; seasonality and storage of products; price instability; administrative and legal barriers; lack of knowledge of modern marketing tools; insufficient support from the state;

All these problems are interrelated and require a comprehensive approach to solving them, including through infrastructure development, new technologies, improved logistics, and government support.

Note: A farm is an enterprise that carries out agricultural activities based on the use of land and other natural resources for the production of agricultural products. It can be small, medium or large in size, and is usually focused on producing products for its own consumption and/or sale.

Keywords: database, digital portal, development methodology, farming, agriculture.

Statement of the problem. Database development for farms is extremely important for optimizing business processes, automating management tasks, and increasing operational efficiency.

Here are the most relevant areas for developing databases for the country's farms:

1. Production management and product accounting.

Creating a database to record all types of products grown by the farm (vegetables, fruits, grains, meat, etc.). This allows you to track the quantity, yield, and availability of products in the warehouse, and also helps in production planning.

2. Accounting for machinery and equipment.

Maintaining a database of machinery and equipment used on the farm (tractors, seeders, combines, etc.). This allows you to monitor maintenance, operating times, and ensures efficient use of resources.

3. Accounting for employees and their schedules.

A database that stores information about farm employees, their functional responsibilities, work schedules, salaries, and other data that allows for effective human resource management.

4. Yield analysis and forecasting.

Using a database to collect and analyze data on the yield of different crops under different seasons and conditions. This allows you to predict future harvests and plan production resources.

5. Monitoring of agricultural crops and soils.

Development of a database for tracking the condition of crops, diseases, pests, as well as monitoring soil parameters (moisture, acidity, nutrients). This helps to quickly respond to problems and optimize growing technologies.

6. Inventory of material resources.

A database for accounting for material resources (seeds, fertilizers, pesticides, plant protection products, etc.). This allows you to control stocks, expiration dates, and the need for purchases.

7. Control over finances and expenses.

A database for tracking financial transactions, costs for crops, land cultivation, material purchases, employee salaries, and other expenses. This allows for detailed accounting and analysis of the farm's financial results.

8. Control over suppliers and partners.

Creating a database to store information about suppliers (seeds, fertilizers, machinery), partners, and contacts with other farms. This facilitates procurement management and creates the basis for effective business relationships.

9. Sales and customer accounting.

Development of a system for keeping records of sales and customer data. This includes information about customers, their orders, purchase history, and delivery features, which allows you to improve customer interaction and personalize offers.

10. Data collection for reporting and analysis.

A database for automated collection of information for state and internal reporting. This includes information on production and financial indicators required for reporting to regulatory authorities or for internal performance analysis.

There are also additional features, namely:

1) Integration with geographic information systems (GIS). Using GIS for spatial analysis of land plots and monitoring of agricultural crops, which helps optimize land use.

2) Automation of warehouse management. Maintaining a database of warehouses, maintaining stocks, and movement of goods and materials. This allows you to minimize storage costs and control shipments.

3) The development of such databases helps farms improve the efficiency of their operations, reduce costs, automate routine processes, and make more informed decisions based on analytics.

That is why, based on the above, the relevance of this topic of work is determined, which in turn implies that to solve it, it is necessary to analyze and give a detailed description of the methodology for developing a database when creating a digital portal for farms.

Analysis of recent research. Recent research in the field of creating databases for farms highlights the importance of integrating information technology to improve the management and development of the agricultural sector.

The main areas include:

1. Institutional transformation and regulatory framework. The research analyzes the stages of development of farms in Ukraine, in particular through the prism of institutional changes and the influence of the regulatory environment. It examines aspects of legal support for farmers' activities, which are key to the formation of effective databases.

2. Analysis of the state and prospects for the development of farms. The research focuses on the current state of farms in Ukraine, identifying key problems and prospects for their development. The results can be used to form databases that reflect the real state of the agricultural sector.

3. Methodological approaches to researching farm development. Research methods are considered, which include statistical data analysis and other approaches that can be integrated into database systems to improve management decisions.

4. Planning of farm activities. The research focuses on production planning issues in the context of rural development. The proposed methodological frameworks can be implemented through appropriate databases to support planning processes.

Overall, recent studies highlight the need to implement integrated farm databases that take into account institutional, legal and economic aspects, contributing to the sustainable development of the agricultural sector. The creation of farm databases is an important topic in agricultural research, information technology and agronomy.

Here are some famous names of domestic and foreign scientists and researchers who have worked and are working on this topic:

Ukrainian scientists: Igor Kravets (Ukrainian scientist in the field of agronomy and information technologies, who studies the issues of automation and information support of agricultural enterprises); Serhiy Boyko (professor in the field of agricultural sciences, author of research on the informatization of agriculture, including the design and use of databases); Oleksandr Ganzha (specialist in the field of agronomy and digital technologies, who worked on the creation of intelligent systems to support agricultural business); Mykhailo Ivanenko (researcher engaged in the development of information systems for the agricultural sector of Ukraine, including databases for managing production processes on farms).

Foreign scientists: John A. Taylor (professor of agronomy and information technology, who worked on the development of information systems and databases for agriculture, to optimize the use of natural resources); Henry D. Smith – (scientist who deals with the use of information technology and automation in the agricultural sector, in particular the design of databases for farms); Benedict AL Lee (author of numerous studies in the field of information technology for agriculture, including the use of databases for monitoring and managing production processes on farms); David M. Reiley (scientist in economics and agronomy, who studies the use of databases to optimize agricultural production processes and the effective management of agricultural enterprises); Klaus JH Rech (specialist in the field of computer science, who developed systems for data management in agriculture and the creation of databases that contribute to the effective management of land and production resources).

These scientists and many others have made a significant contribution to the development of active implementation of databases for digital farm portals, which allows increasing the efficiency of agricultural production through the use of the latest technologies and management methods.

Also the following scientists are actively involved in the issues of scientific research in this area: Pasichnik V.V. [1], Reznichenko V.A. [1], Gaidarzhi V.I. [2], Izvariv I.V. [2], Chubuk V.V. [3], Balik N.R. [4], Shpenik T.B. [5], Zinovieva O.G. [6], Sharov S.V. [6], Redko I.V. [7], Lisenko O.M. [7], Lubko D.V. [8], Ben Forta [9], Sylvia Moestl Vasilik [10], Anthony Molinaro [11], John Viescas [12], Alan Beaulieu [13], Allen Taylor [14].

Formulation of the purpose of the article. The purpose of this article is to analyze, develop, and describe a database development methodology for creating a digital portal for farms.

The main part. Developing a database for a digital farm portal/website is important for organizing, storing, and effectively managing information on the portal/website. Let's develop a step-by-step methodology that will help you create a database for such a digital portal/website:

Stage 1. Requirements analysis and planning.

Defining the purpose of the database: Start by understanding what information you need to store and process. This could be data about products (vegetables, fruits), orders, customers, suppliers, employees, etc.

Data types: Determine what data you want to store. For example:

Products: Name, description, price, quantity, photos.

Customers: Name, phone, email, shipping address.

Order: Order date, quantity of goods, order status.

Employees: Name, role, work schedule.

Stage 2. Designing the database structure

Tables: Design tables to store different types of data. For example:

- Table products (for products).
- Table customers (for customers).
- Table orders (for orders).

- Table employees (for employees).

Field in the table: For each table, define the fields.

For example, for a table products hese could be:

- id (unique product identifier),
- Name (product name),
- description (description),
- price (price),
- quantity (quantity in stock),
- image (link to photo).

Relationships between tables: Determine how the tables will interact with each other:

For example, the table orders must have a field customer_id, which will refer to the table customers.

There can also be a relationship between the table orders and products to record which products are ordered.

Stage 3. Choosing a database management system

Choose a database management system to implement your database. If you don't have specific requirements, you can use:

- MySQL or PostgreSQL for large or medium-sized projects.
- SQLite for simple and small projects.

If your portal/site is developed on WordPress, you will use the default MySQL database.

Stage 4. Creating tables and defining relationships.

Creating tables: Use SQL queries to create tables. For example, to create a table products:

```
CREATE TABLE products (
id INT AUTO_INCREMENT PRIMARY KEY,
name VARCHAR(255) NOT NULL,
description TEXT,
price DECIMAL(10, 2),
quantity INT,
image VARCHAR(255)).
```

Indexing: Create indexes on important fields for faster searching. For example, an index on fields name for products and email for customers.

```
CREATE INDEX id x_name ON products (name);
CREATE INDEX id x_email ON customers (email).
```

Stage 5. Filling the database (recording data).

Insert test data into the table using SQL queries:

```
INSERT INTO products (name, description, price, quantity, image)
VALUES ('Tomatoes', 'Fresh Organic Tomatoes', 20.5, 100, 'tomatoes.jpg').
```

Indicate which fields are required and which are not.

Stage 6. Development of mechanisms for interacting with the database.

Data Retrieval Queries: Write queries to retrieve data from the database. For example, to view all products:

```
SELECT * FROM products;
```

Insert, update, delete data queries: Provide functions to add new products, update existing ones, or delete.

```
UPDATE products SET price = 18.5 WHERE id = 1;
DELETE FROM products WHERE id = 10.
```

Stage 7. Development of an API or interface for working with the database.

API: To connect the portal/site to the database, create an API that will handle requests from users.

This can be a simple REST API that interacts with the database through the server.

PHP/Node.js/JavaScript: Server-side languages can be used to process requests, for example:

In PHP, you can use PDO to work with the database.

In Node.js, you can use libraries like mysql or pg for PostgreSQL.

Stage 8. Database testing.

Query testing: Check that all SQL queries (add, edit, delete, and search queries) work correctly.

Check relationships: Make sure that relationships between tables are working correctly (for example, orders are linked to customers).

Stage 9. Database Optimization and Security

– Indexes: Make sure all queries used for searching have indexes on the appropriate fields.

– Backups: Set up regular automatic database backups to avoid losing important information.

– Security: Use parameterized queries to avoid SQL injections. This will protect your database from malicious attacks.

Stage 10. Database integration with the portal/site.

Connect your database to the portal/website. It must be able to interact with the database via server-side code (e.g. PHP, Node.js).

Ensure that users can easily place orders, browse products, and administrators can update information.

Stage 11. Monitoring and support

– Monitoring: Keep an eye on database performance. If you notice that performance is slowing down, you may need to optimize your queries or indexes.

– Update: Regularly update the database and add new functionality, taking into account changes in business needs.

These are the basic steps for developing a database for a farm portal/website. You need to carefully plan the structure and storage of the data so that the database is efficient and easily scalable.

Some examples of developed database tables for digital farm portals are shown in Figures 1–3.

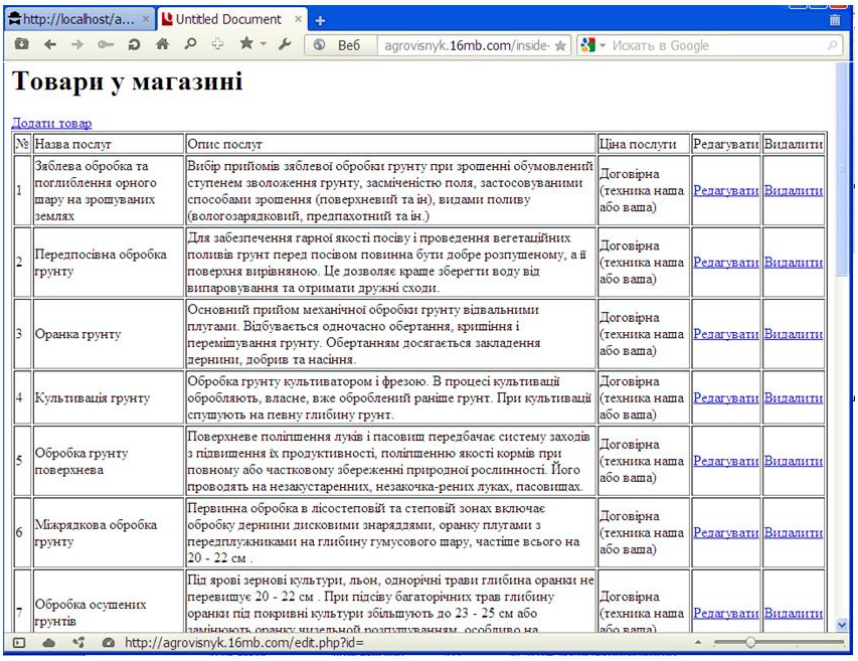
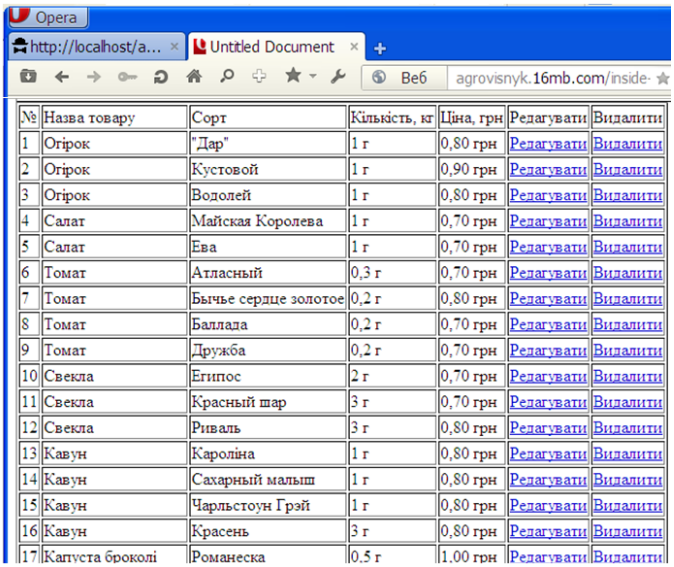


Fig. 1. Example of the table “Goods in the store” with tabular data on the services provided by the farm for soil cultivation



№	Назва товару	Сорт	Кількість, кг	Ціна, грн	Редагувати	Видалити
1	Огірок	"Дар"	1 г	0,80 грн	Редагувати	Видалити
2	Огірок	Кустовой	1 г	0,90 грн	Редагувати	Видалити
3	Огірок	Водолей	1 г	0,80 грн	Редагувати	Видалити
4	Салат	Майская Королева	1 г	0,70 грн	Редагувати	Видалити
5	Салат	Ева	1 г	0,70 грн	Редагувати	Видалити
6	Томат	Атласный	0,3 г	0,70 грн	Редагувати	Видалити
7	Томат	Бычье сердце золотое	0,2 г	0,80 грн	Редагувати	Видалити
8	Томат	Баллада	0,2 г	0,70 грн	Редагувати	Видалити
9	Томат	Дружба	0,2 г	0,70 грн	Редагувати	Видалити
10	Свекла	Египос	2 г	0,70 грн	Редагувати	Видалити
11	Свекла	Красный шар	3 г	0,70 грн	Редагувати	Видалити
12	Свекла	Риваль	3 г	0,80 грн	Редагувати	Видалити
13	Кавун	Кароліна	1 г	0,80 грн	Редагувати	Видалити
14	Кавун	Сахарный малыш	1 г	0,80 грн	Редагувати	Видалити
15	Кавун	Чарльстоун Грэй	1 г	0,80 грн	Редагувати	Видалити
16	Кавун	Красень	3 г	0,80 грн	Редагувати	Видалити
17	Капуста броколі	Романеска	0,5 г	1,00 грн	Редагувати	Видалити

Fig. 2. Table “Goods in the store” with tabular data on new arrivals of crop seeds offered for sale by the farm

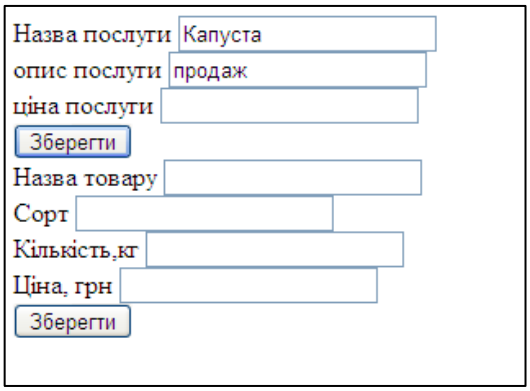


Fig. 3. Table "Goods in the store" of the administrative menu of the digital portal in the editing mode of the seed sales service

Let's make some preliminary important conclusions and recommendations on the topic of the importance of creating databases for digital platforms (websites) of farms. Namely, these are:

1. Improving agricultural production management.

Creating databases for farms allows for the efficient storage and processing of information about production processes, including acreage, crop yields, soil conditions, and animal health. This helps optimize resources, reduce production costs, and increase farm efficiency.

Recommendation: Implementing monitoring and data management systems will help farmers make more informed decisions about their agricultural activities.

2. Optimization of the use of natural resources.

Thanks to databases, farmers can track the use of water, fertilizers, pesticides, and other resources, which contributes to a more rational and sustainable use of these resources. As a result, the negative impact on the environment is reduced.

Recommendation: It is recommended to integrate systems for monitoring and analyzing the use of natural resources into databases, which will help reduce their costs and improve the environmental situation.

3. Improving financial planning and reporting.

Databases allow farms to keep detailed financial records, analyze profits and expenses, and plan future budgets. This helps reduce financial risks and improve financial stability.

Recommendation: Farmers should consider using specialized programs for financial accounting and planning based on data stored in centralized databases.

4. Increasing competitiveness.

Agricultural enterprises that actively use databases for market analysis can better predict demand for their products and adapt sales strategies. Information about market conditions and prices helps reduce the risk of losses.

Recommendation: Farms should integrate modules for collecting and analyzing market data into databases, which will allow them to better adapt business strategies to market changes.

5. Increasing transparency and access to information.

Creating a single digital data repository helps improve interaction between farmers, suppliers, buyers, and government agencies. This contributes to increased transparency, which is especially important for accessing financial assistance, grants, and government subsidies.

Recommendation: It is worth considering the possibility of open databases for farmers, allowing for effective interaction with authorities, suppliers and other market participants.

6. Development of agricultural technologies and innovations.

Databases are becoming an important tool for integrating the latest agricultural technologies. They allow the use of automated systems for processing data on plant and animal health, soil conditions, which makes it possible to apply precision agriculture and reduce costs for protection products.

Recommendation: Farmers should actively implement databases to integrate modern agricultural technologies such as drones, sensor systems for monitoring and use of information for precision farming.

Conclusions. The creation and effective use of databases is an integral part of modern agribusiness. They help increase production efficiency, reduce costs, improve the environmental situation and contribute to the development of sustainable agriculture. The integration of digital solutions into farming allows farmers to be competitive, optimize their operations and reduce risks.

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ОПИС МЕТОДОЛОГІЇ РОЗРОБКИ БАЗИ ДАНИХ ДЛЯ СТВОРЕННЯ ЦИФРОВОГО ПОРТАЛУ ДЛЯ ФЕРМЕРСЬКИХ ГОПОДАРСТВ

Анотація

Багато фермерських господарств стикаються з багатьма проблемами під час реалізації своєї продукції. Ось основні з них: низька ціна на продукцію; відсутність доступу до ринків збуту; транспортні витрати та логістику; сезонність та зберігання продукції; нестабільність цін; адміністративні та правові бар’єри; незнання сучасних маркетингових інструментів; недостатня підтримка від держави. Усі ці проблеми взаємопов’язані й потребують комплексного підходу до вирішення, зокрема через розвиток інфраструктури, новітні технології, покращення логістики та державну підтримку.

Створення й ефективне використання баз даних є невід’ємною частиною сучасного аграрного бізнесу. Вони допомагають підвищити ефективність виробництва, зменшити витрати, поліпшити екологічну ситуацію та сприяти розвитку сталого сільського господарства. Інтеграція цифрових рішень у фермерське господарство дає змогу фермерам бути конкурентоспроможними, оптимізувати свої операції та зменшити ризики.

Ключові слова: база даних, цифровий портал, методологія розробки, фермерське господарство, сільське господарство.