

Integrated CRM system for Bulgarian agricultural sector

Georgi Kolev, Tsvetelina Ivanova, Daniela Tzakova

University of Chemical Technology and Metallurgy, Bulgaria

georgi.i.kolev@abv.bg, t.ivanova@uctm.edu

Abstract: Agriculture is a sector in Bulgaria that contributes significantly the GDP. In the past 20 years steady trends for increasing the arable land, while the number of agricultural holdings decreases. The enlargement of the size of the agricultural holdings is strongly associated with the need for implementation of the advances of information and communication technologies, Industry 4.0 and artificial intelligence. The present paper presents the development of an integrated Customer Relationship Management (CRM) system for agricultural applications. The developed CRM system implements the following functions: customer data management, management of contracts for clients, management of agricultural land, management of processing costs, production revenue management. For the development of the presented integrated CRM system, the needs of the agricultural producers and the work with their clients have been studied in detail.

Keywords: CRM SYSTEM, AGRICULTURAL APPLICATIONS, SYSTEM INTEGRATION, DATA MANAGEMENT.

1. Introduction

The development of a Customer Relationship Management system (CRM system) within each organization aims to manage, automate and integrate sales, marketing and support functions. In this way, long-term and mutually beneficial relationships with customers are created by understanding their individual needs. The CRM system can be a stand-alone system or an integrated module of a larger business information system of the organization. The implementation of an integrated management system is a complex process that can last from several months to years depending on the size of the organization and the complexity of the included business processes [1]. Integrating the information system into an existing organizational structure is a complex task that depends on the flexibility of the system and the ability to easily set up, as well as the ability, desire, setting and training of employees to accept and use modern information technology applications. The effective implementation and use of information systems in management goes through the selection of appropriate technological solutions, good organization of their integration into the existing structure and training of staff (employees and more managers) who will serve and use it in their work.

According to PricewaterhouseCoopers, customer relationship management CRM is a strategy for building long-term and mutually beneficial relationships with customers by understanding their individual needs [2]. The CRM model of interaction assumes that the customer is the center of the business philosophy, and the main directions and goals are the activities to support effective marketing, sales and customer service. Maintaining these business goals includes collecting, storing and analyzing information about consumers, suppliers, partners, competition, as well as internal processes in the company.

CRM systems represent a whole class of software. The CRM system is an information system designed to automate the business processes in the company, ensuring the interaction of all its divisions with customers. This system is on the one hand designed to satisfy and retain customers, and on the other hand provides serves to optimize the company's activities.

The main goal of the implementation of the CRM system is to create a tool for attracting new customers and developing relationships with the existing customers. Customer relationship management, especially in financial enterprises, is of strategic importance for their success. Online banking, Internet insurance, personal care for health and insurance fund clients are difficult, even unthinkable, without an integrated CRM system [2].

- CRM system allows to structure and gather in a single database information about customers, partners and suppliers, even competitors. Archiving the history of relationships allows the

employees to "remember" the entire history of negotiations and agreements with customers and suppliers.

- The organization of electronic exchange of information minimizes the problem of "lack of information" between departments and employees of the company. Electronic business processes have a real contribution to the company's activities, and do not remain only on paper.

- Analysis and forecasting tools allow company management to make decisions quickly and efficiently. Marketing receives tools for solving tasks in the field of planning, budgeting, conducting advertising campaigns and analyzing their effectiveness. The company receives tools for quality management, storage and use of accumulated knowledge.

The CRM system may include an operational part, ensuring the execution of transactions and operational reporting, unified database, analysis subsystem, distributed sales support system.

The development of a CRM system can be the first step in building an integrated management system by integrating it with other functional modules: supply chain management (SCM - Supply Chain Management), finance (Financials) and financial management of supply chains (FSCM - Financials Supply Chain Management).

According to the statistical platform for business analysis Statistica [3], the global customer relationship management software (CRM) market is expected to grow to \$ 43.5 billion in 2024. This is a forecasted increase of almost \$ 1 billion from 2019 at a compound annual growth rate (CAGR) of 0.4%. Salesforce is the world's leading provider of customer relationship management (CRM) applications with a market share of 19.5% in 2020. The company is the market leader with a large margin, followed by SAP and Oracle with about five percent market shares [3].

Manufacturers of CRM systems are beginning to offer integration of their products with external applications, which adds the element of social media in CRM. These innovations help businesses to reach the customers through social media. CRM manufacturers see social media as a cheap way to improve customer support. This allows customers, for example on Facebook or Twitter, to state their problems and to get help. As the amount of data on the Internet grows, so does the need to analyze that data, so CRM vendors are offering better and better tools for analyzing data. The supply of mobile CRM applications is growing, which is gradually making CRM systems look and behave like mobile applications. Wireless technology will increasingly allow real-time decision making. CRM manufacturers are increasingly offering solutions through the SaaS model (Software as a service), based on Cloud technology.

Agriculture is a sector in Bulgaria that contributes significantly the GDP. In the past 20 years steady trends for increasing the arable

land, while the number of agricultural holdings decreases. The enlargement of the size of the agricultural holdings is strongly associated with the need for implementation of the advances of information and communication technologies and artificial intelligence to meet the requirements of the current industrial revolution or German Initiative Industry 4.0.

An in-depth study of the level of digitalization of Bulgarian agriculture and rural areas is presented in [4]. There the great variation in the degree of digitalization in the different sub-sectors of agriculture, holdings/farms of different legal types and sizes, and in different regions of the country is visualized. The majority of farmers are not familiar with the nature of digital agriculture, with only 14% using modern digital technologies. The main obstacles and risks in the introduction of digital technologies are the qualifications of employees, the amount of investment, unclear economic benefits, data security, lack of standardization.

The present paper presents the development of an integrated Customer Relationship Management (CRM) system for agricultural applications. The developed CRM system implements the following functions: customer data management, management of contracts for clients, management of agricultural land, management of processing costs, production revenue management. For the development of the presented integrated CRM system, the needs of the agricultural producers and the work with their clients have been studied in detail. Thus, the requirements for "precision farming" will be fulfilled.[7]

2. CRM development and integration

According the census of agricultural holdings that was conducted in 2020 in Bulgaria by the Ministry of Agriculture, Food and Forestry, its regional and municipal structures [5] and the comparison with data from 2003, there is a steady downward trend of the number of the agricultural holdings in time, while the total area of arable agricultural land increases due the increase of the arable land of the holdings above 10 hectares. This statistical survey

in agriculture is conducted every 10 years on the recommendation of the Food and Agriculture Organization of the United Nations (FAO). The rules for its conduct are established by Regulation (EU) 2018/1091 of the European Parliament and of the Council and the Law on the Census of Agricultural Holdings in the Republic of Bulgaria in 2020. The observed tendencies determine the necessity for implementation of integrated information systems as an essential tool for digitalization in the agricultural sector.

The functional requirements for the CRM system are defined, according to the most essential needs of the agricultural producers (Fig. 1). The aim of the integrated CRM system is connected with management, automation and integration of information about the activities connected with customers, land owners, contracts, lands, production, rents, payments, processing costs, products, sales, marketing and support functions.

The defined functions can make the integration of the CRM system with other systems like Supply Chain Management (SCM) system, Financials, Professional Service Automation (PSA), and in this way developing a larger business information system of the organization.

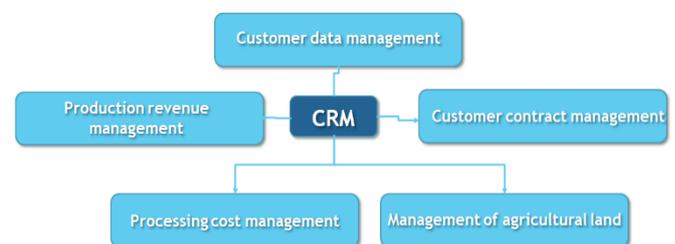


Fig. 1 Functional requirements for the CRM system

3. Database system design

The ER diagram (Entity-relationship diagram) of the developed system is presented in Fig. 2.

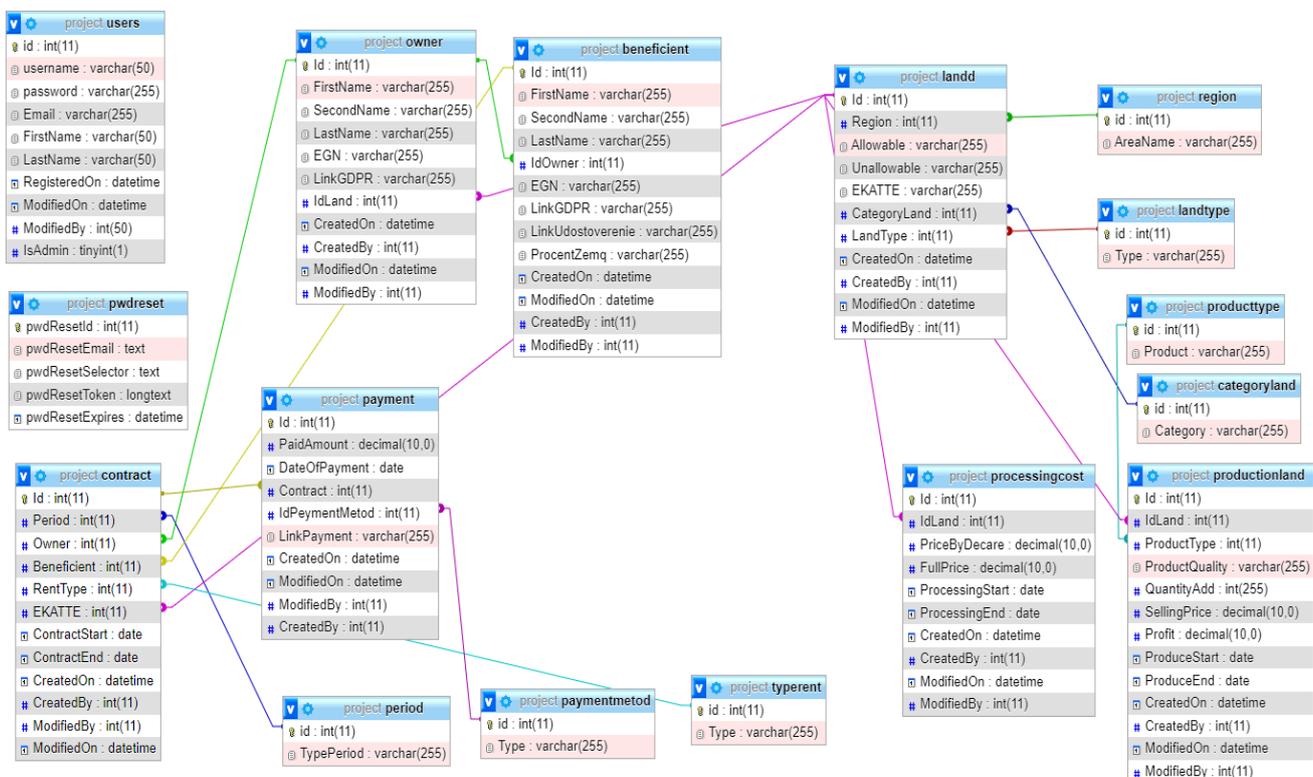


Fig. 2 ER diagram

The relational database consists of 16 tables:

1. "Beneficiary" table – contains information about heirs in case the owner is deceased, keeps a link to a copy of the document verifying the right of ownership and percentage of the land;
1. Table "categoryland" – contains information about different land categories like field, meadow, etc.;
2. Table "contract" – contains information about contracts like type of period, the unique identifier for the land, owners, beneficiaries, start and end date of the contract;
3. Table "land" – contains information about all available lands, their allowable and unallowable area, etc.;
4. Table "landtype" – contains information about land types - the type of soils;
5. Table "owner" – contains information about landowners;
6. Table "payment" – contains information about confirmed payments and a link to a document confirming the payment;
7. Table "payment method" – contains information about payment methods – cash or bank transfer;
8. Table "period" – contains information about different types of contracts' periods;
9. "Processingcost" table – contains information about processing costs for each land;
10. Table "productionland" – contains information about produce, profit, selling price, etc.;
11. Table "producttype" – contains information about different the types of crops;
12. Table "pwdreset" – additional table which eases the process of resetting users' passwords;
13. Table "region" – contains a list with all available regions in Bulgaria;
14. "Typerent" table – contains information about the different types of rent, like money, produce or combined;
15. Table "users" – contains information about system users.

4. Design and development of an online CRM system interface

PHP, HTML, CSS, BOOTSTRAP and AJAX provided by jQuery Foundation are used to implement the CRM management functions during the development of the CRM system's interface. The developed system eases the process of land management. It helps tenants of agricultural lands to manage their contracts with landowners and their heirs, to effortlessly control performed payments, to track the produce, invested funds, actual profit, etc. The developed system contains more than 20 web forms which allow filling importing and editing all required information for management of a specific land.

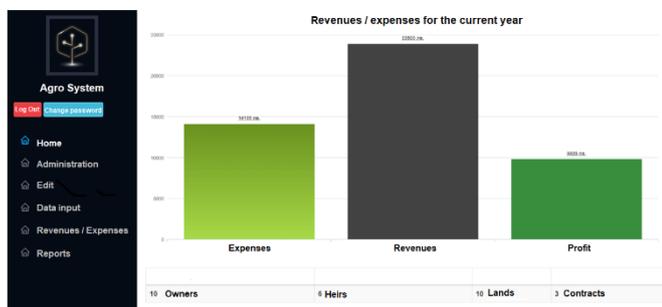


Fig. 3 Home page

The home page of the interface is presented in Fig. 3. There are defined several categories: "Administration" (visible only if the user is an administrator), "Edit", "Data Input", "Revenue / Expenses", "Reports". They give possibility to reach all other pages of the developed interface.

The "Administration" category, which is visible only for administrator users, contains the following pages: "Land category", "Region", "Land type", "Product type", "Payment method", "Rent type", "Period", "User registration". All these web pages allow changes to the main administrative data.

The "Data Input" category contains the pages: "Adding a client", "Adding a contract". These web pages allow the user to add information about new clients and new contracts.

The "Edit" category contains the pages: "Client", "Heirs", "Agricultural land", "Contracts". These web pages allow the user to edit existing information about clients (landowners), heirs and the agricultural land.

The category "Revenues / Expenses" contains the pages: "Expenses / Revenues for land", "Paid Rent". These pages show information about made expenses for corps and produce, including profit and performed payments to the landowners.

The "Reports" category contains the pages: "Processing costs", "Revenues from production", "Paid rent".

The home page also shows the main user reports "Expenses", "Revenue", "Profit" for the current year, number of active "Owners", number of active "Heirs", number of registered entities for "Land", number of active "Contracts".

Below the logo of the home page there is an "Exit" button that deletes the session and logs out the user, and a "Change Password" button that forward the user to the password change form.

5. Conclusions

The present paper presents the development of an integrated Customer Relationship Management (CRM) system for agricultural applications. The developed CRM system implements the following functions: customer data management, management of contracts for clients, management of agricultural land, management of processing costs, production revenue management. For the development of the presented integrated CRM system, the needs of the agricultural producers and the work with their clients have been studied in detail.

Acknowledgements

The research was conducted within the framework of the project KP-06-N27-08/18, funded by the National Fund "Scientific Investigations".

References

1. M. Boneva, A. Petkov, A. Nedyalkov, I. Sheludko, P. Vitliemov. Application of integrated information systems for process management in organizations. Angel Kanchev University of Ruse, Ruse, 2017
2. Customer relationship Management, Wikipedia, 2020
3. Business Data Platform Statistica. www.statistica.com
4. Bachev, H. (2020). Digitalisation of Bulgarian Agriculture and Rural Areas. Ikonomika i upravljenje na selskoto stopanstvo (Bulgarian Journal of Agricultural Economics and Management), 65(2), 3-24 (Bg).
5. Agro statistics. Census of agricultural holdings in 2020 (Agreement № 2019.0191) https://www.mzh.government.bg/media/filer_public/2021/05/05/census2020_publicationpreliminarydata.pdf
6. P. S. Vineeth, K. Shreyas, V. Nayak, T. Reddy, V. Vivek. Internet of things (IOT) for agriculture. IJCSMC, 8(6), p. 79 – 88, 2019
7. EMnify, Smart Farming – Industry 4.0 in Agriculture, Blog