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## **APPLICATION OF CRM-BASED SYSTEMS IN DECISION MAKING IN THE AREA OF INNOVATIVENESS**

### **Key words**

CRM, customer relationship management, client orientated management, computer systems, computer aided decision process, innovativeness.

### **Abstract**

The overall aim of the paper is to present a description of a developed CRM-based solution, its structure, functions, exemplar screen captures and the potential areas of application in a scientific and business activity directed at developing innovative solutions.

The paper presents original computer system that operates within the computer platform PINF, containing a selection of organisational and technical methods that enable a precise integration of business models with computer resources. The development of the system concept was preceded by the analyses of readily available CRM-based (Customer Relationship Management) software. To make an effort to meet modern organisations needs, the presented computer system is intended for managing and organising information in the process of creation, realisation, and implementation of innovative solutions. The system contains modules that support small-to-medium enterprises (SME) as well as research organisations in taking decisions in project management, client service, product sale, and marketing strategies. The proposed system operates in the SaaS model (cloud computing) and offers computing resources that are delivered as a service over the Internet.

## **1. Genesis of CRM-based systems used in managing an organisation's environment**

The growing economic internationalisation and integration of the world, because trade, services, production and science, has caused significant changes in management systems on different organisational levels, i.e. national, regional and corporate. The pace, scope and scale of globalisation have accelerated dramatically, especially in the last 25 years [18], and business units as well as scientific organisations cannot act without taking into account the internal and external environment. The rapid spread of information technologies (e.g. the Internet, ERP systems) and the development of management concepts (e.g. Lean Management, Total Productive Maintenance, Reengineering) are changing the way companies organise production, and increasingly allow services and manufacturing to be globalized.

The attitude of organisations that provide services and products has been basically and philosophically changed. In the present world, the relationship with customer is located in the centre of attention. To succeed in the global market, organisations must maintain good interactions with their customers and shape it, for example, through the personalization of services, marketing analyses, and demand studies. According to P. Drucker, "There is only one valid definition of a business purpose: to create a customer" [7]. Therefore, many companies consider customer relationships as essential assets [13]. Organisations that want to be successful in a dynamic and diverse environment have to provide an efficient way of communication between their valuable customers [14] and build an integrated system for using this information in operational activity. In the process of the development and implementation of innovative solutions, there is much valuable information around customer relationship that should be managed to be a profitable tool in decision making.

Differentiation from competitors is going to be based on the speed with which a company is capable of responding to the requirements and demands of the market with innovative products and services [2]. Therefore, although customer care has always been a basic rule of commercial activity, a new model of customer relationship management (known as CRM) is now necessary in order to adopt a customer focused form of organisation, which maximises the value customers can expect from the company and sees in the information derived from the customer providing the opportunity to establish business strategies [3].

Additionally, from the technological point of view, this new customer-focused organisational model makes it necessary to implement CRM-based Information Technologies (IT) solutions that play an essential role in offering a greater understanding of the relationship with customers [22].

## 2. Customer Relationship Management (CRM) concept

The idea of CRM can be traced back to the field of relationship marketing (RM), which has been introduced by the scientific works of Berry [1], the IMP Group [8], and Christopher et al. [4]. CRM focuses on establishing, maintaining, and enhancing long-term relationships with customers [12]. Measuring and valuing customer relationships is critical to implementing this strategy [17].

Customer relationship management (CRM) is a widely implemented model for managing a company's interactions with customers, clients, and sales prospects. It involves using technology to organise, automate, and synchronise business processes, principally sales activities, but also those for marketing, customer service, and technical support [16]. The overall goals are to find, attract, and win new clients, service and retain those the company already has, entice former clients to return, and reduce the costs of marketing and client service [9]. Customer relationship management describes a company-wide business strategy including customer-interface departments as well as other departments [5].

The central task of CRM systems consists in the following:

- (1) The systematic consolidation and analysis of customer information;
- (2) The synchronisation and support of the central operational CRM processes in marketing, sales, and service; and,
- (3) The integration and management of all communication channels between customers and a company [11].

The numerous functions of CRM are distinguished with regard to three main areas: operational, analytical, and communicative [10] (Fig. 1), that were described as follows [3]:

1. Operational CRM includes instruments and applications that support all business areas and their business processes which are in direct contact with customers, such as marketing (contact management, sales management and customer opportunity teams, monitoring of interactions with the customer, campaigns), sales (collected by different order, delivery note and bill channels) and after-sales (queries, complaints).
2. Analytical CRM corresponds to the integration and processing of the data acquired, converting it into information that is useful for diagnosing customer relationship management and defining improvement projects. Analytical CRM systems are focused on the systematic collection, evaluation, and analysis of all customer contacts and customer reactions, including resulting customer-related information. Information about customers, products, and services is stored, for example, in a customer data warehouse to evaluate, forecast, and optimise customer relationships using analysis tools and techniques (e.g. OLAP and Data Mining). In the process of building a learning system (closed loop architecture) customer actions and

reactions can be systematically evaluated. Thus, the customer-oriented business processes and the individual adjustment of the communication and service to the customers' needs can be continually improved. By building customer profiles and externalising behavioural patterns, the analytical CRM ensures the support of the strategic and tactical decision-making process.

3. Communicative (or collaborative) CRM systems ensure the communication, the synchronisation, and the management of individual communication and distribution channels (e.g. branch, Internet) between the company and the customer. The communicative CRM system is, e.g., responsible for providing the results of the analysis and evaluations of the analytical CRM at the right time to the operational CRM through the appropriate channel of interaction.

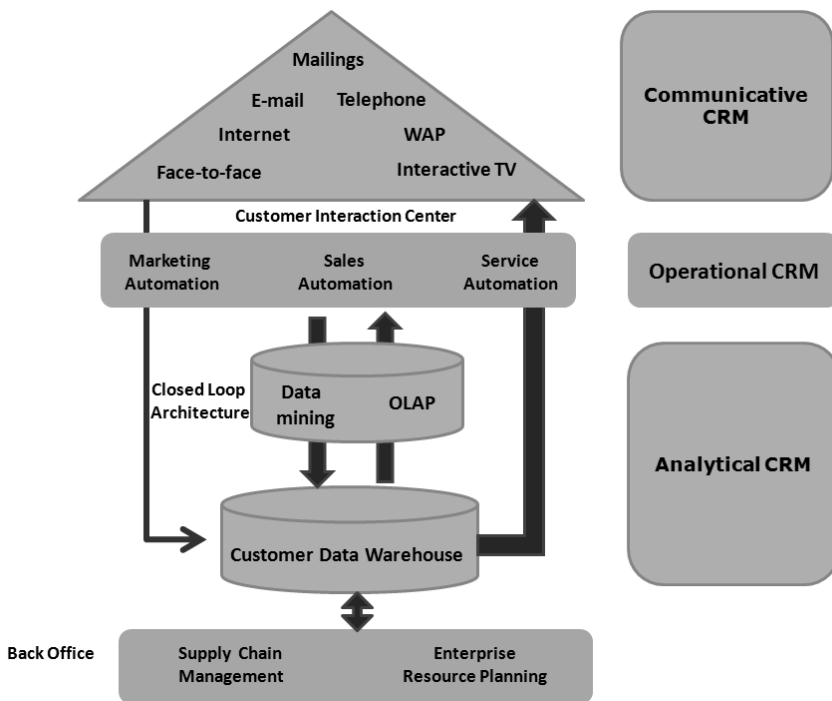


Fig. 1. IT components and technical architecture of CRM-based systems

Source: Author's on basis of [15].

To support and to ensure a consistent and holistic view of a cycle of innovative products and services within an organisation, beginning at the stage of creation through implementation, marketing and ending at after-sale services, it is increasingly challenging to propose CRM-based system focused on taking the advantage of the value of dynamic knowledge and information about internal and external environment that an organisation possesses.

### 3. Structure of the proposed CRM system

The proposed CRM-based computer systems operates within the heterogeneous and multipurpose computer platform PINF intended for support of innovative processes in the area of construction and machines maintenance [6, 19]. The platform consists of the following computer applications:

1. The computer system GeneratInn intended for managing brainstorm sessions [20, 21];
2. The system for video conferences and video seminars that enables communication of business or research teams through the Internet;
3. The computer system I-Questionnaire based on the CAWI method that enables the creation, execution and reporting of the results of research questionnaires;
4. The computer system JUMS for the management of scientific journals intended for gathering, reviewing and publishing scientific and practical results obtained while developing innovative solutions;
5. The crawler intended for searching information from various data resources that includes a semantic dictionary to personalise search results;
6. The content management system CMS designed with the use of the Joomla libraries that were adjusted to requirements of a site connected with innovativeness; and,
7. The original computer CRM system based on the SOA conception that is the subject of this paper.

The structure and functions of the implemented CRM system were proposed on the basis of analyses of similar IT solutions available on the market as well as analyses of requirements of potential users of the system, i.e., SME and research organisations. The main aim of the system implementation was to support transfer of scientific results into business practice.

The implementation of the CRM system required the following:

1. Developing a model of data-flow in the system;
2. Developing the logic and physical structure of the database included in the CRM system;
3. Selecting an open source library for adaptation;
4. Implementing the system's modules with the use of selected libraries;
5. Developing and implementing of modules for mobile connections; and,
6. Verifying the correctness of the system.

Developing the model of data-flow (Fig. 2) required taking into account the SOA concept assumptions that determine the architecture of computer systems that are focused on defining the end-user demands.

The system includes a set of organisational and technical methods that enable precise integration of business models with computer resources. Elements of the software have separated interfaces and can operate

autonomously. In the implemented system, a service is not only identified by the system components, but also has its reflection in services provided by the SME or research organisations. Those services include product selling and process technologies, marketing strategies, improving cooperation with customers and contractors, and gathering of information concerning demand for products and services. In these issues, the proposed system is a CRM-based solution that is used for managing knowledge in the process of the development and implementation of innovative solutions. It also could be used to check future demand on innovative solutions among current customers or monitoring the work of project groups. The architecture of implemented CRM system is shown in Fig. 3.

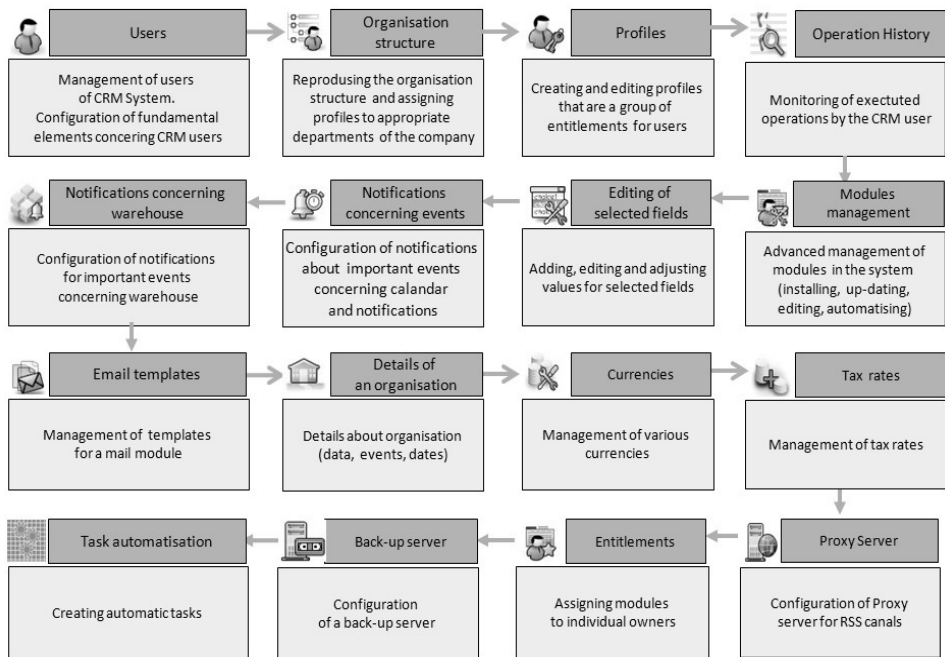


Fig. 2. Selected relations in the data-flow model of the implemented CRM system

Source: Author.

The development of a logical and physical structure was based on the data-flow model. The system includes the following main databases:

1. A database of organisations intended for gathering information about the system users (small and medium enterprises, research organisations);
2. A database intended for gathering information concerning products, contractors, customers, suppliers, innovations, sale services; and,
3. A database of services.

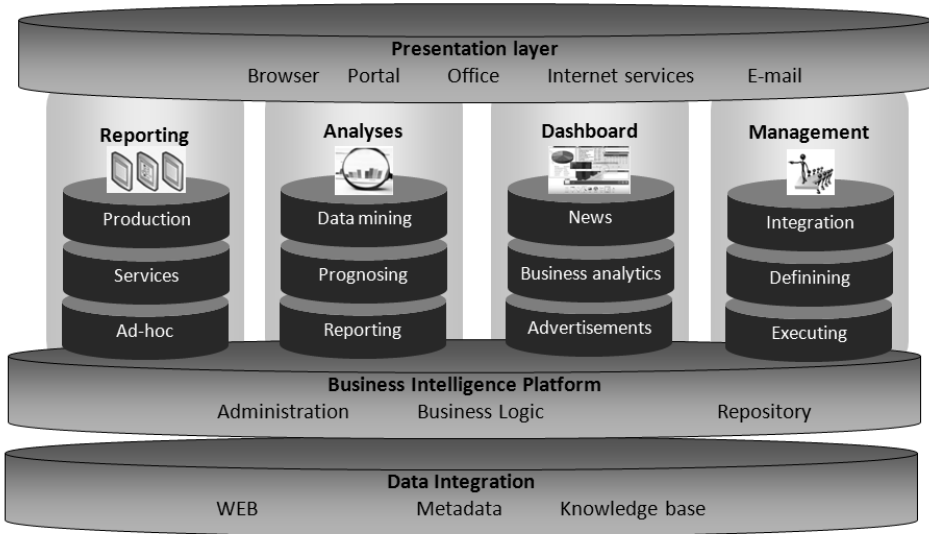


Fig. 3. The CRM system architecture  
Source: Author.

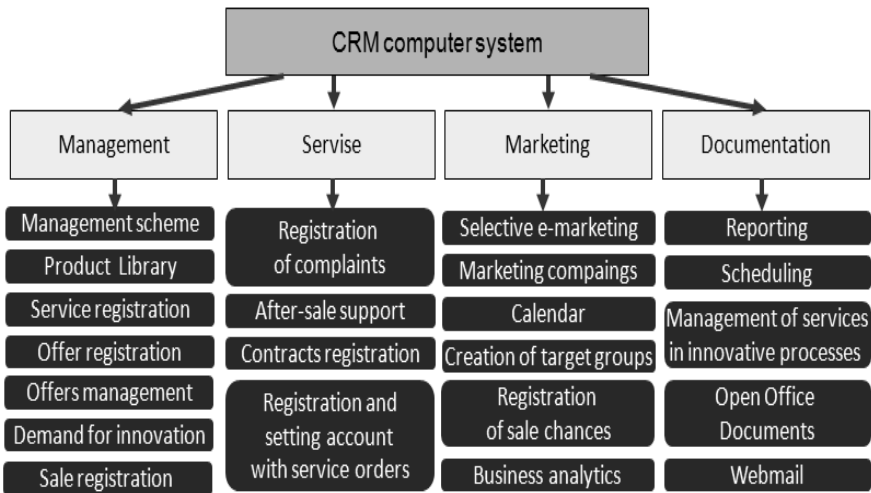


Fig. 4. The structure of the CRM computer system  
Source: Author.

The logical model contains relationships between entities. On this basis, indexes, views, and triggers for individual databases were defined. Developed models were used in creating SQL scripts for database tables. Scripts are used to generate the physical structures of database. Tables were implemented in a relational database in the MySQL standard.

The computer system was implemented with an application of modified algorithms based on an open free-license and GNU GPL license for the VTiger. Original algorithmic models were developed, for instance, a model for the acquisition of data concerning demand for innovative solutions, models of economic analyses based on sale statistics, and a module for the identification of service locations. The main modules of the implemented system are shown in Fig. 4.

The presentation layer is an AJAX-based interface that enables users to efficiently work with the system. The intuitively understandable on-screen user interfaces were designed in a way that users have access to menus and toolbars which facilitate navigation and availability of modules (Fig. 5). The user may edit a content and layout of the form. There is a possibility to configure a graphical view, i.e., to roll up, hide, colourise and move of the form elements. The CRM is multilingual; a choice of a language is done within an authorisation process.

A logged-in user has the following entitlements to modify an information scope of the implemented computer system:

1. Coping selected records – activities, offers, invoices, etc.;
2. Viewing, editing and removing records in accordance with entitlements;
3. Mass editing multiple records simultaneously, for instance, changing a status of selected invoices, or up-dating information about a client;
4. Fast editing a selected record with a single click;
5. Organising the system's objects in categories defined by a user;
6. Assigning a selected record to a user or group; and,
7. Moving selected records to the trash.

A selected screen capture of the proposed computer system showing available modules is depicted in Fig. 5.

The screenshot displays the 'Products' module interface. At the top, a navigation bar contains tabs for various system functions, with 'PRODUCTS' currently selected. Below this is a search bar with a 'Search for' input field, a dropdown menu set to 'Product No', and a 'Search Now' button. A keyboard navigation bar (A-Z) is visible below the search bar. The main content area shows a table of products with columns: Product No, Product Name, Part Number, Commission Rate (%), Qty. In Stock, Qty/Unit, Unit Price, and Action. Three records are displayed: PRO1 (Chamber for concrete carbonisation), PRO2 (Tribotester), and PRO3 (Chamber for VOC emission). The interface also shows pagination controls indicating 'Showing Records 1 - 3 of 3' and 'Filters: All'.

Product No	Product Name	Part Number	Commission Rate (%)	Qty. In Stock	Qty/Unit	Unit Price	Action
PRO1	Chamber for concrete carbonisation	1	2.000	1.000	1.00	100.000.00zł	edit   del
PRO2	Tribotester	2	2.000	3.000	1.00	110.000.00zł	edit   del
PRO3	Chamber for VOC emission	3	2.000	1.000	1.00	150.000.00zł	edit   del

Fig. 5. The exemplar screen capture of the user interface

Source: Author.



A functionality of the system was extended by a module for searching and viewing information. There is the possibility to perform a simple, advanced or alphabetical search. Information might be filtered according to the user's preferences. Moreover, required documents, reports and data can be printed, imported from CSV format, or exported from a current view or CSV format.

#### **4. Capabilities of the implemented CRM-based system in business and research processes**

The developed CRM system makes the following things possible:

1. Having an integrated, single view of partners (for instance companies, research institutes, universities) or customers by using analytical tools;
2. Planning the realisation of work schedules for research and business teams;
3. Improving and extending relationships with the external and internal environment generating new business and research opportunities;
4. Managing partner or customer relationships, regardless of the communication channel – telephone, website, personal visit, and so forth;
5. Improving the effectiveness and efficiency of the processes involved in partner or customer relationships;
6. Defining corporate objectives linked to partner or customer satisfaction which influences business coherence;
7. Increasing the effectiveness of providing partner or customer service by having complete, homogeneous information;
8. The planning and organising of marketing campaigns;
9. Managing to increase the number of partner or customers and secure greater loyalty thanks to the reorganisation and computerisation of business processes surrounding the customer relations life-cycle (sales, marketing, customer care services); and,
10. Providing visibility of internal environment to an organisation's management.

The change towards a customer-focused strategy is leads to a strong demand by companies for CRM methodologies and solutions capable of allowing them to expand their resources by using a model that is closer to their business requirements and demands and, consequently, the gradual move away from the traditional information technology infrastructure and the corresponding implementation methodologies.

#### **Conclusions**

Successful development, implementation, use and support of Customer Relationship Management systems can provide a significant advantage to the user. The aim of the study was to present a CRM-based system that extracts

valid and comprehensible information obtained within innovation development processes and helps decision makers to gain a holistic view of each individual customer, which enables coherent communication. The innovativeness of presented computer is an application of the SaaS model (*Software as a service*), which enables using the system in the cloud computing model. Additionally, the proposed system uses the SOA concept (*Service-Oriented Architecture*). The requirements of the system are minimal, i.e., end user needs only an Internet browser. The model SaaS enables the direct access to numerous integrated applications that are delivered as a service over a network without the necessity of the installation on the PC. Moreover, the system includes solutions that enable one to use them through mobile devices. Thanks to the use of the implemented system, information about stakeholders and actors that influence a business or research organisation is more consistent, updated, complete, and precise, resulting in correct decisions based upon it.

The presented CRM-based system is subject to constant change, and its scope and ability is modified by new functions and features.

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Reviewer:  
**Waldemar FURMANEK**

## **Zastosowanie systemów klasy CRM do wspomagania procesów decyzyjnych w obszarze innowacyjności**

### **Słowa kluczowe**

CRM, zarządzanie relacjami z klientami, zarządzanie zorientowane na klienta, systemy komputerowe, komputerowe wspomaganie decyzji, innowacyjność.

### **Streszczenie**

W artykule przedstawiono charakterystykę zaimplementowanego rozwiązania informatycznego bazującego na modelu CRM. Zaprezentowano strukturę i funkcje systemu komputerowego, dostępne moduły, potencjalne obszary zastosowań w działalności biznesowej oraz naukowej.

Przedstawiony system komputerowy, który funkcjonuje w ramach Platformy Informatycznej PINF zawiera zbiór organizacyjnych i technicznych metod umożliwiających precyzyjną integrację modeli biznesowych z zasobami informacyjnymi. Opracowanie koncepcji systemu zostało poprzedzone analizą dostępnych na rynku rozwiązań bazujących na modelu CRM. W celu wyjścia naprzeciw potrzebom współczesnych organizacji biznesowych, jak i naukowych, zaprezentowany system komputerowy jest dedykowany do wspomagania zarządzania wiedzą w procesie tworzenia, realizacji i wdrażania innowacyjnych rozwiązań. Moduły systemu zawierają usługi dedykowane przedsiębiorstwom sektora MSP oraz jednostkom naukowym w celu wspomagania podejmowania strategicznych decyzji w obszarze harmonogramowania pracy zespołów projektowych, usług serwisowych, sprzedaży produktów oraz strategii marketingowych. Zaproponowany system funkcjonuje w modelu SaaS (*cloud computing*) and udostępnia swoje zasoby i usługi poprzez sieć Internet.