

Development and application of intellectual information systems in social and economic sphere

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Abstract¹

This article discusses the theoretical and methodological aspects of information management in the socio-economic systems on the experience of the projects the Department of Economic Informatics, Ufa State Aviation Technical University. These developments may be the basis for a conceptual approach to the use of new information technologies for the development and application of information systems in various areas of the economy.

1. Introduction

At the heart of information systems development in the socio-economic environment is an integrated approach to the creation of integrated systems, which is the use of modern technologies of software development, implementing the CALS-principles. The base development department is the principle tool information management within the object approach. This principle is realized in the framework of project management methodologies - Rational Unified Process (RUP) IBM Rational and the company uses a set of software tools that support a specified methodology. Life cycle (LC) project developed information systems (IS) corresponds to the spiral model: in each iteration is performed several tasks - analysis, design, implementation and testing. This allows the "output" to obtain an intermediate, but a working version of IT solutions. Before starting a new iteration of the development plan system, its features or functions may be revised.

The aim is to ensure that CALS data exchange between processes that implement the life cycle of products. A full exchange of information between subsystems of different stages of the life cycle (local information-technology areas) can be installed only as a result of a process of knowledge sharing. The system provides full data exchange under these conditions must satisfy several

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requirements: the systems, orientation, instrumentality, etc. The technology allows the RUP best way to configure model domains CALS participants in the process and ensure understanding of specialists in different subject areas.

2. Methods and tools for development, implementation and optimization of ERP-systems in production management

One of the major areas of information systems in the socio-economic environment is the development and implementation of ERP-systems in production management, as part of CALS-technologies. The aim of research in this area is mathematical, information, software algorithms and machine simulation and optimization of technological processes and management systems in production, including research methodology and design, formal description and algorithmization, optimization and simulation of system performance, installation, maintenance and operation of such systems .

The project "Development of technology for consistent management of information resources for education and science-based information models in the field of CALS technology" created the concept of content management component of academic programs and learning specialists in the field of CALS technology [1]. With this technology it was decided to build training centers in the areas of CALS technology at a number of departments of Technical University (USATU). Reference model developed for each area of learning. The funds allow the use of applied technology custom referential learning process model for flexible content management component of the curriculum based on learning objectives, the initial level of the trainees and the needs of industry.

The proposed method can effectively educate professionals of different levels of qualification for one of the fastest growing areas - areas CALS - technologies, clearly demanded in the production and science. The university will be able to significantly improve the

competitiveness of its graduates through the active use of the creative potential of scientists and production workers in the educational process.

On the subject chair was involved in an innovative educational program of training in information technology design, manufacture and operation of complex technical objects. The objectives of the project were performed by the scientific and technological research and development, models and structural solutions man-machine systems for production automation and intellectual support management processes. Was developed and implemented the concept of integrated training in the field. In line with this concept, developed and processed in the direction of a series of educational programs and supporting disciplines educational and methodological complexes, taking into account the implementation in these areas of ERP-systems, published eight textbooks.

3. Design of Information Systems quality management

The second major focus of the department is to design information systems for quality management. First of all, it concerns the possibility of providing a new quality of higher education in today's high school reform and improvement requirements for the training of graduates. On this subject were carried out on various projects as departmental target program "Development of informational and methodological support for quality management systems in educational institutions HPE", "Formation of a quality management system of educational services of the university district", "Management competencies of specialists in the field of information technology based on object approach in the framework of international standards of training, "and others.

The project "Development of informational and methodological support for quality management systems in educational institutions HPE" an analysis of the market platform for the deployment of the Quality Management System (QMS) and ready-made solutions that implement the basic need to maintain a quality management system functions: document management, security implementing a process approach, the registration of complaints, data collection and analysis of indicators of processes, management of discrepancies, the development of corrective and preventive actions, internal audits.

The study showed that in most cases, the above-mentioned quality management functions are implemented in a separate software module that is part of electronic document management system. At the same time, considered the options inherent in either the narrow focus, therefore, there are some difficulties in setting up for the needs of educational institutions of higher professional education (EI HPE), or a specialized development to meet the specific needs of an educational

institution that turn, creates great difficulties in implementing such a software solution in any other university.

In the course of this project was to perform a complex theoretical and methodological research on a computer support QMS:

- Developed the methodological basis for the development of the QMS;
- Conducted a functional modeling of core and support processes of the educational institution. The functional structure of the quality system of the educational institution is shown in Fig. 1. The nomenclature of functional models contains the main and auxiliary processes in an educational institution for the organization and conduct of the educational process;
- Information modeling of the quality management system. The information model describes the general approach to the placement and presentation of information in the SMC, as well as the conceptual elements of the implementation;
- Developed a draft design of computer support QMS educational institution;
- Published a monograph [2].

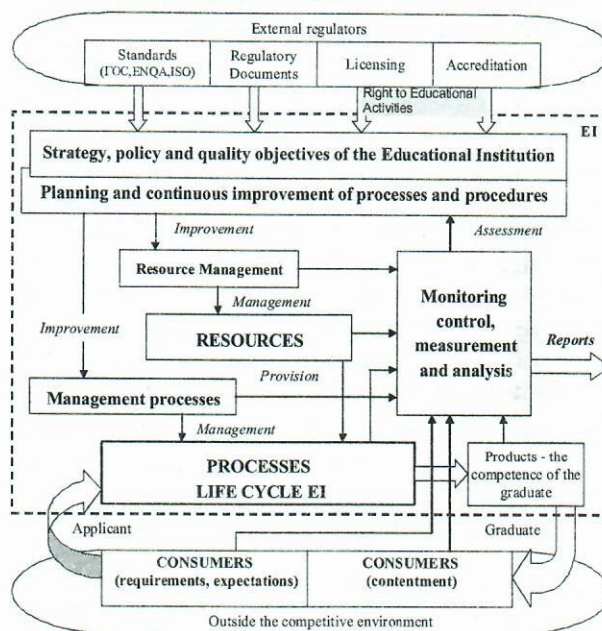


Fig. 1. The functional structure of QMS EI

As a result of the project "Formation of a quality management system of educational services of the university district," published in the monograph [3].

4. Development and application of information systems in education

Global trend of movement to a new quality of higher education manifests itself primarily through the growth of comprehensive, systematic, interdisciplinary and integrated nature of the requirements for the training of graduate students for both professional and social roles in a diverse and broad contexts. This is reflected in the dynamic establishment in recent years, the results of the competency approach to higher education.

Modern technical universities as innovative universities to actively improve the technological base of training, largely relying on the use of information technology (development of e-learning, the development of distance education, etc.). The strategic direction of development of educational systems in modern society is to provide intellectual and moral development of man based on his involvement in a diverse, independent, purposive activity in various fields of knowledge. Competences are formed and appear only in the normal course of business, but their quality is determined by the degree of involvement in activities. Such a process of active learning has been devoted to the project "Adaptive Technology to create distributed electronic resources as elements of a unified educational environment in accordance with international standards", performed in the framework of the analytical departmental target program "Development of Scientific Potential of Higher Education (2009-2011)".

The paper was formed by an agreed system of information technology models throughout the lifecycle of the process of creating adaptive electronic resources, from business modeling, design, resource, resource testing, configuration management and change, project management, quality of life being created. The result is a set of documents developed by the description of the key features and techniques to create links in the implementation of remedial basic education services with the use of adaptive digital educational resources. As a result of the work was published in the monograph [4].

Developed in the framework of adaptive technology for creating distributed digital resources as elements of a unified educational environment based on international standards, provides the following requirements:

- Created with the help of the proposed technology educational resource meets the requirements of the International Association for the Educational Achievement, IEA;

- Developed an adaptive learning rates offered by content elements provide authentic assessment of learning achievements (Authentic assessment);
- The possibility of obtaining from the newly developed general methodology for scientific positions adaptive educational resources are widely known private two earlier versions of computer tools for educational purposes: Intelligent Tutoring Systems (ITS) and Automated Training Systems (ATS).

One of the directions of this research was the creation of scientific and methodological support of andragogical teaching information technology in the systems of training and retraining. Building a system of education for adults is on the principles that allow a high level of theoretical and practical training and retraining through the free development and achievement of the priority interests of the individual, through the development of innovative methods of teaching adults to ensure:

1. Professional training of specialists to perform a new activity;
2. Professional training of specialists for further training;
3. Professional training to improve the social significance of the individual;
4. Skills development in areas corresponding to the profile of specialties and departments of the university.

The aim of the project "Management competencies of specialists in the field of information technology based on object orientation in the framework of international standards of training" is a multi-criteria decision problem of forming the optimal parameters for the didactic program of specialist training in information technology and minimize the cost of training teams within the institutions of professional education in Russia. Improved management of the educational process can be achieved increasing the efficiency of decision making in problem situations. For this purpose has been proposed an ontological approach to the development of intelligent system to support decision-making.

Domain ontology has some specificity, as shown by the example of the use of intelligent systems to support decision making in education. The result was the research structure and methodology of the development of ontological knowledge base, which allows to solve the problem of formation of the employer's requirements to a specialist. A fragment of the ontology created, implemented in Protege 4.1 is shown in Fig. 2.

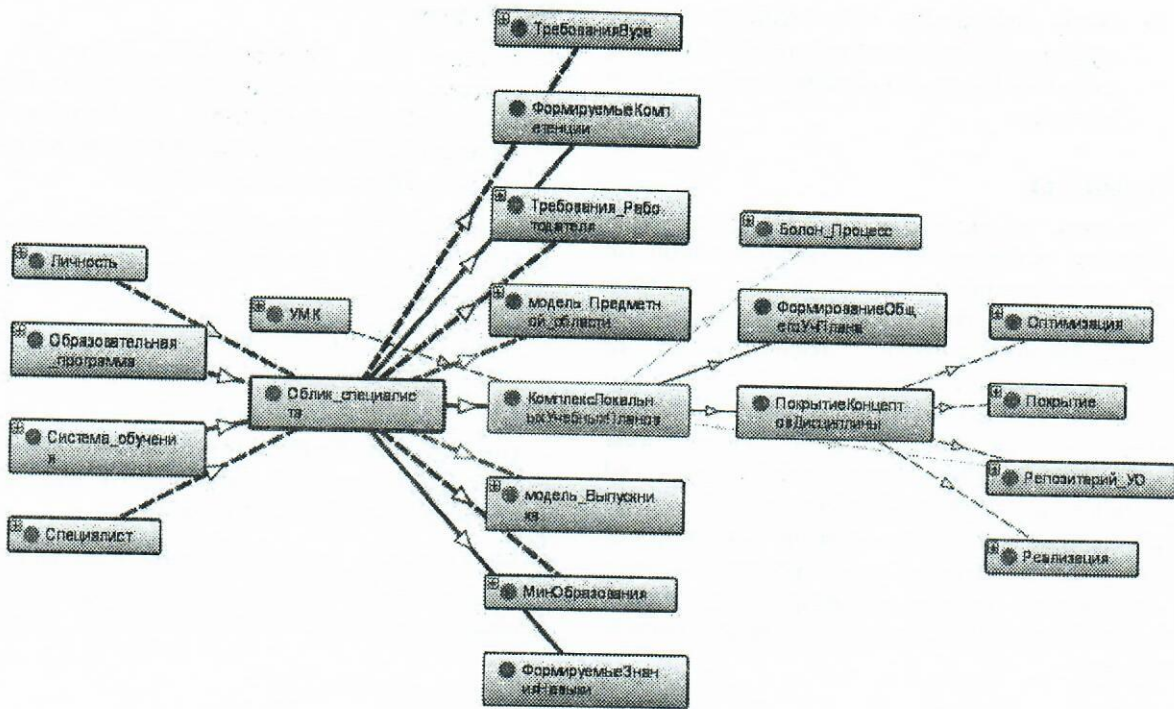


Fig. 2. Fragment of ontology of educational activities

Ontology of the educational process involves a top-level ontology (metaontology) $Onto^{meta}$, the ontology of higher education and the subject of ontology $Onto^{edu}$ training in various specialties $Onto_i^{app}$:

$$Onto = \langle Onto^{meta}, Onto^{edu}, \{Onto_i^{app}\}, Inf^F \rangle,$$

where Inf^F - car model output associated with an ontological system. Entities metaontology $Onto^{meta}$ are concepts such as "object", "attribute", "value", "attitude" and the like, as well as certain types of property values. In addition, established relationships metaontology generalization, association, aggregation, similarity, causal relationships, and others. Ontology $Onto^{edu}$ uses the term to characterize the process of training of higher education (such as "University", "Teacher," "Learner," "educational program" and others) and is organized along the lines of metaontology $Onto^{meta}$.

Domain ontology can be represented as a set of elements:

$$Onto^{app} = \langle C, Pr, V, I, R, A, D \rangle,$$

where C - the set of classes $\{C1, C2, \dots, Cn\}$, Pr - Properties, V -values of the properties, I - number of instances or examples $\{I1, I2, \dots, In\}$, R - set of relations $\{R1, R2, \dots, Rn\}$, A - a set of axioms $\{A1, A2, \dots, AN\}$, D - a set of algorithms for ontology O $\{D1, D2, \dots, Dn\}$. Description of the developed ontology produced in the language of OWL DL (Ontology Web Language based on Description Logic).

Ontology, in particular, is necessary for the user to be able to work with a repository of teaching materials related to a wide range of specialties, to develop

methodological support for the new qualifications based on the reuse of learning objects for the acquisition of competencies established by the federal state educational standards and developed a new generation of teachers University. The ontological approach to the development of e-learning has found its application in the development of the system ontology of the educational process, as well as the ontology of specialty "Quality control".

The knowledge base developed on the basis of object-cognitive approach can be used to create quality indicators for curriculum development to establish consistency in the learning process, depending on the profile of the student.

The tasks of developing a set of functional subsystems that enable object-based and ontological approaches to develop and implement a comprehensive, taking into account the characteristics of teaching, teaching methodology have been performed adequately. According to the results of published monograph [5].

Use in the classroom e-learning courses developed on the basis of the knowledge base contributes to:

- Improve the quality of education through the development of didactics and methodology of creating new forms of learning;
- Reduce the costs of organizing and conducting the educational process, the redistribution of the load of teachers with a routine to the creative activity;

- Work individually with students, enhance efficiency of the educational process of teaching tools for changing the structure and content of education.

4. Conclusion

On the basis of these concepts, the research and development underway in the scientific-educational center "Infocommunication technologies in socio-economic sphere," created at the Department of Economic Informatics, Bashkir regional center for information technology, and the Institute for Social and Economic Research of RAS Ufa (Ufa). Implementation of the results of the projects listed in the learning process allows the department to graduates hold positions related to the design, development and operation of information systems in any organization of social and economic spheres: in the IT-companies, banks, commercial firms in the engineering industry, municipal or regional administration, as well as enterprises and organizations in other sectors.

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