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DESIGNING A MODERN INFORMATION SYSTEM OF UNIVERSITY MANAGEMENT: THE EXPERIENCE OF KHMELNITSKY NATIONAL UNIVERSITY

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Abstract

The article describes experience of designing a modern information system of university management. Conceptual provisions are examined both from technical as from management point of view.

Use of the document-oriented management substantiated. Any activities at the university are presented in information system as some structured documents, which reflect paper documents before implementation of information system. The need of retaining the history of all changes in the system is substantiated. Not just the current status, as practiced in most information systems. It is shown that the calculation of the current state of the object based on the history of changes can be made on the fly without substantially reducing performance.

Advantages and experience of use of the web interface and the open source software, especially for the state universities are considered. Interaction of subsystems is discussed. It is proved that a complete integrated information system should include all main divisions, starting with Planning and finance department and the HR department, and ending with chairs and support units.

Keywords*: information system, university, management, integrated.*

1. Introduction

University management requires coordinated work of hundreds of teachers and administrative staff. The main objective of the university is to teach students the advanced knowledge. Good management should be based on timely information about all the processes that take place in the object of management. There must be effective, both direct control and feedback [1].

Thus, we come to the need for rapid processing of large amounts of information, and the sources of this information may be hundreds of people, and the results of its processing should be available to thousands users. The solution of this problem is possible only with the use of modern information technologies. As shows experience of development and deployment of the various information systems, the greatest effect can be reached only at creation of the integrated information systems where it is possible to check a correctness of entered information and to ensure its safety and optimum processing. At the same time, modern communications allow you to combine a variety of clients in a single system, regardless of where they are - at work, at home or on the road [4].

Another, perhaps more important problem, which solves an integrated university management system is the implementation of best management practices embodied in the information system. Not information system adapts to the existing management practices at the university, on the contrary, university management changes using advanced methods and techniques embodied in the system.

2. Conceptual provisions

Development of the university management system „Electronic University" (EU) at Khmelnitsky national university has begun since 1999. From the beginning we have to solve the range of conceptual problems. First of all, how to store changes? Many information systems store only current state of their objects. But many reports need information from some time range. For example, how many students moved from budget to contract form of financing during the year? You can't find it when your system store only current state. You can find this information if you calculate aggregates during data changes, but in many cases, when data changes happen, you don't know what you should calculate. When at the yearend you receive request to make report, that must include some new aggregate (and this is happens very often) you can't calculate them from current state. So the only solution is to store all history of the changes. But all changes in the university are made as a result of some order or some other kind of document.

So the basic concept of the integrated university management system is „document-oriented management". Any activities at the university are presented in the information system as some structured document, which reflects paper documents before implementation of information system. Structured information can be easily processed providing fast and consistent way for achieving any kind of analytics and aggregated information. Change of any object's state in the system is fixed by separate record with the indication of time of change that allows to determine a condition of all system at any moment [1].

For example, the operator of the dean's office can change work date at any value in past or future and any data will be shown on that date. This means that list of groups, list of students are shown on work date. It may be useful, when you need to reprint diploma which was issued several years ago. At that case you don't need some special interface to find students who graduated, you may use the same interface as for current students [2].

Other case: admission commission issues orders from the first of September, but dean's office starts to work with students before September. Solution is the same, you can change work date to appropriate in the future, when admission order will act, and do what you want.

Our experience shows that with normalized and indexed tables you can calculate current state of any object on the fly without need to store it in the database. For example, on the 8 years old server list of the academic group on given date is calculated in less than 0.1 second. In the case, when calculation on the fly is too slow, you always may save current state to the database, but that reduces flexibility and increases amount of data.

The second conceptual problem is how work with the information system (IS) is arranged. IS is evolving permanently, so traditional client-server technology with custom client applications incur huge problems with software updates. The other option is to use web interface. Pros of this option are platform independence, no software update problems – all updates are made on the server and are accessible for users immediately, security – all data transferred by secure connections using industry proven technologies [3].

Access to information system functions are performed only by authorized users.

The other conceptual decision made in our IS was to use only open source software. It is especially important for universities with its restricted budgets.

Any information entered into the system once by the appropriate department and reused elsewhere in the system as needed.

Distribution of authority, even in one university may change over time, so the distribution of authority in the information system must be specified flexibly either at the level of workplaces, and personally with aid of roles system.

3. Interaction of subsystems

In the root of subsystems hierarchy is Planning and Finance Department. It is responsible for the formation of staffing, based on which the personnel department carries out all orders on the movement of personnel (Figure 1).
Also, the personnel department supports the relevance of personal cards of employees, tracks sick-lists and leaves, controls the total amount of the employee's salaries.

Based on information from the personnel department all other departments obtain the current list of teachers and the rest of personal information as needed.

Historically the accounting department is not a part of EU. It has its own closed information system, but we have close integration: IS of accounting department has direct access to lists of students and employees at any date. In turn, EU can read information about student's debts.

In Ukraine admissions commission has to input information about entrants in the Unified State Electronic Database of Education (USEDE). Actually, entrants can apply in the electronic form from home, without need to go to universities. In that case they come to universities only to bring originals of documents. Although universities can input information about entrants in USEDE through SOAP API we have decided to enter information about entrants directly into USEDE using its web interface. This is because frequent changes in the entrance rules from year to year. Its implementation in the information system is quite complex and costly, but all of them are needed only for entrants and wouldn't be used in further work. We use SOAP API to import new students from USEDE, so both systems are used for their primary purpose. As we think its optimal decision.

Student's staff department provides relevance of student's personal information and executes all orders on their movement. Preparation of orders can be carried out in the relevant dean's offices. The system allows executing part of orders directly by dean's offices without student's staff department control. For example, orders on transfer from one group to another (same specialty), transfer to the following course. Orders applications, prepared by dean's offices are automatically collected in student's staff department into order, printed, signed and after that approved in information system. After that the order is exported to USEDE via SOAP API.

The chair forms curricula, coordinates them with educational department which approves them, the approved curricula are blocked for changes. On the basis of the approved curricula every year the chair forms working curricula which are coordinated with dean's office and educational department. Educational department coordinates the whole educational process at the university, and can also assist chairs in the development and coordination of curricula [1].

On the basis of the approved working curricula the dean's office forms individual student's curricula (taking into account their choice).

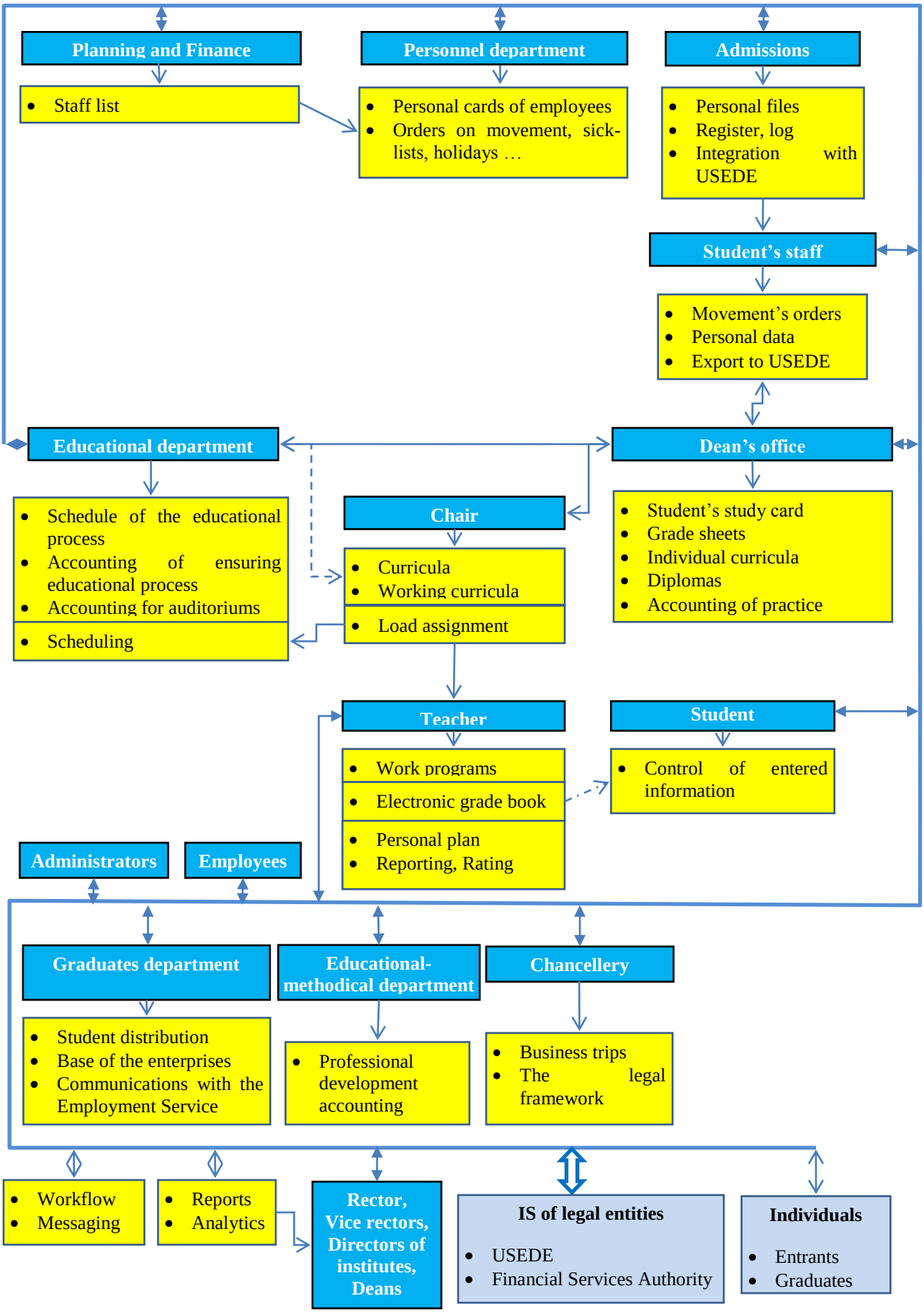

Figure 1: Functional diagram of IS „Electronic University"

On the basis of individual student's curricula chairs assign load for teachers. On the basis of the load assignment educational department creates a schedule.

The educational department also forms the schedule of educational process, performs accounting of ensuring educational process by literature, computers, audiences and so forth.

Dean's office provides the control and organization of the educational process, forming, printing and input of semester and interim grade sheets, control of student's curricula implementation, accounting practices, the formation and printing of diplomas, study cards and other necessary documents. Inside the dean's office access to its functions can be divided further into functional roles, such as Methodist, Deputy Dean for Academic Affairs, Deputy Dean for educational work, etc [2].

The teacher creates the work programs of their disciplines, enters current grades and attendance in electronic grade book, forms an individual plan and report on progress, on the basis of which its personal rating and the rating of the chair are formed.

Students monitor all information about them entered in the system, both personal and academic. Also, if necessary, we can provide students with an opportunity to form individual curricula based on working curricula approved by the dean's office.

Graduates department distributes students, support base of companies and provides a communication to the employment service, graduates.

Educational - methodical department keeps records of information on professional development of teachers.

Chancellery generates orders for business trips and travel sheets, forms the legal framework of the university, delivers and monitors execution of documents by the university.

In addition to specialized roles the system has role without specialized functions for an employee of any department to ensure authorized access to the system-wide functions, such as document workflow, messaging, schedule. All departments have access to the workflow system that enables the formation of documents, track deadlines and control of execution. Also, all workplaces in the system have the ability to exchange messages between users of the system.

All system workplaces provide relevant reports, documentation and analysis. This takes into account the subordination of departments, such as deans have access to the relevant chairs, directors of institutes – to the dean's offices, the rector and vice rectors – dean's offices information, etc.

On the basis of information about the activities of the university (reports, analysis) management makes reasonable decisions and manages the university by orders.

Also single individuals can interact with the system, not only internal users, for example entrants, graduates.

4. Conclusions

Thus, the information system built on the basis of these provisions will provide operative input of all information necessary for the management of the university. This eliminates duplication of input data, and hence increased efficiency. Since each type of information is administered only by

relevant competent people, it provides a correct input data. As the same information is reused in various divisions, in addition, it provides control of reliability and timeliness of input of information. Existence of all information in the uniform integrated system will allow to process most of it effectively and to receive the operative, actual, complex analysis of university's activity.

At the same time, the system incorporates leverages to ensure operational control, as the decision making (using the workflow subsystem) and indicative (using different ratings). As a result, we can talk about an increase in both the efficiency of university's activity and the quality of education.

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Rezumat

În articol se examinează experienţă elaborării unui sistem informaţional modern de gestiune a unei universităţi. Cadrul conceptual este abordat atît din punct de vedere tehnic, cît şi din punctul de vedere al managementului universităţii.

Este fundamentată gestiunea universităţii orientată documentar. Orice activitate în universitate se prezintă în cadrul sistemului informaţional prin documente structurate, care corespund documentelor de hîrtie aplicate pînă la implementarea sistemului informaţional. Este argumentată necesitatea păstrării istoriei tuturor modificărilor intervenite în sistem şi nu doar informaţia despre starea curentă, aşa cum se practică în majoritatea sistemelor informaţionale. Se marchează că identificarea stării curente a obiectului, bazată pe istoria modificărilor, poate fi îndeplinită rapid, fără reducerea semnificativă a performanţei.

Preponderent pentru universităţile de stat sunt examinate avantaje şi experienţa utilizării interfeţei Web şi software-ului în acces deschis. Se cercetează interacţiunea subsistemelor. Se demonstrează că un sistem informaţional complet integrat ar trebui să includă toate subdiviziunile de bază, începînd cu departamentul financiar-planificare şi departamentul de resurse umane şi finalizînd cu catedrele şi unităţile structurale auxiliare.

***Cuvinte-cheie**: sistem informaţional, universitate, management, integrare.*

Аннотация

В статье рассматривается опыт разработки современной информационной системы управления университетом. Концептуальные положения рассмотрены как с технической точки зрения, так и с точки зрения управления университетом.

Обосновано документо-ориентированное управление университетом. Любая активность в университете представляется в информационной системе в виде структурированных документов, которые соответствуют бумажным документам до внедрения информационной системы. Аргументирована необходимость сохранения истории всех изменений в системе, а не только текущего состояния, как практикуется в большинстве информационных систем. Показано, что вычисление текущего состояния объекта, основанное на истории изменений, может быть выполнено на лету без существенного уменьшения производительности.

Рассматриваются преимущества и опыт использования Веб-интерфейса и открытого программного обеспечения, особенно для государственных университетов. Исследуется взаимодействие подсистем. Обосновано, что полноценная интегрированная информационная система должна включать все основные подразделения, начиная от планово-финансового отдела и отдела кадров и заканчивая кафедрами и вспомогательными подразделениями.

***Ключевые слова**: информационная система, университет, управление, интегрированние.*