Information technologies in the service of science and studies development

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ABSTRACT: The article deals with a review of the development of current Lithuanian higher education and its research information system, its organisational structure and the stages of its creation. Higher education institutions, aiming at faster adaptation to the rapidly changing external environment, are today trying to create and implement institution resource planning and management components, eg human resources management, financials, admission, records and campus management, etc. The development of external cooperation depends on the communication system within which the institution operates. Universities have begun implementing plans to create a network called *University for Economy Structures*, which is expected to assist in improving links and facilitate cooperation between universities and the economy's main stakeholders. Most higher education institutions have been using Oracle technologies for several years for educational purposes but, in many cases, the information received from different institutions is incomplete, inaccurate and sometimes delayed. The recent implementation of a library informational system for all higher education and research institutions has already shown the effectiveness of a common system that works on one network.

INTRODUCTION

The rapid development of new information technologies has strong implications for the provision of higher education and training. The knowledge society depends on the production of new knowledge for its growth, its transmission through education and training, its dissemination through information and communication technologies and its use throughout the production processes and/or services [1].

Furthermore, a precondition for the development and support of a university's excellence is an environment in which long-term planning is possible. Excellence does not grow overnight.

In January 2001, the Lithuanian Ministry of Education and Science launched a programme named *Information Technologies for Science and Higher Education*. This programme is devoted to one of the most important areas of the society's activities (ie science and higher education) for everyone who creates, accumulates and transfers such information. This programme outlines the general directions of its computerisation. Further, the programme is based on an Academic and Research Network in Lithuania, LITNET, which provides wide-scale Internet services for all users.

By utilising lines of permanent connection (mainly fibre-optic), networks have been formed that unite all higher education institutions, colleges, research institutions, libraries, university clinics and many other organisations. LITNET forms an environment for other systems and networks, eg science and education information system, libraries information system, distance education, information system for the admission to higher education institutions and others [2]. Vilnius Gediminas Technical University (VGTU), Vilnius, Lithuania, takes an active part in the creation and implementation of these networks and information sub-systems.

SCIENCE AND EDUCATION INFORMATION SYSTEM

The designing of the Science and Education Information System started in conjunction with the European Union PHARE programme, *Higher Education Reform in Lithuania*, and was realised during the period 1997-1999 [3]. Closer cooperation between higher education and research institutions began in 2000, along with the development and maintenance of an information system for admissions into Lithuanian universities.

The Lithuanian Ministry of Education and Science and the State Department of Statistics are collecting information about higher education and research institutions, eg the number of students, personnel or staff, study programmes, entrance results, distribution of students in different fields of studies, admission requirements of different institutions, etc. All higher education and research institutions are obliged by law to submit statistical information to the country's Department of Statistics; however, the information collected by this Department is insufficient for the Ministry of Education and Science and is usually submitted in different forms than what is required by the Ministry. Additional information received from higher education institutions is incomplete, not always accurate and delayed.

The Ministry needs a broader range of information for the following purposes: the preparation of legislative acts for student places and the financing of higher education institutions; an analysis of the financing of institutional needs and efficiency in using funds; approval of the financing of research activities according to research development and planning research trends for Lithuanian research institutions; the presentation of information about higher education institutions to public institutions and the media, etc. Almost all collected information has, for the time being, been stored in

paper format. The updating of information in this format is a time-consuming task. Information is necessary, not only for the Ministry, but for different users, eg other ministries and governmental institutions, universities, expert institutions, teachers, students, graduates of secondary schools, employers, etc. At present, these users cannot always access this information.

The Science and Education Information System is being established for the following purposes:

- To improve the functioning of science and higher education systems and for the coordination of its activity.
- To meet continually growing demand for the information at all administrative levels [4][5].

The main objective of this information system is the standardisation and integration of information systems of research and higher education institutions and institutions that regulate and evaluate science and higher education. In order to achieve the main purpose, it has become necessary to solve the following problems:

- Facilitate automatic information collection by developing unified and standardised software, as well as databases.
- Help the management of institutions by developing information databases and registers, and by forming a system of interactive requests.
- Provide institutions with all of the necessary technical and systemic software.
- Improve users' provisions with information that utilises the latest Internet information technologies.
- Develop an integrated information system that operates in real time.

Information will be always relevant and up-to-date only when it is collected, stored and used where it emerges, ie at the institutions of science and higher education. Statistical information should be received from real data. It is planned that the information system of research and higher education will be hierarchical and should consist of the institution's information system and the general Lithuanian research and higher education information system.

Current analysis of information systems from different higher education institutions has shown a different level of system development. Some universities (such as the VGTU and Kaunas University of Technology (KUT), Kaunas, Lithuania) have created their own information systems [6]. They have intranet, the possibility to connect to the Internet and electronic databases. Students have their own e-mail boxes. Other institutions have only modem connection to the Internet. Due to a shortage of resources, these institutions cannot use new technologies and still store most of their data in paper form. In general, the current level of automated functionality is still quite underdeveloped.

ACADEMIC LIBRARIES NETWORK

In 1998, the establishment of an information system that was designed for the libraries of higher education institutions was initiated. The Association of Academic Libraries was created to coordinate efforts. The network was created in order to generate better conditions for students, scientists and lecturers, so that they can gain the required information in a convenient

and operative way. The main network's objective is to establish an information system of academic libraries that enables improvements in communication and provides users with information and library maintenance, as well as to connect the libraries of science and higher education institutions to a united system and modernise their functions.

The project's budget for libraries at all universities and other higher education institutions permitted the software *ALEPH 500*, produced by Ex Libris, to be bought and installed. This software is the background for all library information systems. The information systems of all of the libraries are connected to the Internet and, for the convenience of the user, are interconnected by special *ALEPH 500* and standard library protocols. This allows for the searching of information on all servers at the same time through both standard World Wide Web (WWW) and a special graphic user interface. By using these protocols, *ALEPH 500* enables participants to share bibliographical inscriptions among various library systems, permits them to store library information and combines work with university publishing houses. Furthermore, it allows participants to collect full text documents, create united directories, search for information, connect to the worldwide *e*-libraries network and share the received information. After fulfilling these tasks, it will also be possible to include electronic directories and databases that are well known throughout the world to these institutions. It is also planned to include electronic directories from other Lithuanian libraries onto this virtual library.

EXTERNAL COLLABORATION AND THE DISTANCE EDUCATION SYSTEM

Higher education institutions no longer concern themselves with only the marketplace of ideas, but also with the economic marketplace as they compete for students [7]. Lithuanian universities have encountered the same dilemma and seek to compete for the distance education market niche.

Distance education system programmes are meant to develop and maintain a countrywide distance education system and assist in the preparation of distance education courses. This is necessary in order to create better conditions for people in life-long learning courses, as well as encourage higher education institutions to develop and apply their methods of *e-learning*. The system is intended to help persons learn without leaving their life- and work-places (in-service training), to simplify the sharing of knowledge and experience accumulated in scientific centres, and to create and sustain a universal *e*-learning environment that is used in both distance education and consistent studies organised by higher education institutions.

Currently, the main tasks are as follows:

- Development of a distance education network (the establishment of video studios and distance education classrooms, as well as new connection links, plus upgrades to software and hardware in video studios and distance education classrooms).
- Maintenance of distance education videoconference networks and assistance in the organisation of studies.
- Development and delivery of distance education courses.
- Training of participants in the distance education process (lecturers, tutors, consultants, administrators, managers and technical personnel).

- Development of specialised software to increase interactivity between a lecturer and a student, as well as between all of the students, etc.

From 1998, a network that comprised of a video studio and learning classrooms located in different cities was established. Through the *gateway* of the videoconference studio, it is possible to connect to any point of the world with distance education classrooms of this network by using ISDN lines. The utilisation of videoconferences and learning tools in the WWW environment assists in the organisation of the learning process.

Such learning needs require specially prepared courses. A running programme of the second level for vocational teachers has already been prepared and a new study programme for the preparation of regional informatics specialists has also been developed. There are trained lecturers willing to deliver distance education courses, as well as courses in the WWW environment and a videoconference support system developed so as to increase the interactivity of studies at several universities. A good example, from this point of view, has been the Ryerson Center for Engineering Education, a satellite centre of the UNESCO International Centre for Engineering Education (UICEE), based at Ryerson University, Toronto, Canada, where students, through distance delivery and by using Web CT, can access the course asynchronously, at their own time and pace, irrespective of their geographic location [8].

The development of information and communication technologies has generated greater possibilities for cooperation with external organisations and individuals, particularly in the context of life-long learning and improving personal qualifications. For any particular university, the development of external cooperation will depend on the plans to occupy a specific niche in distance education and training. In many cases today, this depends on the communication system within which the institution operates. Recently, the VGTU began implementing plans to create a network titled *University for Economy Structures*. This network is expected to assist in improving links between the University and the main stakeholders in the economy; it would also facilitate further cooperation between them. In order for this initiative to network universities and industry, there will have to be government support so as to create or improve the existing telecommunication infrastructure and widen access to it.

INFORMATION SYSTEM FOR ADMISSION TO HIGHER EDUCATION INSTITUTIONS

Until 1999, a system of national regulations for higher education meant that every Lithuanian higher education institution was fully involved in its annual admission process and was, more or less, closely connected to its own information system. Each higher education institution independently advertised its admission rules and terms but only sometimes did a university approve of specific requirements. If, after applying to one institution, a person failed to be admitted, then he/she did not have the opportunity to apply to another institution due to the time schedule for admissions at institutions, which was practically the same everywhere.

Some higher education institutions started to promote initiatives in a common admission system. At first, the common admission system was tested at the two largest Lithuanian universities – a classical university and the other a technical university. These two universities created a unified application form for applicants and created an information system for common admissions. In 2000, the Lithuanian Universities' Council on Admissions was established. The organisational structure comprised university representatives who worked on admission issues. In 2000, the membership of the Council on Admissions had five higher education institutions universities; in 2001, there were 10; in 2002, 13; and in 2003, there were 16 member universities. In future, all Lithuanian universities and colleges of higher education will be linked to this Council. A common admission membership is intended to grow and will reach its completion in the near future.

In 2000, the Universities' Council on Admission offered 181 study programmes; in 2001, 230 were offered; while in 2003, there will be 764 full-time study programmes on offer [9]. This number of offered study programmes might appear quite large and the reason for this is that different study form programmes (full-time, part-time, e-learning, etc) are treated as different, even if they are from the same study field. All universities have their local admission processes, which overlap with the time of common admission. Common admission ensures some basic levels of the common data set and its services among universities, while also reducing overall costs. Universities are interested in helping applicants so as to ensure that common admission services will increase in quality and transparency. The implementation of the common admission system coincides with the rapid growth of Internet technology usage by different users, eg secondary education graduates. Moreover, the universities and academic informational network (LITNET) are already prepared to provide a wide range of valuable self-catering services. The Lithuanian Universities' Council of Admissions creates a common data set on admissions, admittance regulations and admission procedures.

In accordance with the rules, applicants can apply at once for the 20 programmes on offer by the universities - Council members. Figures for the 2002 admission database shows that 23,966 applicants applied for 220,293 programmes. This means that each applicant used his/her right to choose a desirable programme from a wide menu of courses. Each person, on average, applied for 9.2 programmes. It should be stated that engineering programmes were not among the most popular.

This trend was also found at the VGTU with the 2002 admissions. The VGTU admitted 2,079 persons into the Bachelor degree studies, or 14% admission of all universities. Application forms for VGTU programmes indicated that engineering was selected first by only 8.67% of applicants, yet in the following positions, this selection was made by 40% of the applicants. So, many engineering enrolments came from those who failed to be admitted into their most desirable programme.

In 2001, there were 2,331 persons admitted into basic Bachelor degree studies at the VGTU. The competition rate among those applicants, who sought a VGTU programme in the first position of their application form, was 1.7. However, in the Mechanical Faculty, this rate was only 0.4 and in the Electronic Faculty 0.7. This means that classic engineering programmes are ranked lower than industrial or transport management, business management, information technologies, bioengineering or architecture programmes. Even the labour market perceives mechanical or electrical engineers as being more desirable.

This tendency has been observed for many years and the efforts of technical universities to change this tendency have proven to be futile.

Applications can be handed in to the nearest university. Applicants are ranked accordingly in advance and accept the rules and information system for admission. Under the supervision from the Ministry, this public order is effective and is published annually [10]. During the 2000 admission season, there were seven application reception centres located in the four main Lithuanian cities. For the 2002 season, the number of application reception centres grew to 13, while in 2003, there will be 25 in the six main cities. Staff at the reception centres wait for applicants and finalise online forms so that the data can be transferred to a central database (eg Kaunas). Another main database centre, located in Vilnius, was supported via a replica system. Daily copies of data were produced and sent members of the Council on Admissions on request.

From the beginning, customers have had trust in the new application system and services because it allows applications to go through to the nearest centre. Only a small amount of applications from remote regions were transferred via the two major cities by showing the traditional drafts; these two centres: being the capital city of Vilnius and Kaunas, which is the second biggest city in Lithuania.

It should be noted that since the activities of the Lithuanian Universities' Council on Admissions is quite new in Lithuania, and since the information system and services are still largely still being developed, there is considerable room for its evolution. This actually fits in well with the development of the Lithuanian Science and Education Information System, which is naturally based on the local university's information system, and depends on the internal implementation of services for the Lithuanian Science and Education Information System by different institutions.

The common admission system operates in such a way that it is attractive to education institutions and shows the popularity of study programmes among applicants and trends in public opinion. After restoring Lithuanian independence in 1991, the collapse of the existing economy's structures prevailed for a long time among younger people and a *bazaar market* conscience existed. Today, the picture is totally different. In 2002, among those admitted into universities, 78% were 2002 graduates from secondary education institutions. In comparison, this figure is about 45% in developed European countries. Furthermore, 31% of all enrolled persons were graduates from earlier years. This demonstrates changing societal attitudes towards the importance of education.

CONCLUSIONS

The implementation of new information technologies will allow for the improvement of the management of the higher education sector in general by means of information aggregation for prognosis and decision-making.

Universities have been using Oracle technologies for educational purposes for several years. However, a systematic approach is needed for complex and fast IT solutions within the area of higher education and research. There are three ways to resolve this issue, namely:

- The creation of a university's own information system based on existing *homemade* IS products that could be adapted to a universal system.
- The application of developed and tested systems, such as SAP AG, People Soft Corp., Oracle Applications Inc., etc.
- A mixed approach.

Furthermore, the following can be said of the General Information System (GIS) of all higher education and research institutions:

- It will increase the transparency of institutional administration and admission activities.
- It will create wider access to information resources.
- It will allow people to learn without leaving their life- and work-places.

The corporate information system will help to answer questions on how higher education can do a better job of articulating its services to society with regards to career preparation and the transfer of knowledge from teacher to student/learner.

REFERENCES

1. European Commission, The role of the universities in the Europe of knowledge. Communications, *COM*, 58, 17 February (2003).
2. Targamadze, A., Valiulis, A.V. and Zalys, A., On the path of implementing a joint information system for Lithuanian higher education institutions. *Proc. 6th UICEE Annual Conf. on Engng. Educ.*, Cairns, Australia, 35-38 (2003).
3. Zalys, A., *Higher Education in Lithuania and the Recognition of Qualifications*. In: Higher Education Reform in Lithuania: a EU PHARE Programme. Vilnius: Justitia (1999).
4. Information Technologies in Lithuanian Higher Education and Research (ITMiS), http://www.itmis.lt.
5. Lithuanian Higher Education and Research Information System (LieMSIS), http://www.liemsis.lt.
6. Pocius, K. and Reklaitis, V., Web-based services for technology education management and planning. *Proc. IWALT2000, Inter. Workshop on Advanced Learning Technologies: Design and Development Issues*, Palmerton North, New Zealand, 284-285 (2000).
7. Pocius, K., Deveikis, G., Braukyla, D. and Jurgutis, M., Admission to Lithuanian universities: evolutional development of the consolidate information system. *Proc. 7th Inter. Conf. of European University Info. Systems (EUNIS 2001)*, Berlin, Germany, 99-105 (2001).
8. Northwood, D.O. and White, W.E., Global networks in engineering education and the Ryerson Centre for Engineering Education. *Global J. of Engng. Educ.*, 4, **3**, 311-316 (2000).
9. LAMA, Priemimas į Lietuvos Aukstasias Universitetines Mokyklas 2003 Metais (Admission to University Type Higher Education Institutions in Lithuania, 2003). Vilnius: LAMA (2003).
10. Green, M., Eckel, P. and Barblan, A., The Brave New (and Smaller) World of Higher Education: a Transatlantic View. Washington DC: American Council on Education (2002).