E-Learning Risks Management as Competitive Advantage in Institutions of Higher Education

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Abstract: - In this paper, we present an approach to exploational risks management in e-education systems as competitive advantage in institutions of higher education. Technological changes are definitely one of the main generators of competition. They play the most important role in changing the structure of existing and the creation of new industries. In addition, technological changes equate the organization, since they reduce the competitive advantage of other organizations to some even point. Technology, however, affect the competitive advantage only if it has a significant role in determining the relative cost position or differentiation. The best example of this is e-learning, which greatly reduces operating costs and increases student's satisfaction. Currently, building effective e-learning system depends not only on finding adequate technology and architecture of system, but also on taking risks into account. According to this fact, risks management is discussed as one of the most important issues in organizing and exploitation of e-learning systems. The primary goal of the research is to develop sophisticated system for exploitation risks management in e-education that can be used as competitive advantage. In order to improve process of risks management in e-learning systems and make it more effective, few surveys were carried out.

Key-Words: - competitive advantage**,** e-learning, management, risks identification, risks analysis, higher education.

1 Introduction

Many universities exist today are due to the fact that they were able to react and take advantage of technological changes. Technological change is therefore one of the most important factors that can completely change the rules of competition. E-learning is also influenced by the social networking and help to build links with former students as well as to support the Center for Career Development. Additional benefits of information technology are reflected in the e-marketing campaigns, expanding the target group, are important in recruiting and fundraising, registration and overall improvement of academic life.

Distance education could be defined as complex system that includes distance teaching and learning, which are separated in time and space, as well as teaching materials that can be in various forms, individual or group learning process, tutorial and interactive work. E-learning, which should be considered as a key part of distance education, is realized by using the newest information-communication technologies, particularly Internet. Not only permanent and rapid growing could be noticed, but also, so called "on-line learning" becomes dominant in comparison with other types of learning. In accordance to that, more complicated requests for projecting and implementation of e-learning systems are to appear. At the same time, global trends, dynamic environment, complexity of issue, obligate on high degree of effectiveness, adaptability, integration and coordination of all relevant processes. In that context, business intelligence can be recognized as fulfillment of demands for additional, undiscovered, unseen knowledge and possibilities. The term "risk" presents possibility of an event occurring that will have an impact on the achievement of objectives. Risk is measured in terms of impact and likelihood.

The growing importance of e-education requires control of the associated risks. Successful managing of an e-education project has to take business environment in which project is to be realized into account. Process of risks management includes

proactive decisions, which help in permanent risks assessing and planning actions in order to cut risks down. This process should be realized as frequent and incremental procedure and therefore this will help the institutions rise out of competition.

The university has always played a considerable part in cultural, social and economic development. Beyond the society in which it is embedded, its relevance is currently incomparably greater due to the rapid and profound changes brought about by globalization which is full of opportunities and challenges. In these circumstances, material progress increasingly depends on innovation in productivity, competitiveness and the collective and individual access to the most advanced knowledge, thanks to basic and applied research [1], [2], [3], [4], [5], [6], [7]. In addition to reputation, universities may have other sources of competitive advantage [8].

The paper is organized as follows. After Introduction, in Section 2, there is brief discussion about risk management as a driving force for competitive advantage. Section 3 presents e-education. Section 4 presents risks researching. In this Section of the paper survey on users of e-learning system is also depicted, weblog analysis and exploitation risks classification. Section 5 includes exploitation risk management in e-education using Microsoft Solution Framework (MSF). Finally, in Section 6, conclusions and remarks are given.

2 Risk management methodology as a driving force for competitive advantage

Risk management is model that should be applied in all business domains [9].

To keep pace with the time and strengthen their competitive advantage, many institutions of higher education are struggling with the dual challenges, in addition to the rising cost of information technology and the need to avoid technological obsolescence, it is necessary to pay attention to risk management. Also, managing asymmetries in information flows and interaction between R&D, manufacturing, and service in complex product development can gain competitive advantage. This can be easily mapped to environment of high-education. R&D is activity of constantly renewing educational tools and activities, manufacturing is the production of knowledge, while services refer to the knowledge distribution. In knowledge distribution, e-learning has essential role [10]. Risk is a crucial part of any business and managing risk is an essential function for management [11].

Microsoft Solution Framework (MSF) could be defined as methodology for risk management, which implies process of continuous identification and risk assessment in projects, specifying their priority, as well as implementation of proactive strategy during project lifecycle.

In order to improve process of risks management in e-learning systems and make it more effective, it would be very useful to identify main phases and requirements. Steps shown in Figure 1 shouldn't be realized separately, but as integrated components of iterative and dynamic process of using risks in e-education. Indicated phases are explained and used for risks analysis that is carried out in this research. During this process, risks should be identified, analyzed, continuously assessed, monitored, and actively managed until they are either resolved or turn into problems to be handled

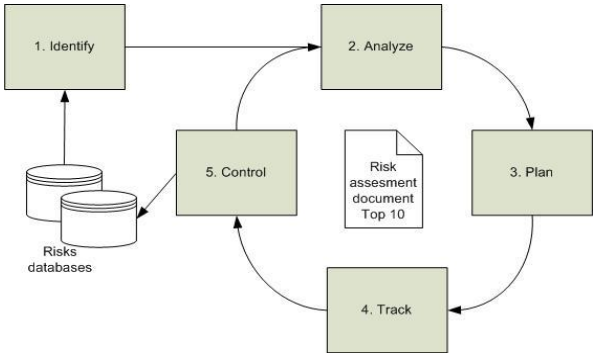

Fig. 1: Main phases and processes in risk management

3 E-education system

E-learning is the key to improving the mission of higher education institutions. Also, it should be noted that mind maps have substantial influence on the learning process. The conclusion from the investigation proposed in [12] that surveyed the effect of 5E learning cycle was that e-learning activities have positive influence on learning activities. In some studies, activity theory (AT) is applied in designing adaptive e-learning systems [13]. It is shown that this feature can substantially enhance e-learning experience.

E-learning system used in this research for studying exploitation risks in e-education is Moodle. Moodle (Modular Object-Oriented Dynamic Learning Environment) is one of the most used learning management systems (LMS) for organizing and carrying out e-learning courses. It is open-

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source, web-oriented, user-friendly platform for online learning. More information about Moodle can be found on www.moodle.org.

During exploitation period of several years, many risks and problems appeared. Some of them have been successfully solved, but others need to be permanently monitored and managed.

4 Risks researching

In order to develop effective risk management system, it is necessary to study all existing risks in e-education system. E-education system is a heterogeneous system where data is stored in different sources, such as course database, server logs, business information system, etc. For evaluating e-learning quality, seven dimensions can be used: Interaction, Staff Support, Institutional Quality Assurance Mechanism, Institutional Credibility, Learner Support, Information and Publicity and Learning Tasks [14]. Risk management can be the core competence of every business process and e-learning environment [15]

For purposes of research described in this paper three different data sources have been used:

- Posts from Moodle forum – in order to find typical problems of Moodle users
- Survey that involves students and teachers – to identify problems that students and teacher at our Faculty deal with when using Moodle
- Weblog analysis from web server – to determine typical students' behavior and typical problems concerning accessing e-education platform.

4.1 Analyzing forum posts

First step in risk analysis was conducting survey that included more than 1000 posts on Moodle official forum. This forum is mainly used by Moodle users all over the world to discuss problems, solutions and best practices. This data is crucial for analyzing e-education exploitation risks.

Primary goal of Moodle's post analysis was to detect main problems that users encounter. Users' complaints and requests present exploitation risks in e-education, which could be easily turned into serious problems. The most frequent risks, i.e. topics with the highest number of posts are presented in Figure 2.

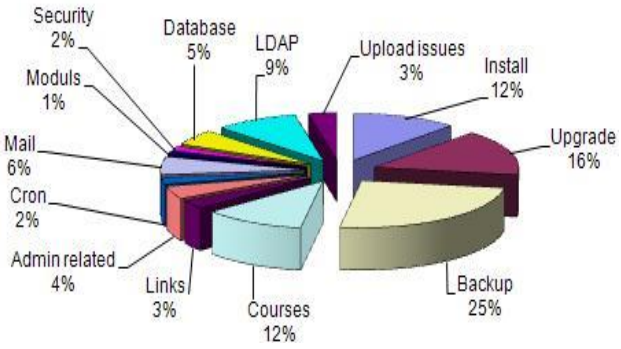

Fig. 2: Graphical presentation of results gained by exploring Moodle's forum posts

Obviously, the most important problems are about backup, upgrade and installation process, as well as online courses. These risks are further analyzed later in the paper.

4.2 Survey on users of e-learning system

For this analysis, data were provided by testing sample of 10 teachers and randomly chosen 150 undergraduate students. Areas included within the scope of the courses are: Computer networks, E–business and Web development. Three exams on the fourth year of undergraduate studies on faculty are completely realized through these courses. In addition, it was used a concept of blended learning to carry out whole process of teaching. Survey consisted of more than 50 questions that dealt with exploitation risks. Users were asked to make a list of problems and obstacles that appeared during using e-learning system. Permanently answering on "what-if" questions can also be the source of competitive advantage [15].

4.3 Weblog analysis

In this part of the research server access weblogs were used. These weblogs contain all records about accesses to e-learning portal. Weblog data was analyzed for the period of highest students' activity on e-learning system. Clustering, as a data mining technique, was applied in building data mining model. Clustering algorithm finds natural groupings among data related to sets of input attributes, so that attributes inside one group (cluster) have fairly the same values, but among groups (clusters) notable differences exist. Created data mining model was used to find out most frequent errors and classify them into classes.

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Code	Description	Count
404	Not found	2, 101
401	Unauthorized	10
405	Method not allowed	9
403	Forbidden	9
400	Bad request	6
503	Service unavailable	1

Table 3: Clusters with the biggest number of cases that represent some type of failure

Table 3 shows that the error with status code *404 Document Not Found* is the most significant. These errors refer on risk of bad link or request for content which are not allocated in databases.

4.4 Exploitation risks classification

By gained results, it should be feasible to perform risk identification and categorization. We suggest that all risks in e-education should be separated in two groups: qualitative and non-qualitative risks. Group of non-qualitative risks includes risks considering technology, such as risks connected to database server, cache server, databases (query execution, communication database-user, databases processes), error messages, exception handling, interface risks, personal risks, computing risks, software upgrade, document confidentiality, system security, memory leaking, inadequate capacity planning, web server, network, navigation, processes, third party risks, web browser, ISP etc.

By analogy to, five types of qualitative risks can be found in exploitation of e-education systems: functionality, reliability, usability, maintainability, portability.

5 Exploitation risk management in e-education using MSF

E-learning system can enhance the diffusion of competitive advantage within and outside the borders of high-education institution [17].

After collecting data from e-education system, it is possible to create system for managing those risks. MSF methodology has been chosen for the purpose. In order to develop sophisticated system for exploitation risk management in e-education, it is necessary to apply all phases of MSF model.

5.1. Defining risks

Risk identification is a first step in proactive approach in risk management. Using collected data and taxonomy of exploitation risks in e-education some of probable risks are shown in table. Similar risks are grouped and shown as one risk. All risks should be considered and analyzed. Possible risks include:

- Update, upgrade and backup risks
- Administration and installation risks
- Bad links
- Unsupported AJAX technology
- Database structure
- LDAP
- Bad protection of sensitive data
- Teachers have low level of Moodle knowledge
- Suddenly or accidently closing of session
- Site requires new functions
- CRON
- Mail
- Uploading files
- Long response time for browse and search functions.
- Browser compatibility
- Require for content not in database
- Incorrect personal data
- Unavailable plug-in and software for using course materials
- Materials for online courses are not well prepared
- Problem whit multiple connections to server
- Assignments and students' results are not well formatted

5.2. Risk identification

In this phase, all risk and possible consequences are considered.

During the first phase, a list of over 50 exploitation risks in e-education was created, but only the most important one will be analyzed in further research. There is a list of top ten risks and classified them into following categories:

- People (teachers, students, administrators, etc.)
- Process (mission, goals, decision making, project characteristics, budget, costs, etc.)
- Technology (security, development and testing, tools, support, availability, etc.)
- Environmental (legal, regulatory, competition, economic, technology, etc.)

5.3. Risk analysis and prioritization

In order to define risks priority, two techniques can be used: risk probability and risk impact. Risk exposure measures the overall threat of the risk, combining information expressing the likelihood of

actual loss with information expressing the magnitude of the potential loss into a single numeric estimate. Risk probability 1%-30% is considered as low, 31%-70% as medium and 71%-100% as high. Risk exposure 1-3 is considered low, 4-7 medium and 8-10 high.

At this point it is necessary to mention that defined roles in Moodle LMS are teacher, administrator, course creator, student and guest. However, in many case teachers perform some administrative functions, as well as course creator's functions.

Upgrade, update and backup risks are grouped and represent exploitational risk of highest priority. Many Moodle forum posts refer to this problem, and teachers and administrators consider this to be the biggest problem in using Moodle LMS. This is also the case with administration and installation risks.

Problem with bad links is also one of the most common problems when using Moodle LMS, both for students and teachers. The conclusion is that many problems are due to to technology, such as unsupported AJAX technology, or LDAP problems.

Also, when planning actions for risk management, problems dealing with students', and especialy teachers' knowledge for using Moodle should be closely concerned.

5.4. Risk Planning and Scheduling

Risk planning and scheduling is the third step in the risk management process. The planning activities carried out by the team translate the prioritized risk list into action plans. Planning involves developing detailed strategies and actions for each of the top risks, prioritizing risk actions, and creating an integrated risk management plan. Scheduling involves the integration of the tasks required to implement the risk action plans into the project schedule by assigning them to individuals and actively tracking their status.

In this phase, it is also necessary to define triggers causing certain risks. In this case, all risks considered are exploitation risks so system exploitation triggers all of defined risks.

Scheduling requires defining starting and ending dates for all activities. However, all identified risks are present during whole exploitation process, so time schedule cannot be defined.

5.5. Risk Tracking and Reporting

Risk tracking is essential to implementing action plans effectively. It ensures that assigned tasks implementing preventative measures or contingency plans are completed in a timely fashion within project resource constraints.

It is necessary to create reports and identify one of the following:

- Risk has been resolved
- Risk actions are consistent with the risk management plan
- Some risk actions are at variance to the risk management plan, in which case corrective measures should be defined and implemented

If risk actions are well planned, exposure to exploitation risks in e-education should decrease, and the whole educational process will be improved. Thanks to that, institutions of higher education will be more competitive on the market.

5.6. Risk Control

During this step the teachers, course creators and administrators, as well as e-education management team, are actively performing activities related to risk plans and contingency plans in case triggers have been reached. Risk management relies on existing standard project management processes and infrastructure to:

- Control risk action plans.
- Correct for variations from plans.
- Respond to triggering events.

When using Moodle LMS, it is necessary to perform continuous risk monitoring, managing and performing actions for elimination of these risks. It is also very important to consider and new risks that can appear during exploitation period.

5.7. Learning from risks

In this phase teachers, administrators and other users are provided with feedback about results and quality of risk management. They create risks database which contains data about all identified risks. It possesses variety of applied patterns, rules and "know-how", which in combination with risk management mechanisms should develop models for cutting risk down.

All users in e-learning systems should be encouraged to give their remarks and suggestions about their experiences in using these systems. At the same time, this would help in detecting new risks, and resolving old ones.

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6 Conclusions

Very common mistakes that were made in developing of e-education systems are detected later during the exploration of system. At the same time, although technology is improving rapidly, dangerous risks are to appear due to people's mistakes. Identifying of exploration risks in e-learning and defining adequate activity is of the biggest importance for clearing potential problems away. New strategies in risk management imply a higher degree of standardization and uniformity in risk management and request real time analyzing of risks. Surely, methods described in this paper are the first steps in exploration risk management in e-learning. Research will be expanded by providing some more data from e-learning systems. It would be very useful to carry out detailed analysis which would show in what extent suggested methodology helps in managing risks. Then the results and whole risks management process would be complete. Additionally, the final outcome would represent effective and valuable e-education system organized in such way that this threats and risks are minimal.

Also, the competitive sprawl concept presented in [18] can be applied to relationship between higher-education institutions that are situated in different cities.

Overcoming these risks is one of the sources of competitive advantage. Many large institutions were made due to the fact that they were able to react and take advantage of technological changes. Technological change is therefore one of the most important factors that can completely change the rules of competition.

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