An Analysis and Comparison of Adoption of E-learning Systems in Higher Education by Lecturers at Largest Universities in Estonia and Turkey

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Abstract. In this study, for the first time, we analysed and compared adoption of e-learning by lecturers in three largest universities in Estonia and Turkey. Total number of students and academic staff in the Estonian universities is 39,259 and 3,991, respectively, and 1,194,735 and 9,076, respectively, in the Turkish universities. The extended Technology Acceptance Model (TAM2) was used to analyse results of acceptance and usage of e-learning by 923 lecturers (298 from Estonia and 625 from Turkey) or 22% from the sample subject, took part in the research from the studied universities. Total number of respondents subjected to the questionnaire distribution was 4,198 (1,423 in Estonia and 2,775 in Turkey). We found and analysed strong and weak sides of e-learning and main barriers, which hinder adoption of e-learning in Estonian and Turkish largest universities. Immediate measures to support development and improvement of e-learning system at higher education in these universities were suggested.

Keywords: e-learning, Estonia, higher education, TAM2, Technology acceptance model, Turkey

1   Introduction

Every year electronic systems in higher education (e-learning) are going to be implemented more and more actively by the most reliable universities around the world. E-learning is phenomenon based on remote collaboration of students and lecturers, facilitating of access to educational resources and services, enhancing of learning quality, upgrading of teaching methods and habits using new multimedia technologies and internet. Fast development of this technology is obliged to global level of technological progress of information technologies (IT). However, balanced adoption and integration of e-learning in higher education by main users of the system, lecturers and students, is controversial. Number of barriers limiting productive implementation and utilization of e-learning in universities' everyday routine is still exists: economic, political, technical, pedagogical, absence of strategic plan and consortia between universities (Hara, 2003; Kilmurray, 2003; Saadé, 2003; Elloumi, 2004; Surry et al.,

2005; Park, 2009). Identification of the critical factors related to user acceptance of technology continues to be an important issue (Yi and Hwang, 2003; Park, 2009). Number of studies was provided to estimate adoption and integration of e-learning between students, e.g. (Koohang and Durante, 2003; Grandon et al., 2005; Park, 2009), and analysing usability of e-learning systems, e.g. (Harms and Adams, 2008; Nielsen, 2012; Genc, 2015). But the main developers and deliverers of e-learning for students are lecturers, which are in most cases accustomed to use old educational system. Therefore, there is a high importance of understanding of how lecturers perceive and react to elements of e-learning along with how to most effectively apply an e-learning approach to enhance learning. These data can help academic administrators and managers to create more effective learning environment to adopt e-learning in higher education. It is necessary to conduct research that provides personal information from lecturers about their perception of, attitude towards, and intention to use an e-learning.

Activities and strategic development of e-learning in higher education in three largest Estonian (University of Tartu-UT, Tallinn University of Technology-TUT, and Tallinn University-TU) and Turkish universities (Anadolu, Sakarya and Istanbul University) have been already studied and compared in previous studies (Güllü et al., 2014; Güllü et al., 2015b). The strongest point of Estonian e-learning in higher education is unity between all participants of e-learning educational system from all the studied universities. While, studied universities in Turkey have its own interaction platforms without links and possibility to cooperate between users from different institutions (Güllü et al., 2015b). Estonia, or "silicon valley of Europe", as one of the most developed countries in the field of Information and Communication Technologies in the world can be a good example for Turkey.

The objectives of this study were to examine and compare quality and issues of e-learning in Estonia and Turkey at higher education, covering social, pedagogical and policy aspects. The results of the research would help e-learning systems administrators and developers to adopt and integrate better e-learning environment for lecturers.

This study proposed an integrated theoretical framework of adoption of e-learning by university lecturers based mainly on the extended technology acceptance model (TAM2). TAM is a theoretical model that helps to explain and predict user behaviour of information technology (Legris et al., 2003). TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use. Two cognitive beliefs are posited by TAM: perceived usefulness and perceived ease of use. According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioural intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use (Davis, 1989; Park, 2009). TAM2 appears to be able to account for 60% of user adoption (Venkatesh and Davis, 2000). As suggested in TAM2, subjective norm, one of the social influence variables, refers to the perceived social pressure to perform or not to perform the behaviour (Ajzen, 1991). It seems important to determine how social influences affect the commitment of the user toward use of the information system for understanding, explaining, and predicting system usage and acceptance behaviour (Malhotra and Galletta, 1999; Park, 2009).

In general, variables related to the behavioural intention to use information technology or to the actual use of information technology could be grouped into four categories: individual context, system context, social context, and organizational context. While social context means social influence on personal acceptance of information technology use, organizational context emphasizes any organization's influence or support on one's information technology use. Reference (Thong et al., 2002) identified

relevance, system visibility, and system accessibility as organizational context variables. They reported that the organizational context affects both perceived usefulness and perceived ease of use of a digital library. Reference (Lin and Lu, 2000) similarly reported that higher information accessibility brings about higher use of information and higher perception of ease of use. In this study, e-learning accessibility refers to the degree of ease with which a university lecture can access and use campus e-learning system as an organizational factor (Park, 2009).

In our recent studies (Güllü et al., 2015, 2015a, 2015b) we used EES model and EES Model-2. TAM2 was selected for further research due to compatibility with previously implemented models. In this study, for the first time, we analysed and compared adoption of e-learning by lecturers in three largest universities in Estonia (UT, TUT and TU), country leading in the field of IT development and integration and three largest universities in Turkey (Anadolu, Istanbul and Sakarya University), quickly technologically developing country. Estonian and Turkish universities operated 5,388 e-courses with 146,067 students and 234 e-courses with 1,401,802 students in 2013–2014, respectively (Güllü et al., 2015b). Total number of students in 2013 at UT (16,000; [1]), TUT (13,050; [2]) and TU (10,209; [3]) was 39,259 that is 65% of total students in higher education in Estonia (59,998; Fig. 1; [2]).

Total number of an academic staff in 2013 at UT (1,800; [1]), TUT (1,731; [2]) and TU (460; [3]) was 3,991 (Fig. 2). Total number of students in Turkish largest universities in 2013 was 1,194,735: >1 mln. in Anadolu [4], 109,901 in Istanbul [5] and 84,834 in Sakarya [6]. It is 24% of total number of students in higher education in Turkey (4,9 mln.; Fig. 1; [7]). Total number of an academic staff in 2013 at Anadolu University (2,000; [4]), Istanbul University (5,100; [5]) and Sakarya University (1,976; [6]) was 9,076 (Fig. 2).

We found and analysed strong and weak sides of e-learning and main barriers, which hinder adoption of e-learning in Estonian and Turkish largest universities. Immediate measures to support development and improvement of e-learning system at higher education in these universities were suggested.
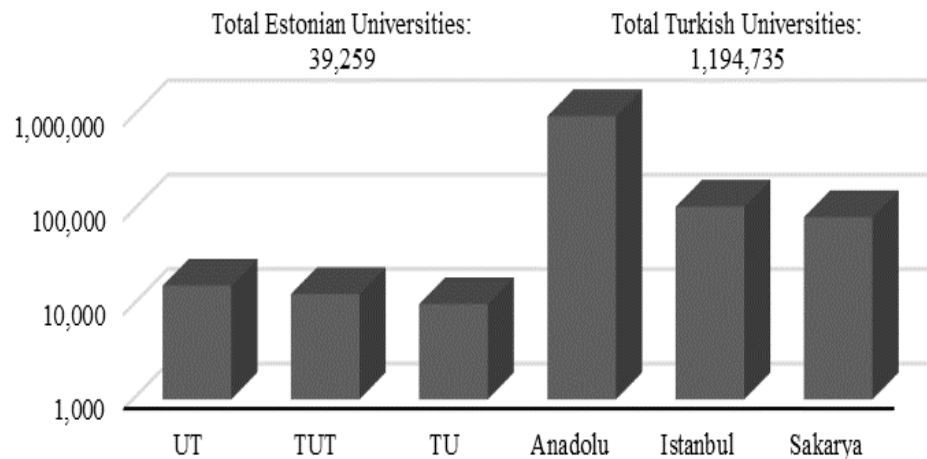

Fig. 1. Number of students in largest universities of Estonia and Turkey

[1]www.studyinestonia.ee
[2]www.ttu.ee
[3]www.tlu.ee
[4]www.anadolu.edu.tr
[5]www.istanbul.edu.tr
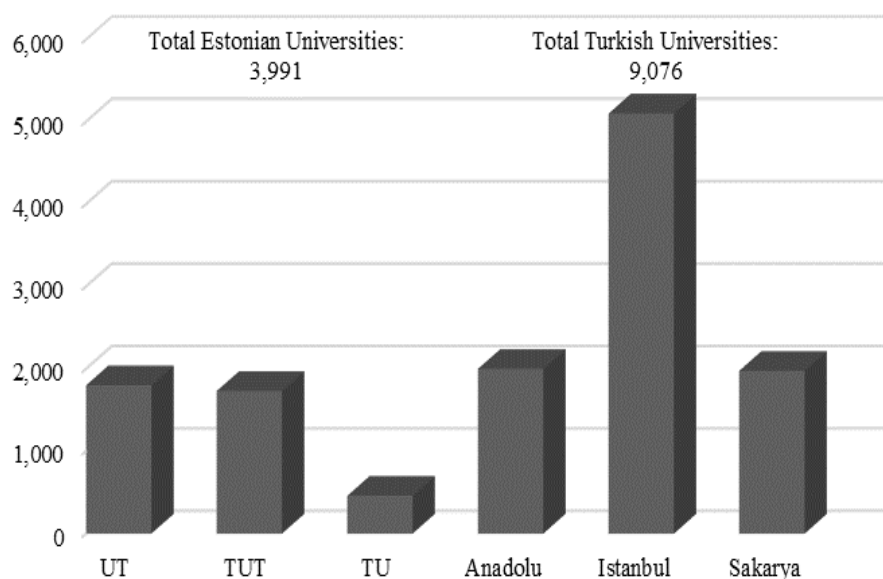[6]http://about.sakarya.edu.tr
[7]www.studyinturkey.com

Fig. 2. Number of academic staff in largest universities of Estonia and Turkey

2   Methods

Collected data were based on questionnaire sent to participants. The questions were divided into two parts, (1) participant profile and (2) how participant feels that e-learning system adopted in his university for education environment (Table 1). Each part consists of different groups of questions. Groups in the first part contain four items (questions) to identify demographic attributes of respondents such as date of birth, gender, academic position and institution facility. Groups of the second part consist of 2-4 questions. These questions are partly based on TAM2 model (Groups: Perceived ease of use, Perceived usefulness, Attitude, Behavioural intention, E-learning self-efficacy, Subjective norm, System accessibility), consisting in total 17 questions. Groups such as Policy factor, Pedagogical level and Barriers consist in total 10 questions (Table 1) were developed for this study by author according to discussion and validation by experts (professors of e-learning study, heads of e-learning centres, developers of e-learning system, [8, 9, 10, 11, 12, 13]) in the field from the studied universities in Estonia and Turkey. Total item pool of the scale consisted of 31 items, four in the first part and 27 in the second one. Participants were asked to complete a seven-point Likert-type scale (1-Strongly disagree, 2-Disagree, 3-Somewhat disagree, 4-Neither agree or disagree, 5-Somewhat agree, 6-Agree, 7-Strongly agree) describing the level of agreement proposed by Vagias (2006). Items were adopted to be appropriate for participants (lectures of e-learning) from studied universities in Estonia and Turkey.

A.   Sample subjects

Participants in the study were lecturers in university (professors, associate professors, professor assistants and lecturers) who use e-learning in their practices. The number of sample subjects was set at 1423 in Estonian universities and 2775 in Turkish universities. Total number of respondents subjected to the questionnaire distribution was

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[8] http://www.uzem.sakarya.edu.tr

[9] http://auzef.istanbul.edu.tr/

[10] https://www.anadolu.edu.tr/en/academics/faculties/2/open-education-faculty/

[11] http://www.tlu.ee/en/E-learning-Centre

[12] http://www.ttu.ee

[13] http://www.ut.ee/en/studies/elearning/learning

4198. Nine hundred twenty-three respondents from the selected universities in Estonia (n=298) and Turkey (n=625) voluntarily participated in the study that is 22% from the sample subject. The overall response rate of about 20% is considered to be satisfactory and accurate measurement in terms of the statistical reliability (Visser et al., 1996).

B.   Statistical procedure

Data collected with the questionnaire were coded by research assistants. The data were recorded first in Limesurvey application, a free and open source on-line survey application written in PHP based on a MySQL, PostgreSQL or MSSQL database, distributed under the GNU General Public License [14]. This software gives opportunity to users to develop and publish on-line surveys, collect responses, create statistics, etc. Collected data were transferred to MS Excel program for further analysis.

Collected data show that respondents in Turkey were predominantly males P2(1) (n=354) than females P2(2) (n=265) (Fig. 3). Six respondents from Turkish universities did not identify their gender. Gender balance of respondents in Estonian universities was almost equal, but however females predominated (n=150 females vs n=148 males). Major respondents were Lecturers P3(4) in both countries (58% of respondents in Estonia and 36% in Turkey, Fig. 4). Assistant professors P3(3) represented 32% of all respondents in Turkish universities, when in Estonian universities only 15%. Associate professor option P3(2) was selected by 20% and 17% of respondents in Estonian and Turkey, respectively. Professors P3(1) composed only 7% of questionnaire participants in Estonian universities and more than two times in percentage professors participated in Turkish universities (15%, Fig. 4). Fig. 5 shows how respondents answered in average for presented questions in total. It is showing a general feeling/intention/satisfaction of users-lecturers of e-learning in their practice. These data shows users adaptation level. According to presented questions (Table 1), positive answers show how users accept this technology, or how it was adopted in their environment.
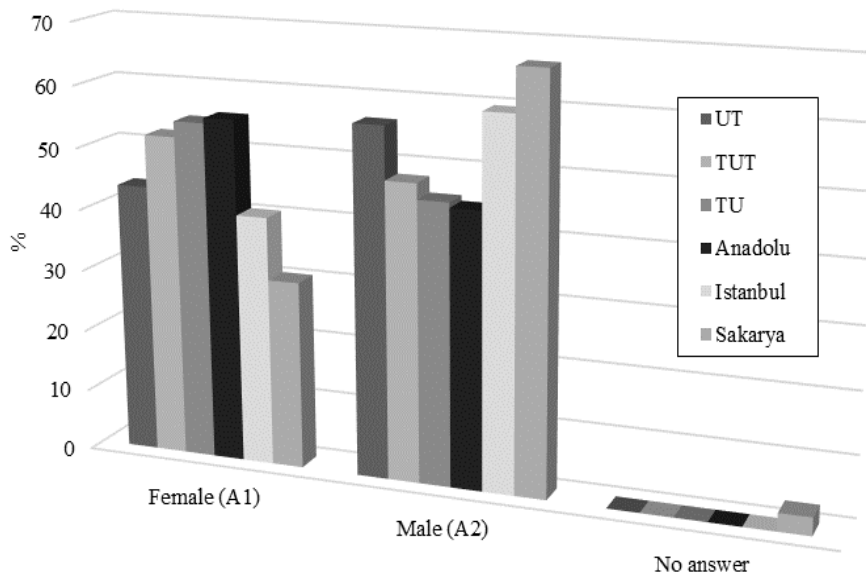

Fig. 3. Participants profile (gender, P2)

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[14] www.limesurvey.org

Concept	index	Group	index	Measurement instrument	index
Participant profile	P	Date of Birth	P1	Year	-
		Sex	P2	Male	1
				Female	2
		Academic position	P3	Professor	1
				Associate Professor	2
				Assistant Professor	3
				Lecturer	4
		Your Faculty	P4	For each university different lists of faculties were applied	
Adoption of e-learning system	AS	Perceived ease of use	PE	I find e-learning system easy to use	E_1
				Learning how to use an e-learning system is easy for me	E_2
				It is easy to become skilful at using an e-learning system	E_3
		Perceived usefulness	PU	E-learning would improve my teaching performance	U_1
				E-learning would increase my academic productivity	U_2
				E-learning would make it easier to teach course content	U_3
		Attitude	AT	Teaching (studying) through e-learning is a good idea	A_1
				Teaching (studying) through e-learning is a wise idea	A_2
				I am positive toward e-learning	A_3
		Behavioural intention	BI	I intend to post announcements, assignments and learning materials via e-learning systems frequently	B_1
				I intend to be an active user of e-learning system	B_2
		E-learning self-efficacy	SE	I feel confident finding information in the e-learning system	S_1
				I have the necessary skills for using an e-learning system	S_2
		Subjective norm	SN	What e-learning stands for is important for me as a university academic staff	N_1
				I like using e-learning because academic society values it	N_2
				In order to prepare students for their future jobs, it is necessary to provide them e-learning courses	N_3
		System accessibility	SA	I have no difficulty accessing and using an e-learning system in the university	SA
		Policy factor	PF	My university has adopted policies for productive implementation of e-learning at higher education in my country	PF_1
				Security aspects of e-learning at higher education are covered by policies in my country	PF_2
				Financial support mechanisms of e-learning at higher education are involved in policies in my country	PF_3
				E-learning policies in higher education are well implemented through productive cooperation between universities in my country	PF_4
		Pedagogical level	PL	E-learning is the main source of pedagogical innovation in higher education in my country	PL_1
				My university provides academic staff trainings to develop innovative pedagogical approaches for e-learning	PL_2
				Academic staff in my university needs today more training in pedagogical aspects of e-learning and less in technological skills	PL_3
		Barriers	BR	The main barrier that hinders adoption of e-learning in my university is poor technological infrastructure and outdated e-learning systems	BR_1
				The main barrier that hinders adoption of e-learning in my university is poor readiness of academic staff to use e-learning system	BR_2
				The main barrier that hinders adoption of e-learning in my university is absence of clear vision and policy for e-learning development	BR_3

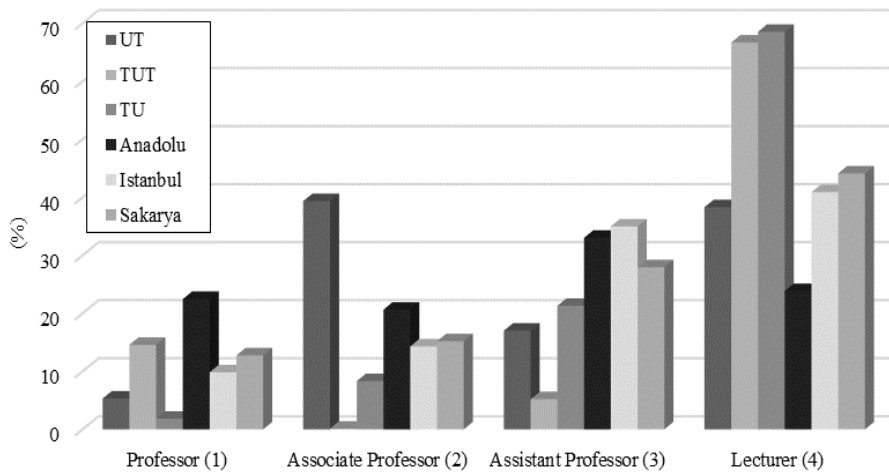**Table 1.** Summary of means, concepts and indexes

Fig. 4. Participants profile (Academic position, P3)

3   Results

Our study showed that the highest satisfaction of usage and adoption of e-learning system in higher education between studied largest universities of Estonia and Turkey was demonstrated by respondents from UT. About 87% of lecturers in average from this university were satisfied-"strongly agree", "agree" and "somewhat agree", when answered for proposed questions. Only 13% in average of all respondents from this university were dissatisfied-disagree with different levels of confidence ("neither agree or disagree", "somewhat disagree", "disagree", "strongly disagree) with statements in questionnaire (Fig. 5). TU is the next Estonian university and next between all studied universities according to satisfaction of e-learning. About 84% of respondents in average from TU were agree and 16% in average were disagree with different levels of confidence when answered for our survey (Fig. 5).

We found that TUT has third place between Estonian largest universities according to satisfaction of usage and adoption of e-learning system in higher education. About 74 and 26% of respondents in average answered with different levels of confidence in satisfaction and dissatisfaction mode, respectively (Fig. 5).

According to our research the highest satisfaction of usage and adoption of e-learning between largest Turkish universities has Istanbul University (average 77 and 23% of answers in satisfaction and dissatisfaction mode, respectively). Lower satisfaction showed Anadolu University with average 73 and 27% of answers with satisfaction and dissatisfaction mode, respectively. The most dissatisfied atmosphere of usage and adoption of e-learning by lecturers between Turkish largest and all studied universities was found in Sakarya University (average 64 and 36% of answers were satisfied and dissatisfied, respectively, with different levels of confidence) (Fig. 5). Estonian lecturers in total more satisfied with usage and adoption of e-learning at higher education in their everyday work (82% in average of satisfied answers, Fig. 5). Their Turkish colleagues in average 10% less satisfied of this technology usage and adoption in higher education (71% in average of satisfied answers, Fig. 5).

We found that respondents from both countries don't find usage of e-learning system in their work difficult and agree in importance of implementation of the system in higher education to improve academic productivity and teaching performance. In general they were positively related to e-learning system in higher education and mentioned them self as active users of the system. However, according to received answers Estonian lecturers were more active in this practice. Respondents from both countries equally answered about their good skills and confidence in e-learning.

The biggest difference in answers was found for Policy factor (PF), pedagogical level (PL), barriers (BR) groups of questions (Table 1). According to policy adaptation, security, financial support mechanisms and productive cooperation we found that between Estonian universities TUT respondents showed lower satisfaction than TU and UT. The lowest satisfaction with questions of policy factor was showed by respondents from Istanbul University.

Lecturers from TUT less than others support opinion that e-learning system is the main source of pedagogical innovation in higher education in Estonia. The highest satisfaction of e-learning staff trainings that proposed at universities was expressed by Estonian respondents. Istanbul University lecturers showed maximum dissatisfaction in this question. Respondents from all universities expressed need in pedagogical training of academic staff.

Poor technological infrastructure and outdated e-learning systems were noted as the main barrier that hinders adoption of e-learning (BR_1, Table 1) in UT and Istanbul University. Lecturers from TUT, Anadolu and Sakarya universities were disagree and strongly disagree with this statement. Poor readiness of academic staff to use e-learning system (BR_2, Table 1) was noted as the main barrier by lecturers from Istanbul University and UT. We found that absence of clear vision and policy for e-learning development (BR_3, Table 1) is the main barrier that hinders adoption of e-learning in Istanbul University. Also big percentage of respondents from TU has noticed about this problem.
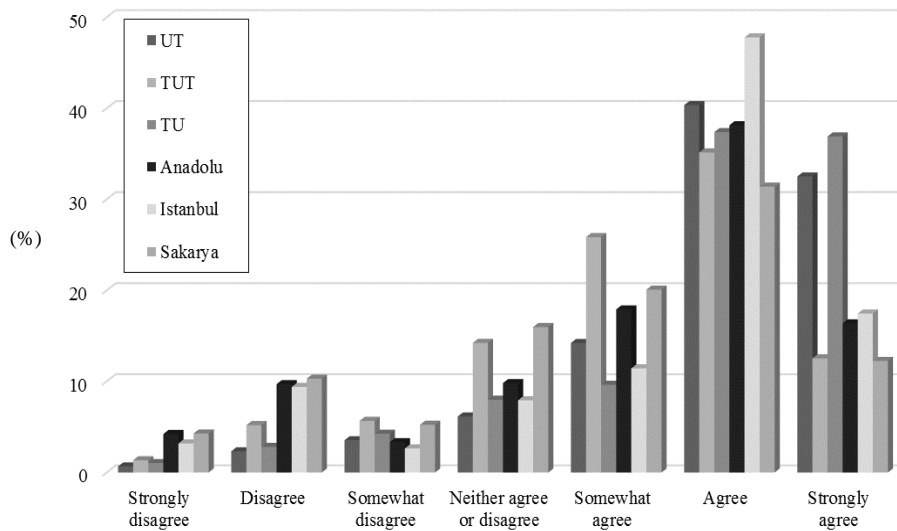

Fig. 5. Summary table of all answers by respondents from six universities from Estonia and Turkey

4   Discussion

As expected, we found that lecturers from the largest universities in Estonia are more satisfied of usage and adoption of e-learning system in their universities than their colleagues from Turkey (Fig. 5). This is due to Estonian e-learning system in higher education is advanced and united in the context of technical, pedagogical and economical aspects, and activities provided by this universities, when Turkish e-learning needs improvements and unification. United platform (like Moodle system in Estonia) was recommended to be involved in Turkey to integrate students, lecturers and all available data for e-learning in higher education from all the studied universities into one independent e-learning environment (Güllü et al., 2014, 2015b). In this study we explored weak and strong sides of e-learning system in higher education in Turkey and Estonia and which aspects need to be improved. Immediate measures for improvement process were suggested.

Strong sides of e-learning in both countries are total acceptance and understanding of importance of implementation of the modern educational system by lecturers of largest universities. Good skills and confidence in e-learning are next strong sides of the system. These make adaptation process easier. As expected, Estonian respondents showed more activeness in this practice due to excellence of the country in IT development and integration.

Problems in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities were found. Lower success of these aspects in respondent's answers, as expected, was found at TUT. Answers for questions of Policy factor group of questions by lecturers from TUT, we suppose, shows that respondents are less informed by TUT governance than lecturers from TU and UT. We found weak side of e-learning system or barrier that hinders adoption of e-learning at TU - the absence of clear vision and policy for e-learning development (BR$_3$, Table 1). We suggest to both universities governance take measures to eliminate these gaps. Improving productive cooperation between institutions aspect only can solve consequently other existing problems due to positive experience of UT in these fields. United e-learning environment (Moodle) that supports productive cooperation between all participants of e-learning at higher education in Estonian universities is already exists and successfully implemented in the studied universities. This environment can be used as prospective tool to rich this aim. (i) Poor technological infrastructure and outdated e-learning systems and (ii) poor readiness of academic staff to use e-learning system were noted as barriers which hinder adoption of e-learning at UT. Those, we suggest to UT administration to renovate technological aspect of e-learning system, taking as example infrastructure at TUT and TU. The second (ii) barrier, we suppose, is due to age of lecturers. Using a personal experience, we know that there is big number of experienced lecturers in the studied universities, whose experience based on old educational technologies and principles. More experienced lecturers often are less flexible to accept new technologies than younger ones and prefer old methods in education. We can suggest a way to solve this problem: to use a systemic change approach, that is effective measure according to previous studies (e.g. Su, 2009). One solution for making qualitative change in effective technology integration in the daily teaching and learning process is to use a systemic change approach. A systemic change is doable as there are successful cases in the literature (e.g. Fullan, 1993). If educators use a systemic approach to deal with both first- and second-order barriers,

success will ultimately come. Reigeluth (1994) points out that systemic change is a paradigm shift that "entails replacing the whole thing" because "a fundamental change in one aspect of a system requires fundamental changes in other aspects in order for it to be successful". Education as a social enterprise is a very complex system that involves many stakeholders such as teachers, students, parents, administrators, business partners and policy makers. To effectively integrate technology, these people will either affect or be affected by the change (Su, 2009).

Main barriers, which hinder adoption of e-learning in Turkish largest universities, were found in Istanbul University: (i) poor technological infrastructure and outdated e-learning systems, (ii) absence of clear vision and policy for e-learning development, (iii) poor readiness of academic staff to use e-learning system. These results confirmed our expectations. The suggestion, first of all for Istanbul University, and other Turkish universities governance (Anadolu and Sakarya University) is to take as example model of development of e-learning system in Estonian universities. We recommend to begin with establishment of strong and stable policy, to build consortia between all universities in the field, significantly finance technological infrastructure, regulate financial support of projects related to development of e-learning system, support security measures to provide safe usage of e-learning and develop training system for new and existing specialists.

We strongly suggest the implementation of measures in a complex. Selection of suggested tools separately will not guarantee stable, productive result of e-learning architecture. Wenger et al. (2002) demonstrated that the adoption of e-learning is actually influencing learning strategy, and that the simple delivery through technology cannot be sustained as a separate form of training, an appendix to traditional instructor-led activities. To be successful, it has to be seen as a part of a complete learning architecture that includes a variety of tools, approaches, and a coherent learning culture. The analysis shows two emerging phenomena: a different degree of success of the e-learning initiative depending upon its coherence with the organizational culture, and the learning strategy; a changing balance of classroom training and e-learning in relationship to the adoption of the Learning Management System in each department (Kok, 2013). Similar results were also presented in many studies, e.g. in (Al-Adwan and Smedly, 2012; Chokri, 2012; King and Boyatt, 2015, etc.).

We believe that results of this study will be helpful for improving e-learning system in higher education in Estonia and Turkey, as well as in other countries that meet similar barriers.

5   Conclusion

In this study for the first time we analysed and compared adoption of e-learning by lecturers in three largest universities in Estonia (Tartu University, Tallinn University of Technology and Tallinn University) and three largest universities in Turkey (Anadolu University, Istanbul University and Sakarya University). The extended Technology Acceptance Model (TAM2) was used to analyse results of acceptance and using of e-learning by 923 lecturers (298 from Estonia and 625 from Turkey) or 22% from the sample subject, took part in the research from the studied universities. Total number of respondents subjected to the questionnaire distribution was 4,198 (1,423 in Estonia and 2,775 in Turkey). We found and analysed strong and weak sides of e-learning and main barriers, which hinder adoption of e-learning in Estonian and Turkish largest universities.

It was found:

- that lecturers from the largest universities of Estonia are more satisfied of usage and adoption of e-learning system and showed more activeness than lecturers from Turkey
- that lecturers from both countries largest universities completely accept and understand importance of implementation of the modern educational system, such as e-learning is and showed good skills and confidence in e-learning
- gaps in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities. Less success of these aspects in respondent's answers were found at TUT
- absence of clear vision and policy for e-learning development at TU
- poor technological infrastructure and outdated e-learning systems and poor readiness of academic staff to use e-learning system at UT
- that main barriers, which hinders adoption of e-learning in Turkish largest universities are in Istanbul University (poor technological infrastructure and outdated e-learning systems, absence of clear vision and policy for e-learning development, poor readiness of academic staff to use e-learning system).

We provided suggestions for Estonian and Turkish universities governance to take into consideration results of our study and to improve current situation in e-learning. We recommend:

- to improve productive cooperation between Estonian institutions. It can solve existing problems at TUT and TU
- to renovate technological aspect of e-learning system at UT, taking as example infrastructure at TUT and TU; and to use a systemic change approach that is effective measure to implement new technologies
- to take the model of development of e-learning system in Estonian universities as example for all Turkish universities, beginning with establishment of strong and stable policy, to build consortia between all universities in the field, to finance significantly technological infrastructure, guarantee financial support of projects related to development of e-learning system, support security measures to provide safe usage of e-learning and develop training system for new and existing specialists
- to implement measures in a complex. Selection of suggested tools separately will not guarantee stable, productive result of e-learning architecture.

Suggested measures are important to support development and improvement of e-learning system in higher education in studied universities, as well as in other countries who meet similar barriers.

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