ELSEVIER

Volume 77 • 2015

ISSN 1877-0509

Procedia Computer Science

ICTE in Regional Development 2015 Valmiera, Latvia

Editors-in-Chief:
Egils Ginters
Marco Schumann

Available online at www.sciencedirect.com

ScienceDirect

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 77 (2015) i

Procedia
Computer Science

ICTE in Regional Development 2015 Valmiera, Latvia

Editorial Board:

Egils Ginters
Marco Schumann

ELSEVIER

Amsterdam - Boston - London - New York - Oxford - Paris - Philadelphia - San Diego - St Louis

Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 77 (2015) iii–iv

Procedia Computer Science

Contents

doi:10.1016/S1877-0509(15)03900-9

Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 77 (2015) 48 – 55

Procedia Computer Science

ICTE in Regional Development

Towards Knowledge and Information Technology Transfer Concept and Its Validation

Leonids Novickis[a]*, Antanas Mitasiunas[b], Viktorija Ponomarenko[a]

[a]*Riga Technical University, Setas str. 1, LV-1048 Riga, Latvia*
[b]*Vilnius University Universiteto str. 3 ,LT - 01513 Vilnius, Lithuania*

Abstract

One of the main results obtained within the 7th Framework Programme international project eINTERASIA[1] is presented in the paper. The paper is devoted to the creation and validation of a process-oriented knowledge and Information Technology (IT) transfer concept. Several technology transfer process scenarios have been elaborated. They are based on the questionnaires developed according to innoSPICE methodology[2,3]: end user reactions to selected information technologies / solutions to be transferred from European Union (EU) to Central Asian Countries. The results of validations have been processed, analysed and presented as diagrams.

Peer-review under responsibility of the Sociotechnical Systems Engineering Institute of Vidzeme University of Applied Sciences

Keywords: Information technology transfer; Software engineering; Validation; eINTERASIA project;

1. Introduction

One of the major objectives of the eINTERASIA project[1] was creating of Information Technology (IT) Transfer Concept for adaptation and dissemination of selected EU research results in Central Asian countries.

The paper is focused on the following aspects:

- Usage of Software Engineering (SE) models

* Corresponding author. Tel.: +371 27891711;
E-mail address: lnovickis@gmail.com

Peer-review under responsibility of the Sociotechnical Systems Engineering Institute of Vidzeme University of Applied Sciences
doi:10.1016/j.procs.2015.12.358

- Technology transfer model
- General approach to validation activities
- Validation and estimation of EU research results.

eINTERASIA IT transfer concept is based on Capability Maturity Model (CMM) ISO / IEC 15504[4] and the best practices in the fields of Software Engineering (SE), project management and commercialization of research results.

2. Towards IT Transfer Concept

2.1. Process Capability Modelling

Some three decades ago, software developers started to seek established and confirmed procedures and solutions to cope with the software crisis that was caused by recurrently exceeding project costs and schedules as well as the failure of functionality and quality. Inspired by traditional engineers, the software engineering community has developed standards (ISO/IEC 15504 and CMMI) that were used by numerous software providers to improve of the software development process[5].

Therefore, the research in this area is based on:

- Capability Maturity Model developed by Software Engineering Institute of Carnegie Melon University[6]
- International Standard for process assessment ISO/IEC 15504, also known as project SPICE (Software Process Improvement and Capability dEtermination) initiated by the Ministry of Defense of UK[7].

The third main source in the process capability maturity area is iCMM v2.0 (integrated Capability Maturity Model), leading to the issues of model integration and architecture representation, developed by US Federal Aviation Administration[8]. It had a significant impact on the current state of the CMMs area[8] and is along the same lines as ISO/IEC 15504 (SPICE) and CMMI models. The convergence of SPICE and iCMM models is completed as the Enterprise SPICE initiative and the draft of the future standard is publicly available.

2.2. Technology Transfer Model

The results obtained in the area of software engineering can be successfully applied in the area of innovation, knowledge, technology and research results transfer. The approach taken here is the "white box" approach, i.e. the innovation, knowledge and technology transfer activities are decomposed into a set of processes and their performance descriptions.

InnoSPICE model for knowledge and technology transfer has been developed within the Baltic Sea Region INTERREG Program project "Baltic Organization and Network of Innovation Transfer Associations" (BONITA)[3].

eINTERASIA Technology Transfer Concept (TTC) presents the further development and adaptation of InnoSPICE model to the local conditions of Central Asian countries (Fig. 1).

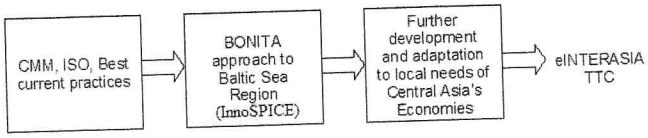

Fig. 1. eINTERASIA Transfer Model.

Three roles act in the field of innovation and technology transfer: technology supplier, technology receiver/acquirer, and technology transfer facilitator (Fig. 2). An organization can perform more than one role in the innovation and technology transfer process as well as one role can be performed by more than one organisation.

The roles of the partner organizations in eINTERASIA project:

A) Technology supplier. Technology supplier organizations focus on the development of technologies and advanced research solutions: Riga Technical University (Latvia), University of Bremen and Fraunhofer IFF Institute (Germany), MIT-SOFT Ltd. (Lithuania), Logitrans Consult Ltd. (Estonia);

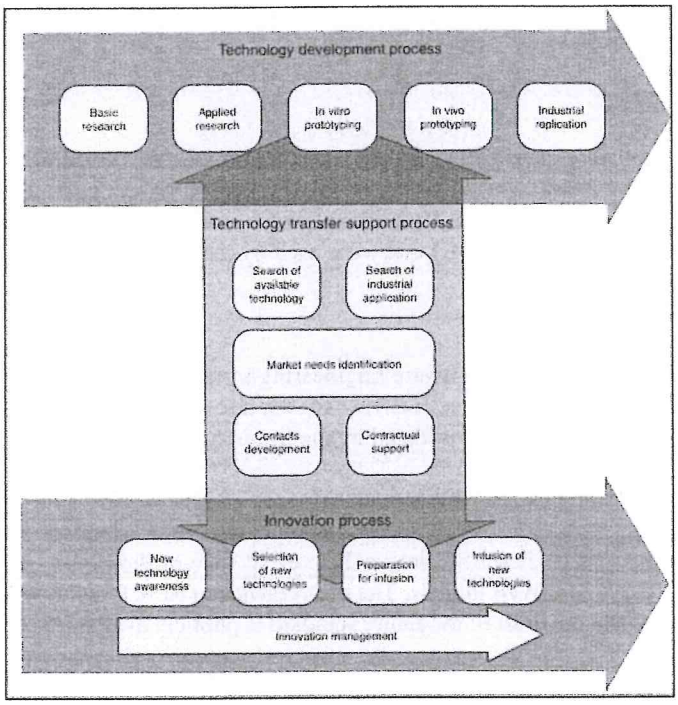

Fig. 2. The roles in technology transfer.

B) Technology receiver/acquirer. Technology receiver organizations are the ones that take a new technology/solution and implement it to improve their products, services, processes or work environment: Uzbek International Forwarders Association (UIFA) and its members, Astana Innovations, Technological University of Tajikistan (TUT);
C) Technology transfer facilitator. Technology transfer facilitator organizations are the ones that enable and in many cases drive technology/solution transfer: UIFA and TUT.

Technology transfer facilitator's activity can range within quite wide limits from a technology transfer broker to a technology transfer driver.

A knowledge commercialization broker's scenario takes place when an active role in knowledge transfer is taken by an intermediary who seeks knowledge acquirers' needs and knowledge to be transferred and to create a demand-supply database and/or a network of brokers. The primary action in this activity is to catch the demand. The knowledge supply is secondary. It can be based on the existing knowledge ready for use or can be developed according to the order of the acquirer. There is data provided by brokers, whose success ratio is about one in 60 cases.

The role of the broker in knowledge commercialization finishes when an agreement for knowledge transfer is concluded between a knowledge acquirer and a supplier. The knowledge commercialization broker's scenario can be classified as low knowledge on the demand side and low knowledge on the supply side. The main risk is up to a knowledge broker that knowledge transfer intermediation efforts will not be successful. The impact of the risk is low because of limited investments into a brokerage activity.

Knowledge commercialization driver's scenario takes place when full responsibility for the knowledge transfer is up to a knowledge transfer driver. The knowledge transfer driver is the one who creates a knowledge commercialization loop with involvement of many players, including knowledge marketing managers, acquirers, developers, sponsors etc. The knowledge transfer driver's activity is based on a knowledge commercialization concept elaborated by the involvement of experts from acquirers, developers, marketing, and funders' communities and on the complementarity of integrated efforts of various capabilities for value creation.

Knowledge commercialization driver's scenario can be classified as sufficient knowledge on the demand side and sufficient knowledge on the supply side. The main risk is up to a knowledge transfer driver. The impact of the risk is high because of concentration of responsibility into a driver's activity.

2.3. The Novelty of the Proposed Approach

The concept is based on the integration of several innovative elements[9]:

- Adapted to the local needs Capability Maturity Model ISO 15504 and InnoSpice model
- Virtual Reality – based environment
- Showrooms as "a windows" to scientific innovations
- Web-based software framework to support business processes in selected areas.

The concept will help corresponding companies from Central Asia to organize effective communications between the EU and local players in the IT solutions transfer field, formalize and improve the process of knowledge transformation into local innovations.

3. Validation of Selected EU Research Results

A set of questionnaires for validation of findings of the project eINTERASIA project have been created.

Validation of innovative results of the project was assessed by means of questionnaire completion by potential end-users[10].

The following piloted EU results were validated[1,10]:

- Web-based framework
- Showroom concept
- Virtual Reality-based environment
- InnoSPICE™ transfer model
- Web portal SIGNA for e-signature.

eINTERASIA project partners responsible for the validation of a specific solution were implementing this process.

In addition, each responsible partner attracted organizations interested in the specific solution, as volunteers. To do so partners used contacts from the database, as well as information obtained in the course of the eINTERASIA meetings.

4. Validation and Estimation of EU Research Results

The questionnaires for Validation of selected EU research results and obtaining end user feedback on technologies to be transferred according to IT transfer concept have been created.

The following piloted EU results were validated [1,10]:

- InnoSPICE™ transfer model,
- Web-based framework eLOGMAR/ eINTERASIA.com ,
- Virtual Reality –based environment,
- Product line SIGNA™ for e-signature,
- Showroom concept.

5. Processing of Results of Validation

5.1. Web Based Framework : www.einterasia.com / elogmar

1-5 points scale is used („5"-„excellent", „4"-„good", „3"- „average", „2" - „poor", „1" -„very poor").

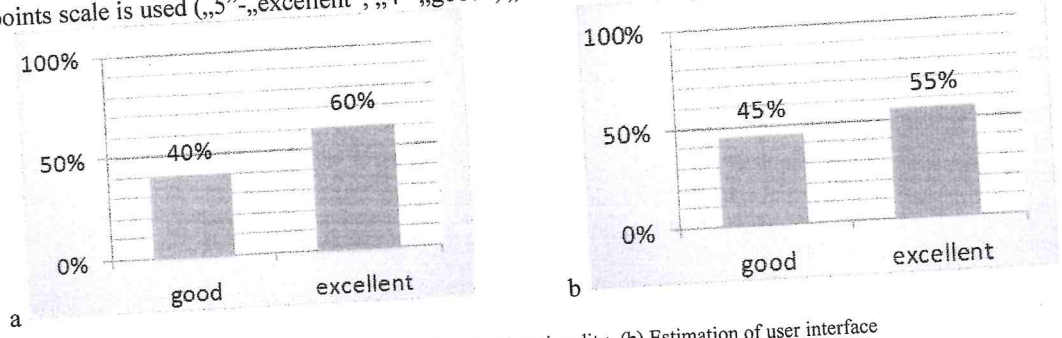

Fig. 3. (a) Estimation of Web portal functionality. (b) Estimation of user interface

5.2. Showroom environment at TUT

1-5 points scale is used („5"-„excellent", „4"-„good", „3"- „fair", „2" - „bad", „1"- „very bad").

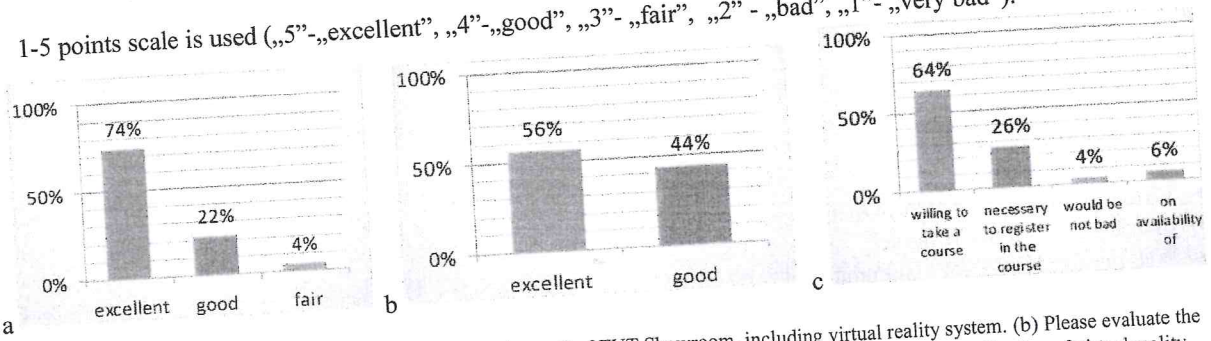

Fig. 4. (a) Please evaluate the functional opportunities (equipment) of TUT Showroom, including virtual reality system. (b) Please evaluate the functional opportunities 3D glasses of TUT Showroom. (c) Please evaluate your wishes to take a course on the application of virtual reality technologies in 3D format

1-5 points scale is used („5"-„obligatory", „4"-„necessary", „3"- „probably yes", „2" - „probably no", „1"- „not needed").

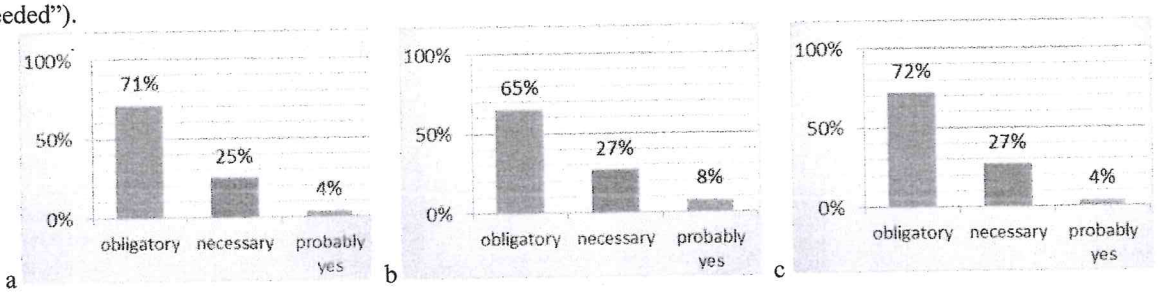

Fig. 5. (a) Please evaluate the importance of application Showroom technologies in the educational process. (b) Please evaluate the importance of application of Showroom technologies in scientific-research works1-5 points scale is used (c) Please evaluate the necessity of teaching advanced IT (including virtual reality technologies) to new generation

1-5 points scale is used („5"-„excellent", „4"-„good", „3"- „fair", „2" - „bad", „1"- „very bad").

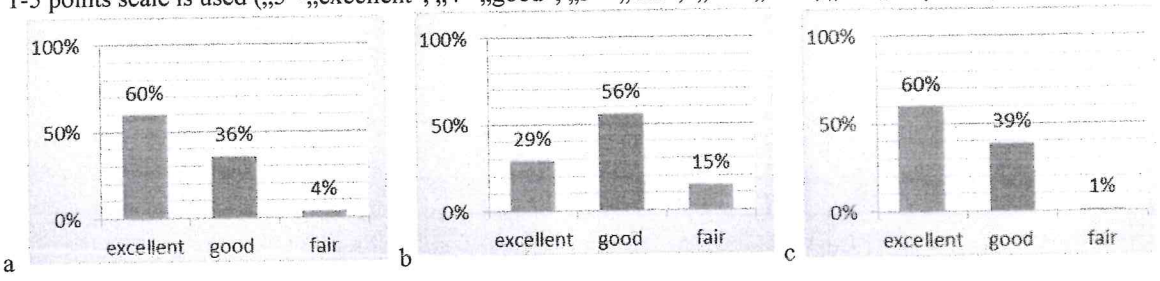

Fig. 6. (a) How do you evaluate the role of Showroom in the development of students' creative thinking? (b) Please evaluate the level of application of advanced IT (including virtual reality technologies) in your country/town/company (c) Please evaluate the perspectives application of technologies of TUT Showroom

5.3. Virtual Reality – Based Environment

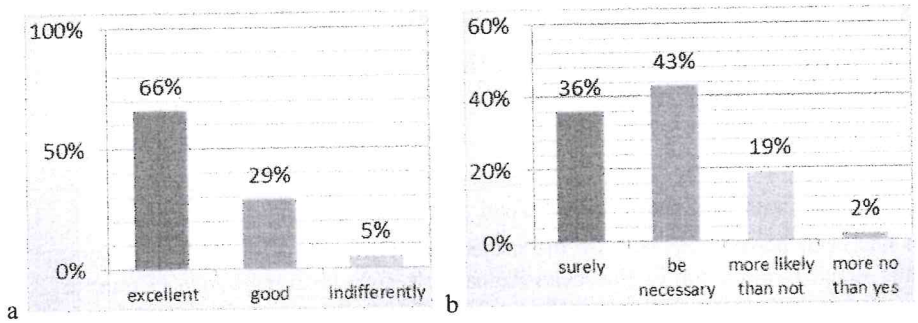

Fig. 7. (a) Estimation of Virtual Reality functionality of Astana Innovations 3D lab. 1-5 points scale is used („5"-„excellent", „4"-„good", „3"-„indifferently", „2" - „badly", „1" -„ very bad"). (b) Need of VR technology. 1-5 points scale is used („5"-„ surely", „4"-„ be necessary", „3"-„more likely than not", „2" - „more no than yes", „1" -„ there is no need")

5.4. InnoSPICE Transfer Model

1-5 points scale is used („5"-„excellent", „4"-„good", „3"- „average", „2" - „poor", „1" -„very poor").

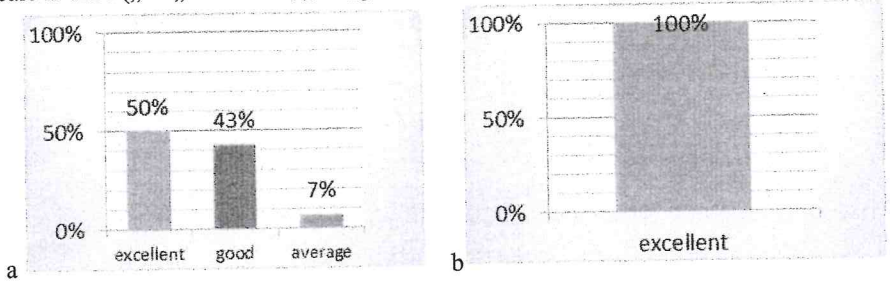

Fig. 8. (a) Estimation of facilities of Technology transfer model (b) Estimation of clearness of the description of the model's usage

5.5. Web portal SIGNA for e-signature

1-5 points scale is used („5"-„excellent", „4"-„good", „3"- „average", „2" - „poor", „1" -„very poor").

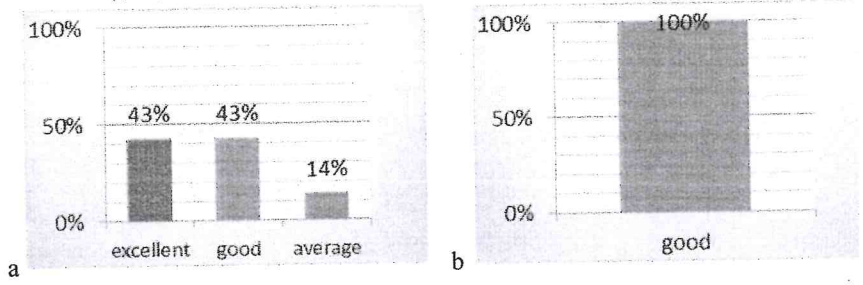

Fig. 9. (a) Estimation of portal functionality (b) Estimation of user interface

6. Conclusions

The generic IT transfer concept is presented in the article. It incorporates several innovative elements to provide the process of advanced solutions transfer from EU to Central Asian countries. The results of application of IT solutions in target countries have been validated by means of questionnaire completion by potential end-users. The results of validation show that the most part of validators rated functionalities and user interfaces of the transferred solutions very highly.

Future plans are related to the piloting of eINTERASIA results to other target regions and further improvement of the proposed IT solutions and technology transfer concept.

Acknowledgement

The research has been partly supported by the project eINTERASIA "ICT Transfer Concept for Adaptation, Dissemination and Local Exploitation of European Research Results in Central Asian Countries", grant agreement No. 600680 of the Seventh Framework Program Theme ICT–9.10.3: International Partnership Building and Support to Dialogues for Specific International Cooperation Actions – CP-SICA-INFSO.

References

1. Novickis, L., Mitasiunas, A. eINTERASIA Project: IT Transfer Concept for Adaptation and Dissemination of Innovative European Research Results in Central Asian Countries. In: Scientific Journal of Riga Technical University Computer Science,. Vol.17, RTU Press, 2015, pp.7-11.
2. Besson J., Woronowicz, T., Mitasiunas A., Boronowsky, M. Innovation, Knowledge- and Technology Transfer Process Capability Model – innoSPICETM. In: The Proceedings of the 12th International Conference SPICE 2012, Volume 290, 2012, pp 75-84
3. Boronowsky, M., Woronowicz, T., Mitasiunas, A. BONITA – Improve Transfer from Universities for Regional Development. In: The Proceedings of the 3rd ISPIM Innovation Symposium, 2010, pp.952-978
4. People Capability Maturity Model (P-CMM), Version 2.0, Second Edition. . In : Technical Report, Software Engineering Process Management, Carnegie Mellon University, 2009.
5. Mitasiunas A., Rikure T., Novickis L., Jurenoks A. Further Development of Information Technology Transfer Concept for Adaptation and Exploitation of European Research Results in the Baltic Sea Region Countries. In: Scientific Journal of Riga Technical University Computer Sciences, 2011, pp.9-16
6. CMMI-ACQ. CMMI for Acquisition, Version 1.3. In : Technical Report, Software Engineering Process Management Program, Carnegie Mellon University, 2010
7. Enterprise SPICE. An Integrated Model for Enterprise-wide Assessment and Improvement. Technical Report - Issue 1. The Enterprise SPICE Project Team, September 2010, 184 psl.. Available at: http://www.enterprisespice.com/page/publication-1
8. Ibrahim, L., Bradford, B., Cole, D., LaBruyere, L., Leinneweber, H., Piszczek, D., Reed, N., Rymond, M., Smith, D., Virga, M., Wells, C. FAA-iCMM, The Federal Aviation Administration Integrated Capability Maturity Model for Enterprise-wide Improvement. Published by U.S. Federal Aviation Administration, 2001
9. A Generic IT Transfer Concept. eINTERASIA project Deliverable D2.2.2. Available at: http://www.einterasia.eu/wp-content/uploads/2014/03/eINTERASIA_Del_D2.2.2_Generic_IT_Transfer_Concept.pdf.
10. Report on Validation Activities. eINTERASIA project Deliverable D5.5.2. Available at: http://www.einterasia.eu/wp-content/uploads/2015/06/eINTERASIA_Newsletter-Nr-3.pdf

Leonids Novickis is the Head of the Division of Software Engineering. He obtained Dr.habil.sc.ing. degree in 1990 from the Latvian Academy of Sciences. Since 1994, he has been regularly involved in different EU-funded INCO Copernicus, FP5/FP6/FP7 and LdV projects. He was an independent expert of IST and Research for SMEs in FP6, FP7. He is a corresponding member of the Latvian Academy of Sciences. His research fields include applied software system development, business process modelling, eLogistics, international cooperation, web-based applications. He is the coordinator of FP7 eINTERASIA project. E-mail: lnovickis@gmail.com

Antanas Mitasiunas is the founder and chairman of the board of company MitSoft. He is also an Associate Professor of the Department of Computer Science at Vilnius University. He obtained a Doctoral Degree in Computer Science (Dr.sc.comp.) from Moscow State University in 1981. He was a national expert of the ICT Committee in FP7, member of advisory board of the international project Enterprice SPICE, expert of national European Structural Funds. Research areas: software design, software quality management, innovations and technology transfer. E-mail: antanas.mitasiunas@mitsoft.lt

Viktorija Ponomarenko is a master student of Riga Technical University in Business Informatic. She has been involved in different EU-funded projects: BONITA (INTERREG, 2008–2012)., Baltic - German project VR & DE4BALT (DAAD), eLearning for eGoverment" (Community Programme Lifelong Learning Programme), eINTERASIA (EU FP7 Programme). E-mail: viktorija.ponomarenko@gmail.com