Technology Transfer Model and Web-Based Solutions for Transport Logistics Service Providers

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Abstract: - This paper describes the approach aimed at supporting industrial enterprises, especially small and medium enterprises (SMEs), in solving research and technological problems in their business sector of transport logistics services. The approach is focused on strengthening SMEs technological facilities and creating a win-win situation for the actors of the global transport logistics chain (shipping lines, container terminal operators, freight integrators, transportation brokers, etc) through the use of technology transfer model and innovative Internet-based information technology (IT) solutions.

Key-Words: Technology transfer model, e-business solutions, transport and logistics.

1 Introduction

The transport logistics segment is characterised by a very high competition and especially strong pressure from logistics giants. Logistics giants with their international networks have significant advantages over small and medium-sized transport logistics companies. For individual SMEs it is difficult to solve the problems alone; however, by co-operating, they can keep relatively big segment of the world transport logistics market. Looking at the transport domain, we face one of the biggest challenges of the next 10 years. As a response to these challenges, all SME actors have to cooperate and develop sustainable innovative solutions that will lead to advances in improving freight forwarding and logistics. Today, we are just at the start of this challenge and it is clear that in the future technology transfer and Internet-based solutions will revolutionise the world of SME-based transport and logistics by creating a new platform of business and revenue opportunities [1].

The EU Digital Agenda has a strong focus on the research activities which in particular address technology transfer and IT research in the transport sector. To overcome the gap between innovative solutions and their commercialisation and practical application, effective technology transfer models, methodologies, and tools must be used by SMEs.

The generic technology transfer concept and model represented in this paper include a set of components: starting with an investment in Research and Technological Development (RTD), the actual RTD performance, building a prototype to demonstrate the approach and solutions, the further development needed for commercialisation and, finally, resulting in the successful introduction of a product / services on the market.

The success of technology transfer depends on the interaction between all actors - technology suppliers (universities and research institutions), technology transfer drivers (technological parks and centers), and technology acquirers (SMEs) - and their ability to tackle a number of challenges along the way (Fig. 1).

1.1 Current bottlenecks and limitations

The following bottlenecks and limitations have been identified:

• Typically, technology development is done by RTD partners, but commercialisation of innovative IT solutions is the matter of SMEs. Collaboration between these two social groups is still a real challenge. It is a complex, multidisciplinary area that can't be covered only by traditional oriented approach. We have to consider the full life cycle of technology transfer and innovations. This approach is not sufficiently addressed in the existing solutions:

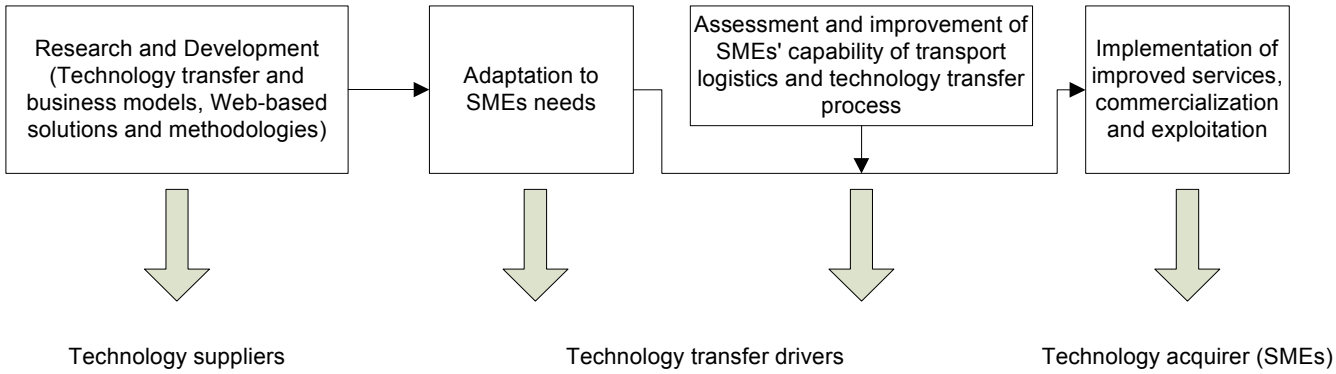

Fig.1. General scheme

• Logistics service providers (LSP) often lack global visibility and are poorly integrated with suppliers and customers;

• Intermodal collaboration among logistics service providers usually aren't effectively organized;

• Most LSPs must undergo Internet-based technology transformation;

• The existing IT solutions mostly support separate stages of logistics processes and are not focused on "user demand driven" integrated Internet-Based solutions that provide an opportunity to manage business processes within logistics chains.

1.2 Advances

The following advances that the research brings are identified:

• A generic Technology Transfer Concept (TTC) to transfer research results into SMEs innovations. TTC is based on integration of transportation and logistics processes Capability Maturity Model and Open Model [2, 3]. Though the Capability Maturity Model (CMM) comes from the field of software development, it will be used together with Open Model as a general model of the maturity in the field of technology transfer.

• The methodology for Internet-based Collaborative Framework (ICF) development is based on transport and logistics CMM and Web technologies. ICF provides the adaptation mechanism to distinct between different target groups (technology supplier, technology receiver, technology transfer facilitator). ICF also provides easy adaptation of technology transfer process and commercialization to the new conditions of target countries and SMEs requirements.

2 Technology Transfer

Transfer model is based on Capability Maturity Model [2], International Standard for Process Assessment (ISO/IEC 15504), and the current best practices in such fields as communication, knowledge management, project management, human resources/organisational development, and commercialisation of research results [4].

In contrast to the original meaning of the term "capability" as characteristics applicable to each process to indicate its predictability as introduced by software engineering community, the term "capability maturity" is used to express some specific process area. Namely, this meaning of process capability is taken by Thomas Peisl to apply process capability assessment framework techniques for innovation domain modelling [5]. Technology transfer process capability maturity model can be created as external process reference model and process assessment model satisfying requirements of ISO/IEC 15504-2.

The Transfer model helps corresponding SMEs from transport logistics sector to characterise capability in the current transfer practice and to establish a program of organisational development and a culture of excellence. Identification of the indicators that show how efforts in the technology and research results transfer process enhances innovation in the "real business world" settings helps to provide measurable arguments on the importance of the investments for the innovation capacity.

The label "technology transfer" is the subject of expression of interests, and it is used in various contexts and in various meaning. In our research, technology transfer means technology development and technology commercialization. It is complex, multidisciplinary area that can't be covered by traditional discipline-oriented approach. Technology transfer community needs to posses the system that

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describes technology transfer full life cycle in a systematic and structured way at micro level, i.e. at enterprise level.

The proposed approach is based on the development of the new, conformable to ISO/IEC 15501 information technology transfer Capability Maturity Model. In comparison with the existing technology transfer models, the proposed model is "white box" elaborated at the level of enterprises. The idea of the approach is to propose the system of notions to codify technology transfer related knowledge and to describe and share technology transfer as process oriented knowledge in a systematic and structured way.

The proposed approach is based on the set of assumptions:

• Technology transfer is process oriented activity;
• In process-oriented activity, a systematic approach to work with product improvement is process improvement;
• Technology transfer process improvement can't be done at once and is the result of continuous improvements [6].

This approach is based on the assumption that the product quality can be achieved by the means of process quality -process capability. High process capability can't be established at once during the launch of activity. Process capability can be improved applying iterative procedure of process capability assessment and improvement.

Process capability is related to process predictability. Organizational maturity expresses the way organization activities are performed. Maturity idea indicates the improvement path of organization activities to achieve better results. Process capability concept allows to measure the state of performance of organization's activities and to plan individual steps of processes capability improvement.

The research in this area is based on ideas originated from capability maturity models (CMM) developed since 1987 by Software Engineering Institute (SEI) of Carnegie Melon University. These models have evolved into CMMI version 1.2 known as CMMI for Development, CMMI for Acquisition, and CMMI for Services. In parallel, international community has developed international standard for process assessment ISO/IEC 15504: Process assessment framework, also known as project SPICE (Software Process Improvement and Capability dEtermination). Project SPICE was initiated by the UK Ministry of Defence in 1991. ISO/IEC 15504 represents third generation of process capability maturity models that refer to the external process reference model.

Third main source in process capability maturity arena is iCMM v2.0 (integrated Capability Maturity Model). It was developed by US Federal Aviation Administration in 2001 and influenced a lot to the current state in CMMs area [2]. Hundreds of various generic and specific CMMs that can be treated as results of codifying process-oriented knowledge have been developed. It is important that ISO/IEC 15504 approach is referring to the external process reference model and allows to extend model's application area outside of the software engineering. Using external process reference model approach, it is possible to converge SPICE and iCMM. In fact, there is a work in progress in Enterprise SPICE initiative, and iCMM plays the role of baseline in the development of SPICE-based Enterprise Process Reference Model and Process Assessment Model. Enterprise SPICE is the most challenging process capability assessment and improvement initiative during the last years [3]. First stage of Enterprise SPICE project is completed and the draft of publicly available standard is announced.

The approach includes the following major stages:

• Analysis of transport logistics and identification of key processes. Identification is performed as decomposition of whole activity in logistics at the level of "what should be done" and avoiding "how it should be done".

• Development of technology transfer process reference model according to requirements of ISO/IEC 15504-2 for process reference models is based on the set of processes identified in the previous stage and definition of process categories and subcategories if needed.

• Development of technology transfer activity process-oriented model in SMEs organisations terms and notions that are currently used in the daily work.

• Mapping of SMEs activity model with developed standard information technology transfer process capability maturity model. Guided self-assessment of information technology transfer process capability in SMEs organisations. Definition of current process capability profile.

• Update of SMEs current transfer activity model to achieve target capability profile.

The proposed approach allows to improve technology transfer processes capability of SMEs and to introduce in their business activities.

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3 Internet-Based Support of Networked Logistics Processes

The number of stages of general logistics model "buy-move-make-sell" and, correspondingly, the individual structure of adapted to the specific needs of LSPs can be dynamically extended using Web-based coordinating mechanisms and semantic interoperable services. It is very important in a case when customers requirement are dynamically changed and they are willing to extend the number of provided services. The Internet enables and supports logistics collaboration among different LSPs, new dynamic relationships, new opportunities and markets.

Use of Internet-based Collaborative Framework (ICF) incorporating several advanced IT solutions, makes it possible to support networked logistics service providers. The Internet enables LSPs to become the WYSIWYG (What You See Is What You Get) enterprises, where Web-based applications become as rich as their desktop equivalents.

SOA, Web services, Semantic Interoperable Services, XML, and AJAX Web development techniques are used as a technological platform for the integration. Using these technologies together with the existing enterprise web platforms and portal frameworks (Liferay, GateIn, WebSphere Portal, JetSpeed, etc), it is possible to design the integrated portals that will provide seamless integration of the various logistics-related services and data sources (Fig. 2). For instance, separate portals that support different logistics business processes along the selected freight route (www.elogmar-m.org, ww.containeronlineshop.de, www.e-56.com.cn) are united into one framework with a single entry point [7].

An enterprise portal, built with a robust portal product, provides an off-the-shelf framework for developing and deploying service-oriented applications. It can serve as a ready-made Web services consumer platform, and enables you to build composite applications, deploy syndicated content from other portals through remote portlets, replace/augment legacy interfacing applications, create common views of data, and facilitate access by mobile and wireless devices [8].

Most of the mentioned above portal frameworks also have personalization features. Personalization provides end-users with an opportunity to customize their version of a portal; thereby, greatly improving end-user performance and satisfaction. Using personalization mechanism, portal administrators can define specific groups which may represent portal users' real-life roles (operator, manager, CEO, etc). Depending on their roles, users will have access to the features and content designed for their group.

4 Conclusion

Information Technology Transfer approach is based on Capability Maturity Model, International Standard for Process Assessment ISO/IEC 1550, and the current best practice is presented in the paper.

The concept of the development of the Internet-based collaborative framework for the transport

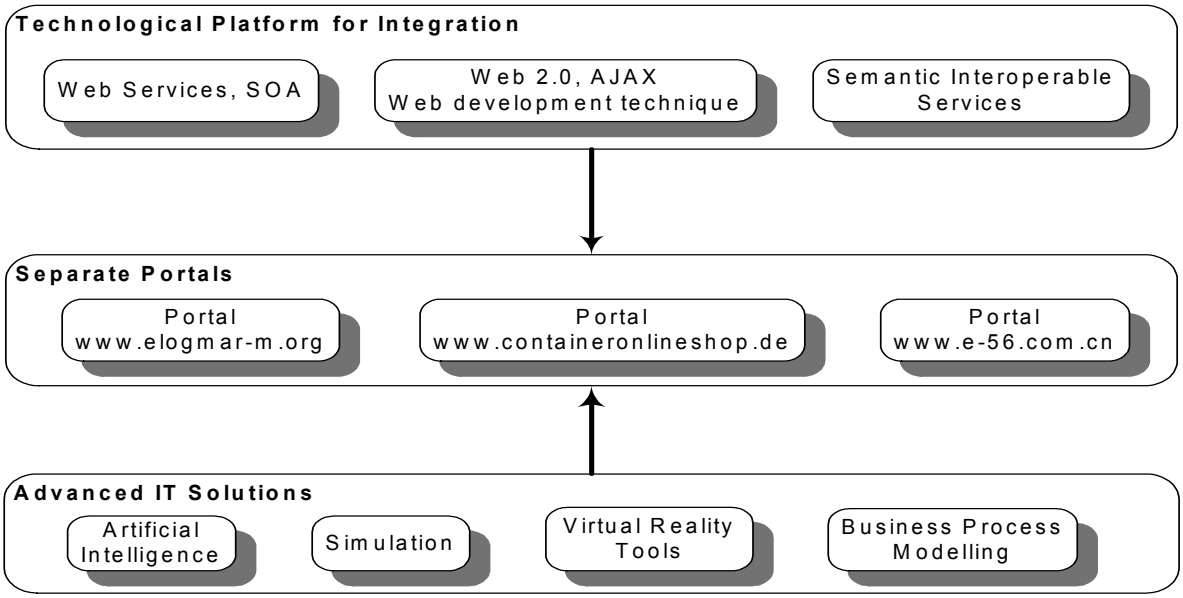

Fig.2. Integration in ICF

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logistics service providers, along with technology transfer model, is used to improve their business processes.

Transport/logistic -related web portal www.elogmar.eu was developed as a demonstrator of the proposed approach. It is currently used by the transport logistics service providers in different countries.

The future plans of the authors include the development of the integrated portal that will provide seamless integration of various logistics-related IT services and data sources.

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