

ENRICHING COLLABORATION AMONG EASTERN EUROPEAN SMEs THROUGH DEDICATED VIRTUAL PLATFORM

Potentials, Needs, and Research Challenges

Ali Imtiaz,

*Research Institute for Operations Management (FIR) at Aachen University of Technology,
Ali.Imtiaz@fir.rwth-aachen.de, GERMANY*

Jannicke Baalsrud Hauge

*Bremen Institute of Industrial Engineering and Applied Work Science
baa@biba.uni-bremen.de, GERMANY*

In the wake of Globalization, the Eastern European small and medium size manufacturers (SME) are facing ever-increasing competition from the larger and multi-national players. Collaboration with other companies may be the only economical way to overcome this challenge. In most cases, these communities are formed due to favourable socio-economic conditions found in a specific geographical area. Therefore, a specialized approach needs to be developed to cater the possible interactions for related SMEs in a specific industrial sector; this is only possible through an affordable collaboration platform. This article will present a research approach and the relevant challenges for the development and introduction of a collaboration tool based upon open source capabilities with industry specific business process functionalities.

1. INTRODUCTION

The success of collaboration is not only a matter of finding a partner with the right key competencies, but more a question of having the right ICT tools for seamless information processing and the right people to perform the daily collaboration work as well as on the ability of the participating organisations to act in a dynamic environment [Österle, 2001, COM 2002]. Looking at the supply chain of the manufacturing industry, it is obvious that the Tool-and-Die making workshops play a role as suppliers of knowledge intensive products and services [Auerbach et al. 2006]. Therefore, every change large manufactures do on their supply strategies, leads to a new requirement which a tool and die making workshop has to meet in order to stay as a supplier.

Up to now, the Tool-and-Die making workshops have been able to meet these new requirements with high quality products and services as well as an excellent educated workforce but this isn't possible any more as the non-European competition from other SMEs grows [Semolic et al, 2007]. Furthermore, the one-of-a-kind production results in high costs and risks, since more complex products in terms of functionalities and high quality demands engage more complex and expensive manufacturing technologies. The range of needed manufacturing technologies comprises traditional as well as more innovative and expensive

technologies. These are seldom all in-house, so there is need for sharing capacities (machines, materials, machine operator) and knowledge resources (technologies, competences). This leads to a need for tighter collaboration [Scheer, 2002, Sherman, 1996, Frederix, 2003] and to a further development of the existing regional industrial clusters towards virtual enterprise networks not only loosely sharing tools, but actively using a common collaboration platform.

The need of better collaboration requires a faster, more reliable and integrated support system. It is needed to sustain a constructive trend for industrial collaboration among SMEs. Therefore an effective as well as an efficient way of observing, analysing and handling of information is required. A collaborative platform can help to achieve a seamless information flow between the cooperating companies. Furthermore, only implementing a common collaboration platform without developing a common business model will lead to sub-optimal solutions.

2. BACKGROUND

Typically clusters are product-oriented specialized communities [Porter, 1998]. Within clusters, there are companies focusing on different stages of the manufacturing cycle (e.g., treating raw materials, assembling) [Eschenbächer, 2003]. All companies maintain a high degree of specialisation on the final product specific features, which implies that “generic” production capacity is not offered. The situation of company specialisation within clusters historical and cultural reasons. Product know-how has been transferred from one generation of workers to the other, as the strong localisation has prevented work force mobility. In periods of growth, the number of companies have multiplied through spin-offs and outsourcing, spreading the knowledge of products and processes.

Customers of clustered SMEs are medium to large companies selling to final customers world-wide. The customer’s expectations from these SMEs are mainly the faster, cheaper and more efficient delivery of the complex tools. Due to the above described features, the cluster is a natural source of specialised production capacity for these companies. Often SMEs do not have resources to response to these requirements alone. It is therefore imperative to form sustainable collaborative networks. Far from being “community leaders”, these companies develop opportunistic subcontracting relations with the small manufacturers. Sub-subcontracting is observed frequently, as excess demand is passed on from one small company to the other when an order cannot be fulfilled internally. In most cases, this happens in quite informal and hectic way through a network of relationships nurtured by proximity.

Sharing knowledge, expertise, competences and particularly the lessons learned is very well acquainted inside the tool-shops. So the basic premise for the collaborative work and the sharing culture is well developed [Österle, 2001; Frederix, 2003; Semolic, 2007]. The latter premise, the motivation to share, is pushed by extremely tough market conditions because of the cheap labour force from China and other fast developing countries from the Far East. Tool-makers detected already that their only competitive advantage is continuous innovation in technology and technical solutions. For this reason, they are able to offer high quality and innovative solutions to the most complex problems (tools). The only guaranty is the effective knowledge sharing supported by the management of the

innovations.

Looking at different SME clusters, it can be stated that these often have both “technical” and “organisational” problems related to their production management and resource planning, as well as to e-collaboration but also with respect to management of customer relations and e-collaboration in carrying out their day-to-day business.

3. RESEARCH METHOD

Clusters are still trying to find the most efficient organizational model to support interoperability and collaboration in the production of tools. Because of the nature of the small production volume, which is usually individual production, interoperability and collaboration in particular process is still vague. Each project usually includes one or at most two partners collaborating. The rules of interoperation are therefore not yet exploited. Collaborative design, collaborative technology planning and distributed manufacturing are still far from real implementation. The most successful collaboration processes in tool making clusters are seen to be education, marketing activities and some common research projects.

On the level of operation software, the clusters are dependent on their customers. As suppliers, they are usually bonded to the software solutions of their customers. Most used commercial solutions are SAP and BAAN as ERP systems, CATIA and ProEngineer as CAD/CAM systems. They are also using some specific B2B applications and solutions to solve particular specific problems which are mostly connecting one of the partners in the cluster to one of the customer. The figure below shows a typical network of tool and die makers:

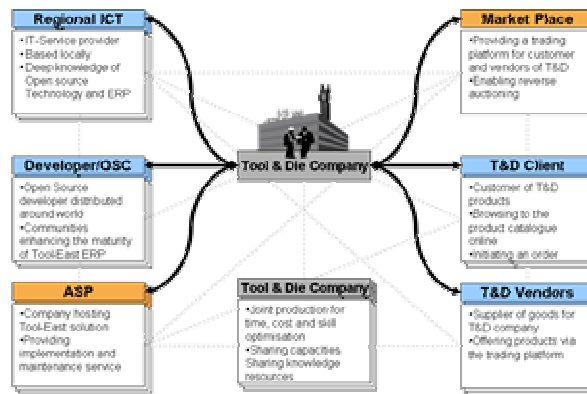


Figure 1: Network of tool and die makers including customers and suppliers

In order to improve the collaboration ability, there is a need among the Tool and Die maker to have a common collaboration platform serving their specific need and reflecting the diversity and different needs and requirements within this industrial sector. This platform must also offer an access to all other stakeholders in the networks (Suppliers, It vendors, etc.) [Meyer, 2004, Baalsrud Hauge, 2004].

Requirements on collaboration tools

Today, the borders of organizations are becoming more transparent and

organizations, enabled by ICT, cooperate in changing constellations. Information, services, and products can be offered by sub-units of organizations, by single organizations or by collaborations between companies [Hribernik, 2008a,b]. The Tool and Die-making workshops have the same typical organisational and technical problems as a lot of other SME clusters. Furthermore they are also facing harder competition from the Far East as well as increasing labour costs which reduce their competitive advantage. The effects of these challenges have become dramatically evident in the last years, as many SMEs have been shut down in industrial clusters around Europe. The process will ultimately endanger the competitiveness of the SMEs clusters and of the entire local economy. Therefore, a suitable collaborative platform for this sector must not only provide an ICT-tool, but need to be embedded in a business model decreasing the organisational challenges, too.

Collaboration means, above all, the integration of systems, services and people in order to deliver results. This implies that in order to achieve the optimised result, all stakeholders need to have the ability to support a seamless information flow and to exchange all relevant documents without any interruptions.

Collaborations are complex to handle due to various reasons: different goals among collaborating partners and rapid process changes [Seiter, 2006]. In these dynamic and flexible networks, most partners have not collaborated before, which often results in the lack of trust. In addition, European collaboration networks also need to deal with the culture aspect. The above mentioned problems are relevant for almost all collaborations. These problems can be classified into three categories:

- Interoperability, management and organisational models
- Sharing culture and technology transfer
- Cheap and effective software solutions based on open-source standards

For Tool-and-Die making workshops, the problems are mainly related to their production management and resource planning, customer relationship management, and especially e-collaboration. Collaboration processes represent a key factor in the competitiveness of Tool-and-Die making clusters. By improving these processes, clusters will be able to strengthen their position as suppliers. Such an improvement can be achieved through the implementation of a collaboration platform utilising emerging, innovative technologies at the lowest possible cost. The Tool and Die making industry can only collaborate if they have interoperable IT solutions. Since expensive ERP and Middleware solution are not being an alternative for many companies, the interoperability problem can only be solved if they begin to use a standardised businesses language. One first step in this process is the use of common Enterprise applications which have similar business concepts and common data schemas. In particular electronic collaboration of the industry we studied (and believed to be true for many similar industries) is best facilitated through the provision ERP applications and to integrate existing applications. To enable industrial cluster made up of SMEs to participate in e-collaboration these applications however must be extended with modules specifically created for the particular processes carried out in the cluster which may be different for other industries.

So far the research and work carried out have shown that if small and medium sized enterprises intend to enter into e-business by means of a solution which is integrated into their business processes with their partners, suppliers and customers, it is not enough to look only at the technical infrastructure and to implement a

technical solution, but it is also important to look at the interoperability at an organisational level, so that there is a need for a business model supporting the optimisation of organisational structure within in the cluster additional to the collaboration platform.

Collaboration Platforms

Collaboration platforms are inter-organizational application systems for supporting or enabling inter-firm cooperation and collaboration. Over the past years different collaboration platforms have been developed. Such platforms may differ in the services they offers- ranging from only supporting document handling to complex collaboration platforms comprising ERP-, and SRM/CRM functionalities [Bafoutsou, 2002].

Collaboration platforms support or facilitate inter-firm collaboration and electronic integration within inter-organizational arrangements such as supply chains or in virtual enterprises and networks. Collaboration platforms are expected to benefit participants by reducing the costs and increasing the quality of inter-firm information exchange. Information sharing through shared IT-based platforms may reduce companies' required investments in relationship-specific IT assets [Gogolin, 2003; Hieber, 2002]. However, analysis of the use of collaborative platforms shows a progress in its acceptance and is widely used for research collaborations.

There are several commercial collaborative platforms available on the market today. A typical example of such a platform is the BSCW platform. This platform has been used for several years, and supports common file exchange, messaging etc. Another example is also the waste of collaborative platforms established during research projects in order to support the collaboration. Two good examples here are the collaboration platforms of the ECOLEAD and Laboranova projects. Common for many of the collaboration platforms of research projects is that they are in operation during the project run time, mostly kept on a status quo for several years after that. This allows the partners to get access to tools and material also after the project, but most of these platforms are only open for project members. Additionally, these are non-profit platforms, so that little efforts will be put in order to maintain and improve the platforms for new users after finishing the project.

Also the Tool East project has a collaborative platform which is in use during the project period. The Tool-East collaboration platform is an industry specific solution based upon already available open source based ERP solutions. In this way, the costs are kept on a low level but on the same time offer a solution with the needed functionalities and the possibility to integrate this into already existing solution at the company site. By introducing the Tool-East concept, a standardisation process will be induced, which leads to better data exchange with their business partners in electronic format. For the tool and die making clusters this implies that they can take advantage of other e-business tools to support their particular business processes including collaborative engineering, change management, supply chain management, collaborative load balancing among others.

In order to integrate the component into the overall supply chain, as well the SMEs' existing individual back-end enterprise systems, the solution is being augmented with (adaptive) Web Service Modules based on SOAD, allowing fast and flexible, standardised interfacing. Since the Tool-East solution need to be put on top of existing software it is imperative to identify interfaces at an early stage.

Therefore, the process models and the flow diagram were extended with a column for IT application, which the users completed.

However, as the project develops an open source collaboration tool with ERP functionalities it is essential that the industrial partner can continue to use this platform after closing the project, so it is necessary to develop a platform which is easy to maintain and which generates enough benefit and revenue to be proactively driven from the stakeholder also in the future.

Business model

Looking at the current situation among the tool and die makers, it becomes clear that their future competitiveness will be based upon their ability to adapt their organisational structure combined with their ability to take advantage of new collaboration tools. However, even though we have set upon an open source solution which is quite cheap to maintain and to develop further, it has been recognized that the Tool-East collaboration tool will still require quite much technical know-how. It cannot be expected that the Tool and Die makers do have this expertise in house, so it is important to develop a business model ensuring that the tool and die makers will get support and the solution will be maintained also in the future.

In this context, a business model, placed on industrial level, provides a framework. It includes all relevant main business processes in a Tool-and-Die industry. The Tool-East model will decrease existing obstacles for seamless collaboration among SMEs. Business model consists of interrelations of three elements business strategy, business organization and ICT usage and together with legal and social environment, competitive forces, customer demand and technological change impact on company's business model definition as described in the figure below. Until recently, research paid only little attention to the aspect of establishing information transfer and sharing among business networks for collaborative efforts supporting SMEs to play a major role in competing with large enterprises, but strategies that reflect toolmakers clusters intentions is under development. It can be characterized by the strategy developed by the cluster TCS from Slovenia (also partner in this proposal). This strategy supports:

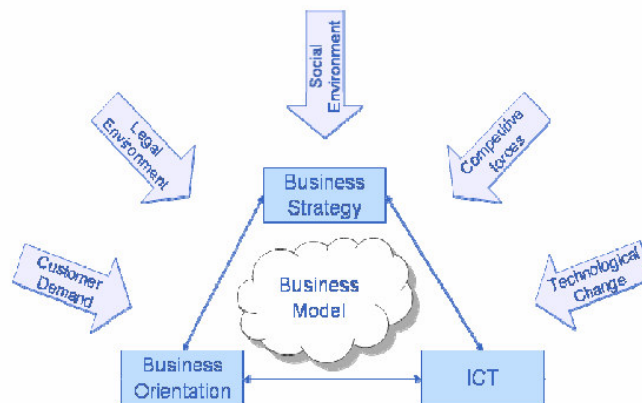


Figure 2: Environment, Business Models, Strategy, Process and Information Systems (Osterwalder, 2004)

- Horizontal and vertical integration of the companies and organizations involved into the tool-making business
- Strategy of a concentric diversification - where the Tool-and-Die technologies are the key competences
- Strategy of internal development on the field of strategic key competences
- Strategy of joint ventures and internationalization

4. FINDINGS

Even though there are several tools available on the market suitable for supporting collaborative work, like advanced SRM/CRM/SCM-tools, most of these are neither affordable for SMEs, nor offer the functionalities required. While adapting and implementing an ERP system for clusters of SMEs, the participating SMEs need to be aware that their business processes belong in the bigger picture of the overall cluster. Therefore, participating SMEs within a cluster must reach the highest level of awareness of the cluster – the realisation that their cluster behaves externally like a single enterprise.

On a high level, the collaboration platform needs to fulfil the following requirements:

- Building-up a platform that bridges the geographic distance between the actors, and creates a virtual mirror-image of their real-world collaboration
- Specifying and developing a secure and trustful plug-and-play environment, that is flexible enough to be adapted to the specific needs of the Innovation Network
- Defining, specifying and developing services and applications supporting characteristic processes in innovation networks, for instance: competence search for network configuration, knowledge exchange among partners, collaborative product development, and setting-up and running virtual laboratories.

The project has decided to develop an open source-based solution, which is quite cheap to maintain and to further develop, but the Tool-East collaboration tool will still require much technical know-how. The Tool and Die-making companies cannot be expected to have the expertise in-house, so the first business considerations have been taken in order to ensure that the platform will be maintained after the finalization of the research project. Therefore, the consortium has emphasized on developing a business model for the post-project time supporting an association between the Tool and Die-making companies and the ICT community. The collaboration will be based on clearly defined roles, strict contracts and management of the various contracts. A proposed structure is developed maintaining a focus on the functional and organisational constraints; briefly presented in the figure below.

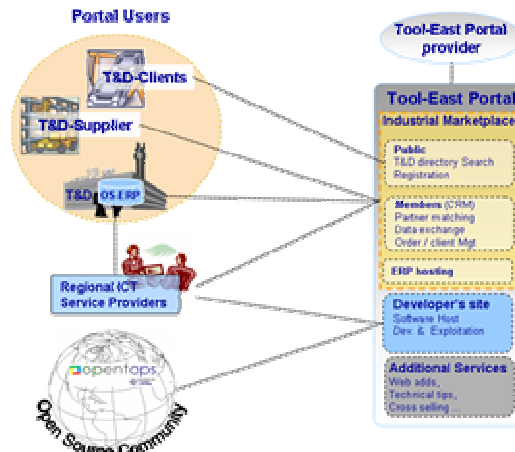


Figure 3: Tool East Solution with the Business Concept

One entity is recommended to run the Tool-East portal with the only public data. The entity will be formed as a virtual organisation of the Tool-East ICT partners representing regional industries. The clients and regional service providers (SPs) have access to the portal and can search and update their profiles. Restricted data is stored and shared between regional SP as a backup of the local setup at the client. A client can access the Tool-East portal through these regional SPs (regional SPs are responsible for data security, maintenance, and training and customized solutions for their regional clients). The Tool-East solution will promote combined development at client level as well as the involvement of open-source community for enterprise level customisations.

The Tool-East collaboration platform has the following logical structure:

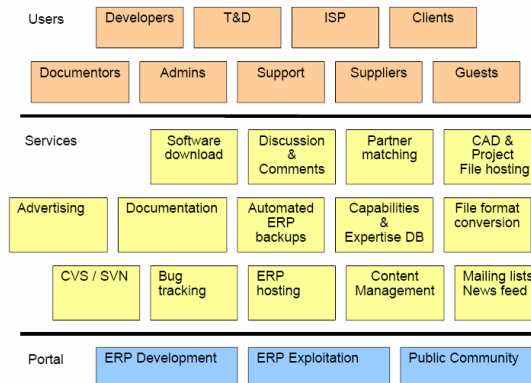


Figure 4: Tool East portal logical structure (JSI, 2007)

The main functionalities are:

- ERP development portal functionalities (source code hosting and versioning system, bug reporting and tracking, file upload / download area through CMS, discussion groups & commentaries (portal database), testing platform (a test installation of an ERP system), news feed (portal))

- ERP exploitation & support functionalities (documentation hosting, program files download area with installation instructions, ERP system testing for evaluation, training and dissemination, ERP system hosting for T&D companies, registration, ERP users directories, public interfaces to link to the ERP system (for public data sharing/gathering, open hosting platform for additional and third party services, automatic software upgrade functionality)
- Public community portal (T&D related news feed with comments and discussion groups, Registration and mailing lists, T&D company directories with their specific knowledge/capability/expertise, Listings, Advertising and business promotion (optionally paid services), Partner matching between clients and T&D companies, Project design file hosting / sharing, Open platform for additional and third party services)
- Portal management functionalities (Users management (login, registration, user groups management), Layout management, Editorial function, Contents protection, System and storage management)

5. CONCLUSION

Clearly the European SMEs can only be globally competitive if they manage to organise themselves into clusters and collaborate. To enable industrial clusters, comprising of SMEs, to participate in e-collaboration, ERP based applications must be extended with modules created specifically for the particular processes carried out in the cluster, which may be different for other industries. It is also imperative that they have access to a common collaboration platform not only including common software and the core components of collaborative platforms like messaging and team collaboration tool enabling real-time collaboration and communication but also offering additional services such as training material and a virtual community for information and knowledge exchange. Furthermore, their business processes needs to be aligned and optimised.

The previous research has shown that if small and medium sized enterprises intend to enter into e-business, by means of a solution that integrates their business processes with their partners, suppliers and customers, it is not enough to look only at the technical infrastructure and to implement a technical solution.

The Tool-East virtual collaborative platform will be fairly inexpensive and in addition, offer guidelines and training concepts that assist SMEs in analysing, identifying and finally modifying their business processes through ERP as well as a collaborative e-platform. The solution's modular architecture and the open source approach will not only help SMEs to keep the costs of maintaining and future development low, but also at the same time allow for future technical developments and organisational changes. The implementation of interfaces to standard software used in Tool-and-Die making workshops will also improve the interoperability not only on the organisational level, but also on the data flow level.

For SMEs, an enormous potential can be found in strengthening the open-source initiative in general and particularly in this field of business. The challenge of harnessing the open-source community remains, but the Tool-East project considers it of up-most importance to attempt to leverage the immense power of hundreds of dispersed developers for the development of an integrated business application for

Tool-and Die making enterprises from the very onset to create future sustainability.

ACKNOWLEDGEMENTS. This work has been partly funded by the European Commission through IST Project Tool-East: Open Source Enterprise Resource Planning and Order Management System for Eastern European Tool and Die Making Workshops (No. IST-FP6-027802). The authors wish to acknowledge the Commission for their support. We also wish to acknowledge our gratitude and appreciation to all the Tool-East project partners for their contribution during the development of various ideas and concepts presented in this paper.

6. REFERENCES

- Auerbach, M.; Imtiaz, A.; Baalsrud Hauge, J.: Collaboration within tool and die making industry through open-source ERP-solution with integrated CRM-functionalities. In: ICE 2006, 12th Int. Conf. on Concurrent Enterprising: Innovative Products and Services through collaborative networks. Palazzo delle Stelline, Milan, Italy, 26-28 June 2006, Proceedings ICE-Conference 2006, S. 141 – 148
- Baalsrud Hauge et al.(2004): Enhancing e-commerce business models of selected SMEs by a multi-mode approach in *International Journal of Internet and Enterprise Management*, p.122, Vol.2, 2004
- Bafoutsou, G., Mentzas, G.: Review and functional classification of collaborative systems, *International Journal of Information Management*, 22, 2002, S. 281-305.
- Porter, M.: Cluster and new economics of competition, *Harvard Business review*, p.6, 1998
- Eschenbächer, J. et al.: Emerging Concepts in E-business and Extended Products, s.15 in Gasòs/Thoben: *E-business Applications*, p.24 and 28ff, Springer Verlag, Heidelberg, New York, Tokio, 2003
- European Commission, COM 2002, 714, Industrial Policy in an Enlarged Europe, Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of Regions
- Frederix, F., Cooperation in Dynamic Networked Organizations, p.221 in Gasòs, J. Thoben, K.-D. (Eds.): *E-Business Applications – Technologies for Tomorrow's Solutions; Advanced Information Processing Series*, Springer, 2003
- ECOLEAD project: <http://virtual.vtt.fi/virtual/ecolead/>
- Gogolin, Marcel (2003): Success and Failure of Collaboration Platforms, in: Lechner, Ulrike (Hrsg.), *Proceedings of the Tenth Research Symposium on Emerging Electronic Markets 2003*, S. 169183, Bremen: University of Bremen, Germany, 2003.
- Hieber: R.: *Supply Chain Management. A collaborative performance measurement approach*. Vdf Hochschulverlag at ETH, Zürich 2002.
- Hribernik, K., Thoben, K.-D., Nilsson, M.: Collaborative Working Environments. in: *Encyclopedia of E-Collaboration*. Idea Group Reference, 2008, pp. 308 – 313 (ISBN: 978-1-59904-000-4)
- Hribernik, K., Thoben, K.-D., Nilsson, M.: Technological Challenges to the Research and Development of Collaborative Working Environments. in: *Encyclopaedia of E-Collaboration*. Idea Group Reference, 2008, pp. 616 – 617 (ISBN: 978-1-59904-000-4)
- Laboranova project: <http://www.laboranova.com/>
- Meyer, M.; Lücke, T.; Schmidt, C.: Plug and Do Business – ERP of the Next Generation for Efficient Order Processing in Dynamic Business Networks. In: *International Journal of Internet and Enterprise Management* 2 (2004) 2, S. 152-162.
- Meyer, M.: From Enterprise Resource Planning (ERP) to Open Resource Planning (ORP) – The OpenFactory Project. In: *Advanced Manufacturing – An ICT and Systems Perspective*. Publisher: Taisch, M.; Thoben, K.-D. Network of Excellence on Intelligent Manufacturing Systems, Mailand and Bremen 2005, S. 324-328.
- Österle, H.; Fleisch, E.; Alt, R., *Business Networking*, Springer Verlag, Berlin, 2001;
- Osterwalder, A et. al(2005): clarifying business models;origins, present and future of the concept; <http://www.businessmodeldesign.com/publications/Preprint%20Clarifying%20Business%20Models%20Origins,%20Present,%20and%20Future%20of%20the%20Concept.pdf>
- Scheer, A.-W., Grieble, O., Hans, S., Zang, S.(2002), *Geschäftsprozessmanagement – The 2nd wave*. In: *Information Management & Consulting*, 17, 2002 Sonderausgabe, pp. 9-14.
- Seiter, M.: *Management von kooperationspezifischen Risiken in Unternehmensnetzen*, Verlag Vahlen, München, 2006
- Semolic, B, et al: The Tool East Sololution for industrial Clusters in Eastern Europe in: *Project Management Practice*, Issue 4, Winter 2007/2008, p.3-8.