

# Collaboration within tool and die making industry through open-source ERP-solution with integrated CRM-functionalities

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## Abstract

This paper focuses on a reliable collaboration within European tool and die making industry emphasising on competitive advantage through inter-reliance and cooperation among distributed networks. The presented focus is to develop a methodology as well as an appropriate ERP-toolkit to support collaboration within distributed entrepreneurial networks. Based on intended findings the paper presents the chosen approach which covers basic ERP-functionalities with integrated CRM-functionalities at an affordable price for all tool and die making workshops.

## Keywords

Networked businesses, collaboration, open-source, business model, enterprise resource planning

## 1 Introduction

In the recent years two major trends could be observed in the sector of tooling industry within Europe. On the one hand companies concentrate more and more on their core competencies, while on the other hand networked businesses have become a recognisable success factor in the tough global market arena [5]. As a result of the need of collaboration, a faster, more reliable and integrated support system is needed to sustain a constructive trend for industrial collaboration among SMEs to survive and more over thrive in an industry which is dominated by large multinational enterprises. These trends are geared towards high productivity and efficiency through better and wider reach to the customers.

Tool and die making workshops provide critical support for European industry by providing and designing customized mechanical components. It is estimated that within the EU these enterprises, especially the Eastern European, are mostly organized as SMEs. They do not have the financial and human resources for the implementation of complex ERP applications from the powerful software suppliers. A survey was conducted showing that even within the 500 largest Polish companies only 50 % have an ERP-system, which in comparison with Western European companies is far less; for example in Germany 95 % of the companies with more than 500 employees have an ERP-System [4][6]. Another reason for this minor spread is that the functionalities of these standardised applications do not fulfil the specific requirements of the tool and die making industry. Only about 30 percent of all ERP system's functionalities are common among all the industries. Rest of the 70 percent are held as un-segregated ratio among sector-specific and its individual company [6]. Therefore, based on preceding figures it is imperative to narrow down the focus from all industries to individual industries and find out their core ERP functionalities that could support collaborative network among companies. Many companies have implemented ERP-Solutions but they are still restricted to internal and/or enterprise level. There is a grave need for collaboration among companies but different goals and

ethic values among networked partners as well as dynamic changes within processes are very complex to handle. The higher the flexibility of the network, the more important the aspect of trust becomes, as it is no longer to be built on extensive experience with the partners. Yet another challenge is overcoming of cultural barriers. In addition, different goals, ethic values and cultures, as well as a lack of trust, inhabit the exploitation of the potentials of networked knowledge.

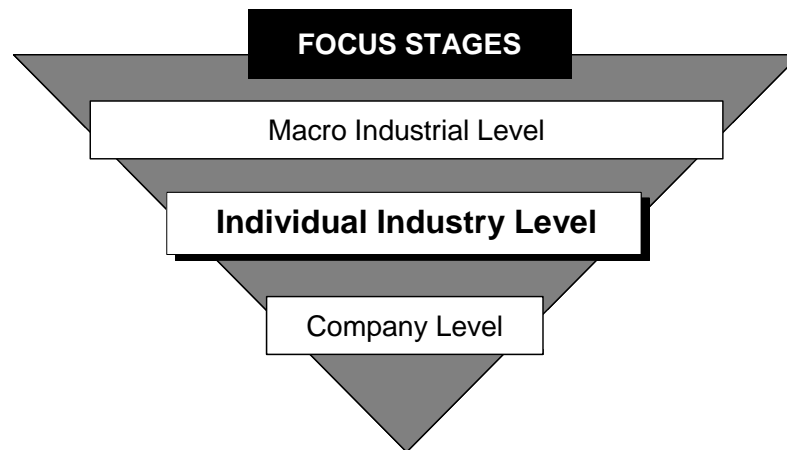


Figure 1: Hierarchical focus for research

## 2 Relation to Existing Theories and Work

The exploitation of ERP functionalities for networked economy within an industry-wide integration through information and communication technology (ICT) has been subject to research in a number of publications [8]. In general, currently available methods and applications for establishing networked communities with collaborative goal of global competitiveness have so far not been achieved at an industrial level; focus has been to distributed units of large enterprises.

Until recently, research paid only little attention to the aspect of establishing transfer and sharing of information among business networks for collaborative efforts supporting SMEs to play a major role in competing with large enterprises. Although different descriptions and procedures regarding the introduction of single tools and methods for network business in the tooling industry can be found in the literature, a holistic approach is still missing. Appropriate models and methods and in particular a methodology of integrating tool and die making industry through open ERP solutions in distributed and globally dispersed entrepreneurial networks is lacking.

The idea behind our research is based on two factors; first is the lack of affordable ERP applications for SMEs and the second is that the existing ERP solutions do not support common platform and therefore are hindering the possibility of interoperability in networked businesses. Along with establishing an IT infrastructure supporting collaboration, SMEs have to be taught how the structured information-sharing along complex and networked value-chains can be accomplished. An external manager, one or a group of companies, who acts as an intermediary in the network and represents a neutral trust centre can analyse applicable tools and critical success-factors for such networked collaboration. Our research integrates both: affordable open ERP-Solution and business interoperability driven approaches with ICT methodologies and instruments in order to develop and implement an innovative integration among SMEs of tool and die making industry.

### 3 Main Challenges Research Approach

#### 3.1 Networkability

In order to structure business processes, a large number of basic concepts are available (e.g. IDS-Reference model, SCOR-Model, Aachener PPC-Model) [7]. All of these models have their own well-established advantages and limitations, which are not elaborated here. The business process model developed in this project will not cover all but focus on the core business processes of tool and die making workshops. Therefore, a hierarchal model structure is necessary based on the identification of segmented core processes, relevant supporting processes and the least important ones. As a general framework, PORTER's value chain model can provide an idea, how to distinguish between main/primary and supporting/secondary processes [9]. The approach is to apply these methodologies to fragment and filter the business processes to develop a generic business model and use it to further establish the requirement and specification based application.

To gain the expected benefits, the goal of the participating tool and die making workshops is not just to substitute their isolated software applications by a more integrated one, but also to optimise their business processes at the same time. Therefore, one goal is to perform benchmarking methodologies to attain measurable processes which will further help to design a more effective, efficient and flexible business model. That means it is not just necessary to describe the processes as they are, but also to optimise business processes by designing and implementing reengineered processes.

#### 3.2 Extended Products

One of the main challenges is to use open source technology for the development of an integrated business application for tool and die making enterprises with high performance regarding availability, safety and maintainability at the very onset. Further, this will be enriched by enabling coordination between the different players in this sector. Strengthening the open-source initiative in general opens an enormous potential for SMEs. A case study and dissemination platform in the specific branch will pave the way for future initiatives.

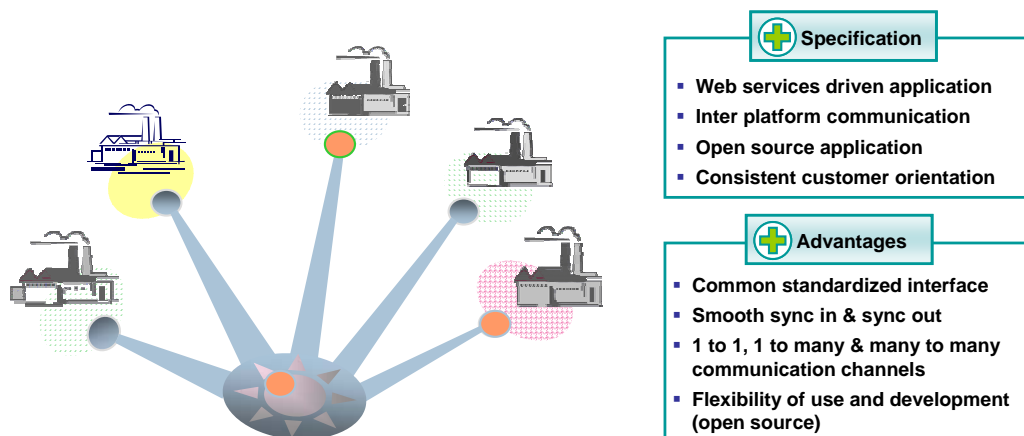


Figure 2: Specification and advantages of the communication platform

Unlike conventional ERP systems, the project is geared towards the extension of restrictive and limited ERP systems to incorporate a standardised collaboration at an industry level. That is to provide a uniform application platform that will include the features focussing on interoperability and communication for collaborating companies to work together. The extension is found at two levels. First is the development of a strict standard for intercommunication at industrial level with the possibility for different companies with different ERP-Systems to communicate via a

central platform. Second extension is the flexibility through open-source application allowing the users to further extend the features on top focusing company’s requirements without altering the base application.

### 3.3 Value Creation through Innovation

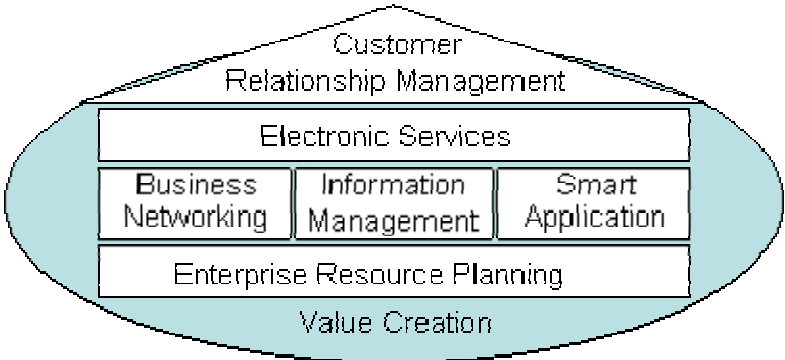


Figure 3: Value creation through innovation

For the networking of SMEs and other players in this sector it is imperative to have a collaborative development based on the open-source IT systems developed as an internet based platform. To make the results and particularly the open-source ERP-application easily available for a wide range of users, a download service will be implemented on this platform. It will enable the partners to download relevant source-code, install it using the help from the online manuals or request support from the IT partners. In addition to that, all other research results will be disseminated via the platform for which a business model will be developed by using the House of Value Creation [1] [2]. Resulting based on the preceding a new approach towards CRM is briefly presented in the figure 2, a structure is shown above that will be facilitated CRM functionalities through the collaborative handling of customers, i.e. internal collaborators as well as external customers.

## 4 Findings

The tool and die making industry is a highly complex and labour-intensive industry branch which is involved in the design and production of a wide range of usually customized products. It is an order based business dependent on technical and technological innovations, solutions and tools. Therefore tool and die making workshops combine innovation and knowledge intensive processes with abilities and skills. It is often the case that a particular tool or part cannot be produced just by using the available technologies in one company or that the technology to be used is so expensive that just few specialized tool and die shops can afford to master them. The need for sharing capacities (machines, materials, machine operator) and knowledge resources (technologies, competences) is therefore inevitable.

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, the sharing culture is well developed. The other premise, the motivation to share, is pushed by extremely tough market conditions because of the cheap labour force from China and other fast developed countries from the Far East. Toolmakers detected already that their only competitive advantage is in 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. The only guaranty is the effective knowledge sharing supported by the management of innovations.

There are several tool-clusters and other types of associations between tool-makers in Europe. Some of them are already active; some others are still under way/development: TCS - Toolmakers Cluster of Slovenia, Advanced Engineering Cluster – UK, Cluster of robust rapid-tooling technologies - DE, Centre for Toolmakers and Tool Design Engineers IE, The Moravian-Silesian Engineering Cluster (CZ), ... just to name some of them. The members of these clusters are SMEs, tool-shops, research institutes and educational institutions. Some clusters have been financially supported by the governments and local communities. Their objectives to join and operate inside the clusters can be summarized, like increasing competitiveness, sharing and expanding markets, joining resources and knowledge for cost optimisation, increasing production volume, strategic alliances with complement industry clusters.

Current identified 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 standards

Clusters are still trying to find the most efficient organisational 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 are still vague. Each project usually includes one or at most two partners collaborating. The rules of interoperation are therefore not yet exploited. Collaborative design and technology planning and distributed manufacturing are still far from real implementation.

Our research initiative is going to leverage these common goals with regard to different aspects identified so far. To harmonise the efforts of the different partners, it has been categorised into four main modules with each module achieving distinct goals and helping to achieve the final vision.

- Module I: Definition of a generic business process model for tool and die making workshops
- Module II: Open source software architecture and application development (adaptation and improvement of one existing open-source ERP solution; the development of another new open-source ERP application is not the ambition)
- Module III: Standard interfaces for open-source applications
- Module IV: Training and education

This common structure facilitates the integration of different aspects. Different modules will be integrated to develop a synchronised open-source ERP application in close relationship with each SME in the consortium.

#### 4.1 Module I

Modelling the business processes is an essential part of any information based business networking development process. Deriving from the business model, the software requirement specification will be formulated as the basis for software development. A software requirement specification is the describing of requirements of a computer system from the user's point of view. It specifies the required behaviour of a system in terms of input data, required processing, output data, operational scenarios and interfaces and the attributes of a system including performance, security, maintainability, reliability, audit ability, availability and safety requirements and design constraints. The project aims to evaluate the special requirements of

SMEs as analyses show that only about 30 % of the requirements to an ERP-System are of common interest, 70 % are branch and company specific. [6]

## 4.2 Module II

In order to develop software for SMEs as large group of companies which are not well served by the strong software suppliers the project will come up with an enlarged open source ERP-system with CRM-functionalities.

Until recently, there was no ERP-system that economically addressed the business needs of SMEs. But now there are some affordable and good featured business applications available which offer different levels of integration in a traditional ERP environment, e.g. OpenMFG, GNUEnterprise, Compiere and Open for Business. These systems are the ERP solutions that provide e.g. integrated customer relations management, supply chain management, online analysis processing, accounting, sales order entry, purchase order creation, inventory and warehouse management systems. Since the systems focus on generic business functions, they actually do not cover all the specific requirements of tool and die making workshops. Even if all of the mentioned systems are basically open-source solutions, some still require access to commercial databases like Oracle.

The first objective of module-II is to evaluate and select the best open source solution available as basis for the intended specific development. The second objective is to develop additional modules to support processes described in the business process model. SMEs will be included in this work and to a very early stage a first prototype will be available in order to receive a first feedback. This early prototyping is possible, since the project will use the selected open-source system as basis for programming.

Together with the open-source community the consortium will evaluate which functionalities are of common interest. As open-source communities usually have limited scope of features it is likely that they will only develop functionalities with common interest; the remaining modules will be developed within the project.

## 4.3 Module III

Competitive forces are driving technology efforts towards e-collaboration and cooperative exchange of data and applications within and across corporate boundaries. That means that intelligent interfaces have to support the exchange of data. Evolving new technologies provides an array of services to effectively design and develop integration and collaborative solutions that connect different systems like ERP, CRM, or other internal systems, as well as connectivity with partners, vendors, and other service providers. For SMEs not only the integration of large systems is problematic but also the possibility to import existing data stored e.g. in Microsoft Excel files or other individually programmed databases in order not to retype all information manually.

The strategy is to provide additional functionality via interfaces, so the technical possibilities and latest development will be examined and evaluated. There are various commercial and open-source products available. The latest developments of open-source interfaces show, that the gap to commercial products is getting smaller.

More and more tool and die making workshops cooperate with other companies e.g. to make production more efficient. One of the most important issues is to exchange data and documents (e-collaboration) like requests for quotation, orders, confirmation of orders, stock of inventory and underworked production capacities.

For the integration of collaboration functionalities into a project solution – the exchange of data and documents inside a production network – a holistic process and data model for the inter-organisational order management is required. These will be developed on the basis of the process model (see module I) and existing international standards like ROSETTANET etc.

#### 4.4 Module IV

The findings of training and education module are critical to develop a methodology to carry out personnel training, establishing an appropriate relationship between classroom, on-site, and e-learning modules. It has to meet the different stakeholder groups' individual requirements and training needs. It is believed that the training activities will be an important means of dissemination attracting attention in the industrial clusters themselves and bringing in actors who had not originally identified. Further on information management in the clusters is critical and thus supported with highest degree.

### 5 Conclusion

Based upon all the attributes and related sets of possible specifications for each of the four modules an appropriate standardised framework for analysis of the current processes is outlined. But in order to secure their long term success, tool and die making enterprises have to set the course for innovative business strategies early in time. One essential strategy of the future is participation in dynamic business networks. Two major objectives of this strategy are coordination of intra-enterprise order processing and bringing of core capabilities into a flexible network.

The project focus is to provide a cost-efficient ERP application for tool and die making workshops on the basis of existing open-source ERP applications. Within the project the open-source applications are analysed for best fit; then adapted and modified for the specific requirements of this branch. The new adapted and modified ERP application supports the efficient coordination of intra-enterprise order processing and strengthens competition and competitiveness of Eastern European SMEs. Primarily, order management, work planning, resource allocation and CRM need to be optimised and linked together in a dynamic work environment. Moreover ERP applications are necessary for the e-collaboration in dynamic business networks. To enable industrial cluster to e-collaboration the consisting process and data standards (for example ROSETTANET, ebXML etc.) are to be considered for the project. Considerable attention is given on the tools and technologies in our research to be sustainable and is provided to public, especially to the open-source community.

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