An approach to develop a collaboration platform for tool making industry

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Abstract. Critical point of the tool industry is data management considering that all applications are mostly based on the industrial data processing as well as the business process. Nowadays electronic collaboration platforms are unique environments that support synchronous and asynchronous communication through a variety of devices and channels within the toolmakers facilities. This paper gives a brief overview of an approach to develop a collaboration platform for tool making industry focusing the goal to improve the collaboration along the entire life-cycle of both the tool and the customer's product on a cross-company and cross-country level of relationship.

1. Introduction

Electronic collaboration platforms are unique environments that support synchronous and asynchronous communication through a variety of devices and channels within the toolmakers facilities.

Also the collaboration platforms offer a set of software components and software services in order the managers to find the information they need and to be able to communicate and work together to achieve common business goals.

The objective of this material is to propose an approach to develop a concept of collaboration for European toolmakers. The main result of this work is estimated to be an internet-based platform for collaboration in global networks of toolmakers. These global networks should to comprise the collaboration along the entire life-cycle of both the tool and the customer's product on a cross-company and cross-country level of relationship.

The proposed collaboration platform is expected to be tool-centred, as the different tools link the single parties and allow collaboration between toolmaker, moulder and tool owner for each single unique tool.

The paper is structured as follows: In the sections in terms of related work are listed the basic requirements that need to be taken into consideration during the implementation and the crucial factors for successful collaboration in tool making industry. Section 2 shows the proposed approach for concept of collaboration platform including the architectural view and the functional view.

2. Related work

In case the platform is web-based will means that an easy access will be guaranteed and will serve a collaboration and information to all relevant information on a detailed level as it stores and processes data that has so far been implicit or non-existent. The actors in that business model would have the possibility to select the information of interest out of the information provided.

The successful model of platform have to consist of six essential parts (Figure 1) in order to fulfil the specified requirements. [3]
The successful concept of collaboration for toolmakers have to allow collaboration between toolmakers, their customers and service providers and to deliver process data from in terms of enabling the toolmaker to offer an optimised preventive maintenance and to react promptly and adequately to specific problems. The concept of such collaboration platform is shown below. [6]

**Figure 1.** Features of the platform concept

Details about the organisation, rules, processes and requirements needed for the collaboration platform should to be additionally elaborated. Basic requirements and a framework can be extracted concerning collaborations in general and for the specific collaboration concept of European toolmakers. The basic requirements that need to be taken into account during the implementation are the following: [2]

**Figure 2.** Concept of collaboration platform

**Figure 3.** Requirements for the collaboration platform concept
Considering the analysis of the virtual factory and workshops, the main success factors have been depicted and were included into a criteria list for collaboration platforms, and are summarised in Figure 4. In general, criteria for choosing a collaboration partner are the same size, similar qualifications and the corporate culture. More specific elements of successful collaborations are the following: [3]

![Figure 4. Criteria list for collaboration platforms](image)

Besides these crucial factors for successful collaborations, further factors need to be considered to permit a good working collaboration. At first it has to be ensured that every collaboration partner has the necessary technical background to use the platform properly. [1]

In order to facilitate the selection of a partner for a specific task, a description of the partner's various competences has to be available. Furthermore, the mode of distributing the performance inside the network must be considered so that, on the long run, there is a use for every single member.

There has to be an interface for order processing that guarantees the document traceability and responsibility. Each company is responsible for the actuality and accuracy of its data. Another aspect is the monetary side of the collaboration. It has to be clarified how the expenses of the platform are divided and where the responsibilities for e.g. tendering and accounting are. [5]

The most important elements of such collaboration platform are messaging (email, calendaring and scheduling, and contacts), team collaboration (file synchronization, ideas and notes), and real-time collaboration and communication, and Social Computing tools. According to such definitions, it is possible to say that a collaboration platform can be classified on the basis of the services provided. [7]
The collaboration platform can also be classified according to the self-explaining schema in Figure 5 from an organizational point of view, where the requirements can be identified with the 'collaborative networked organization' box.

3. A concept of collaboration platform for tool making industry
Management of machine manufacturing is the most complex case of production management. As a rule, machine manufacturing industry produces items with complex hierarchic structure. These items are usually multi-variant on all levels of production. In difference to the chemical industry where the product has its process route from the raw material to the end product, in machine manufacturing every assembly, part and semi-finished product have individual process routes. In other words, machine manufacturing industry produces complex multi-variant products based on complex multi-variant process routes.

A general view of proposed concept of collaboration platform is presented in Figure 6 with more focused on IT architectural aspects, where different layers are focused to specific technical and logical components. One can distinguish the user interface (UI) layer that will be provided through a web portal, some middleware layers for the management of the software services and the bottom layer devoted to handling data sources such as databases, file systems, real time process data generators, etc. [4]

![Figure 6. A collaboration platform architectural view](image)

The proposed collaboration platform is showing the most relevant support tools that can be accessed from different types of users playing different roles within the toolmaker's business community. The different actors as it has been mentioned above in this collaboration are toolmakers, tool owners and service partners as well as moulders. They can access the collaboration environment from any internet access point and – provided the right authorization level – use the functions available with a simple web-browser.

An overview is presented in Figure 7 where functions and the information handled are given for the different systems and roles and the most general user working conditions are displayed.
On the customer/part producer side, the mould jinis (data loggers) are the principal process data sources. The proposed platform needs to be installed in order to allow the access of the data logger devices and the provision of typical functions on a server basis which enables the connection of all such devices. Data related to the mould jinis configurations is stored on the local customer databases as well. Database and mould jinis are connected and accessible by the data collection services through the customer intranet. These services are in turn accessible from an authorized user/application that requires the process data from any internet access point. Therewith the customers may use the platform for monitoring and analysing the situation of their installed injection moulds. They can also keep track of relevant events or check potential technical services available for their moulds and book the ones of interest. [8, 10]

The collaboration platform IT components as the database, for storing all master data used by the functionalities provided, and the server have to be installed on the toolmaker's side. The stored data is related to tools, customers, a service catalogue and service partners and can be accessed through the toolmaker's intranet, mainly for managing the web collaboration platform.

This distribution of roles is logical, since from the physical point of view the adopted IT technology allows to keep the software components also running in a distributed environment. With some of the resources running anywhere, the toolmaker's IT operators can still access and control them.

Finally, the service partners’ role has been considered, too. For them the collaboration platform does not include specific functions. Since the exchange of technical documents has been considered as the most relevant requirement this service is available on the portal for all members of the community. [9, 11]

The IT architecture described in greater detail is based on a pool of IT resources installed within the toolmaker domain as most of the functions are in fact based on the use of data with the toolmaker as logical owner (toolmaker database). Since some of the functions available on the platform also require the use of process data (both historical and real time) from a specific mould as well as data logger data, a platform installed on the customer side is required too. Before using the functions based on process data they need to be properly configured. Here the identification and set-up of rules that are activated on a specific set of process variables for a given mould is required. This kind of set-up should be provided from the toolmaker platform administrator and requires good IT management capabilities as well as an adequate level of process engineering knowledge.
Conclusion
This paper presents an approach that can be applied to develop a collaboration platform for tool making industry. It is crucial furthermore the platform to be focused on surveillance in terms of ensuring solutions for online early detection of tool wear based on recent Internet of things technology and artificial intelligence. All that would be focused to present any damage from the tool increasing the tool reliability and efficiently.

In order to overcome the challenges of production in high-wage countries innovative services can be integrated within the collaboration platform in the area of after-sale to differentiate themselves from global competitors. A specific database can be designed for the collaboration platform that includes all the master data necessary for the characterization of the most relevant entities of the IT domain: toolmakers, partners and customers as well as moulds and technical services that can be provided.

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