PROCESS-ORIENTED VALUE CREATION IN TEXTILE NETWORKS FOR MASS CUSTOMIZATION IN SMES

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ABSTRACT

PROFUND (Process-oriented value-added creation in textile networks for mass customization in SMEs), as part of the futureTEX project, tries to close the backlog and the research gap for mass customization in textile networks. Special attention will be paid to the co-creation processes for complex textiles, the envisioned small and medium enterprise (SME) cooperation approach, processes and data structures for knowledge transfer and a proof-of-concept of a complex product development platform. By using the envisioned PROFUND platform, the cycles for the new development of a product are significantly reduced. Thus, this paper contributes to research in the area of co-creation in SME networks and addresses a relevant problem in practice.

Key Words: TEXTILE PRODUCT DEVELOPMENT, MASS CUSTOMIZATION, NETWORK CREATION, DIGITALIZATION,

1. PROBLEM DEFINITION & PROJECT CONTEXT

An increasingly greater shift of the classical manufacturing of textile products with large quantities towards countries and regions with low salaries can be observed. The European textile industry has significantly decreased to the currently stable but low level. It is necessary to organize a novel value creation approach in textile networks, starting with the product development phase. The development is focused on specialized products with small quantities but with a high degree of innovation, which is a great opportunity for the European textile industry. Therefore, the individual processes need to be adapted to an effective production under industrial conditions. The most effective and efficient recording of customer requirements is still unsolved for individualization in the business context of research and practice [1]. The creation of vertical networks for the production of mass customized products has been carried out so far by a strategically leading, focal company with a central position in the network [2]. Therefore, particular attention will be paid to the integration of the customer in the development and manufacturing processes via a network and the role of information technology (IT) within it. The project PROFUND, as part of the futureTEX project, tries to close the backlog and the research gap for process-oriented value creation based on mass customization (MC) in textile networks (Figure 1). MC is a strategy to create products that address the needs of individual customers with nearly mass production efficiency and thereby integrates the customer into the value creation, which is referred to as cocreation (CC) [3]. This paper describes the current challenges for specialized textile companies to implement MC within the framework of process-oriented value creation in textile networks. First results on the individualization of textile processes and possible potential for the development of MC products in a textile network will be presented. The subject of the investigation is to create an appropriate company network structure for the development of customized technical textiles. This network structure aims at enabling SMEs to optimally exploit their resources for MC along the textile value chain. With the organization of the product development phase across company boundaries, the configuration of value creation can be organized in a completely new way and thus have a significant impact on the business model. Development orders can be processed faster and more cost efficient by exchanging and processing information on customer requirements, preliminary products, development data and manufacturing processes by means of configuration tools.

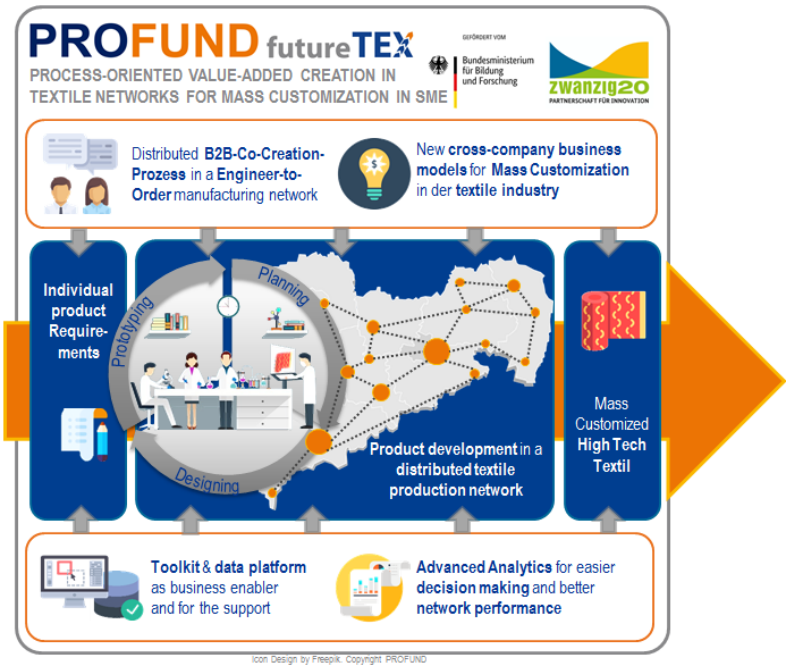

Figure 1. Overview of PROFUND project

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2. FOUNDATIONS OF CO-CREATION PROCESSES FOR COMPLEX TEXTILES

The German textile industry is characterized by high product complexity and solution-oriented industrial customers. This is why customer integration competence is particularly relevant to success here, i.e. the competence to support the customer in the configuration to such an extent that he chooses the right option for him/her. A new comprehensive perspective, also called service-dominant logic (SDL), is a fundamental shift in worldview towards network-centeredness, service-centeredness and customer involvement [4] that has lastingly changed the understanding of marketing and value creation processes. This network thinking can also be observed in the key indicators for the Saxon textile industry: about 65 % of the companies have access to a supplier pool, 42 % are part of a fixed supplier network and 69 % work together with partners in the manufacturing process. In 84 % of the companies surveyed, customers are integrated into the manufacturing or sales process [5]. The question of how highly diverse and complex (business) customer requirements can be addressed efficiently in the CC process has remained unanswered in research and practice [6].

The PROFUND project includes the cross-company CC process and studied it from different perspectives to fill this gap and to have a closer look at the digitalization of this cross-company phenomenon [7]. IT support and the value-creational use of data are becoming increasingly important, especially against the background of the ongoing digitalization of value creation. In this context, suitable configuration tools to support the individualization process will also be designed and implemented in the project. Apart from that, big data and analytical methods support the customer data management that is especially promising in conjunction with long-term partnerships in the industrial sector. The central principle remains the mastery of supplier-side complexity through modularization and customer-side complexity through toolkits according to [3, 8]. In this area of tension, this paper shows how a

data-driven platform can support an SME network in the CC. The following chapters include our first solutions starting with a general vision up to a proof-of-concept (PoC) of an IT platform.

3. ENVISIONED SME COOPERATION APPROACH

In traditional (single-company) value creation, market and customer-oriented innovation goals as well as the technical capabilities of an individual company limit the solution space. In the case of a CC distributed over several companies, this solution space becomes larger due to the higher vertical range of manufacture and thus increases the need for inter-organizational information exchange, which in turn increases the overall complexity of the development of new products. Especially because of the now much larger solution space, it is necessary to map individual customer requirements to existing standard products. Starting with existing products, new prototypes can then be developed by reconfiguring existing solutions, which are then considered as innovations.

The envisioned PROFUND platform simplifies access to existing knowledge and the collective solution space, and therefore shortens the cycles for the development of a new product significantly. The proposed platform requires the collaboration of the companies involved in CC for individual product scenarios. The strategy for cooperation between SMEs in the manufacture of individualized products should be to share the development in the network across the textile value chain. In this case, the solution space is based on robust processes for flexible production and offers customer integration from supplier to delivery. All suppliers, logistics and other network partners form a product-related virtual company at a defined point in time. The exchange relationships between the various stakeholders with regard to money, data and goods must always be adapted within the agreed solution space. The following sections successively present individual aspects of our solution approach.

4. PROCESSES AND DATA STRUCTURE FOR KNOWLEDGE TRANSFER

At the company level, the CC process comprises many individual steps, which realize the actual value of the product, is located in the manufacturing stage. The information about which process steps fulfill the requirements of the customers represents the most valuable knowledge in the network. The existing knowledge about feasible products should therefore be available in a standardized digital form in the network in order to serve as a knowledge database for the creation of new products. The temporary textile production chain of a new product is broken down into individual modular process steps and stored in the platform (Figure 2).

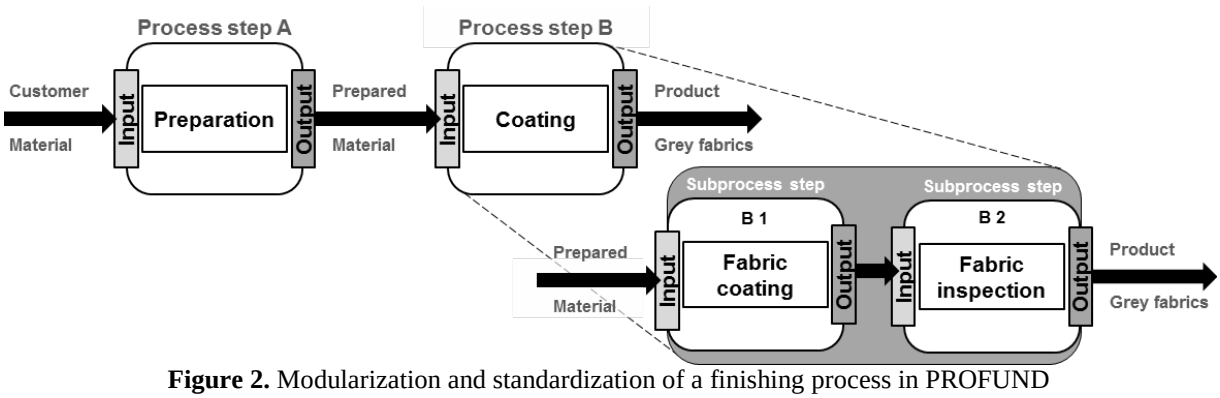

Figure 2. Modularization and standardization of a finishing process in PROFUND

This storage of the valid solutions and the individual process steps makes the product configurable via the production steps. With the help of this approach, a step towards MC and standardization is made in the area of complex contract manufacturing products without a component-based product platform by striving for a similar re-usability as with standard components for process steps in the network. Inputs and outputs are characterized by transmitted process and material parameters as well as by newly calculated or digitalized characteristic values from the analog level.
In order to achieve this goal of the comprehensive exchange of knowledge in the PROFUND platform in the CC process, the first step is to transfer historical company data to a common data exchange platform. This forms the basis for the subsequent PROFUND platform. A special focus will be placed on companies being able to determine the handling of their sensitive CC data themselves. The approach for ensuring control over what data is shared is described below.
The companies joining a development network assign their different data categories to the respective development mode with a self-controlled release status (Figure 3). The platform level of the product development network accesses these data packages analytically via the interface and keeps them within the framework of cross-company network formations in line with the customer requirements.

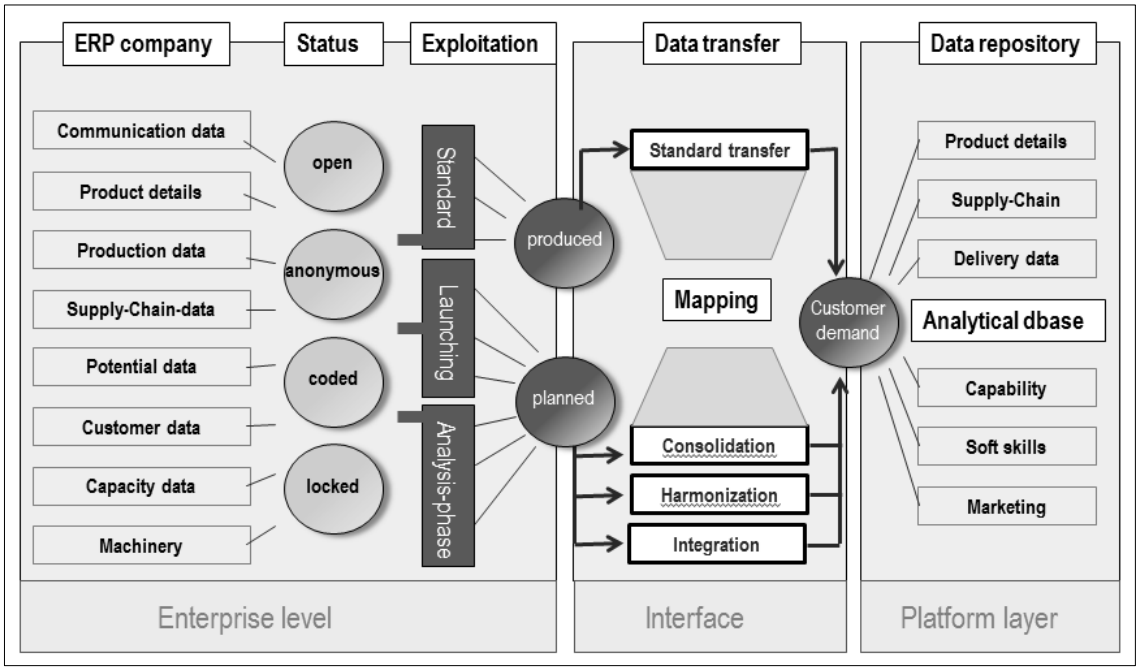

Figure 3. Access to PROFUND company data

The mapping in the interface therefore also includes, in addition to an agreed standard transfer for already manufactured products, data consolidation, harmonization and integration (filtering and placement) for planned product developments. Development and access to the respective company data take place against the background of the initiation of a new textile product and/or the associated actual production (standard development). However, a company-related analysis phase is also taken into account, which after the data transfer becomes part of a network-related product development. The cross-company data exchange is ensured via the enterprise resource planning (ERP) system and its interface to the development data platform. This enables employees to benefit from end-to-end digital

engineering, as they now have all the information and forecasts they need at any time to enable efficient and effective action in flexible production structures.

The general architecture for the PROFUND platform is presented as a three-layer architecture and is shown in Figure 4. The consolidated company data as well as the data repository for the applications, i.e. for the configurator and the analysis system is located at the data repository level. At the application level, a similar distinction is made between the analysis system, the configurator and also between an external information interface. These three components are implemented onto the graphical level with their own user interface.

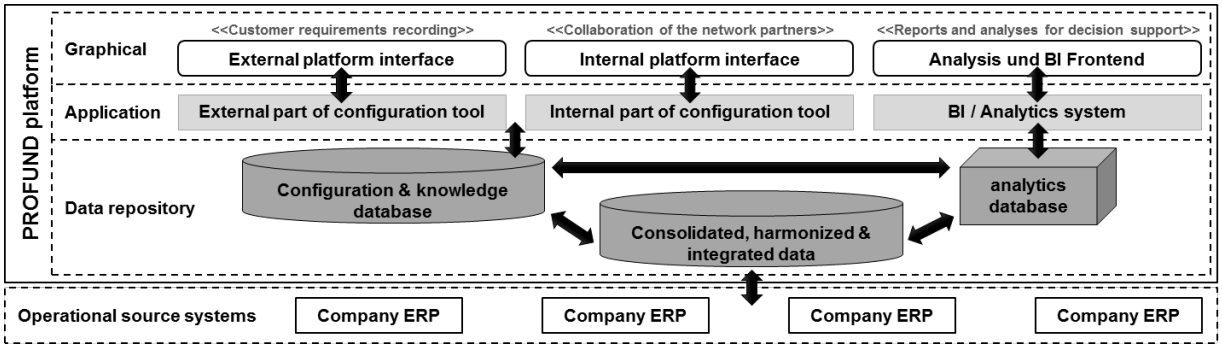

Figure 4. General architecture of PROFUND platform

5. COMPLEX PRODUCT DEVELOPMENT PLATFORM – A PROOF-OF-CONCEPT

On the basis of the above and the consideration of best practices for analysis support and MC-specific configurators [9-11], a PoC was developed which shows how IT support along the CC process can be implemented across companies in the network.

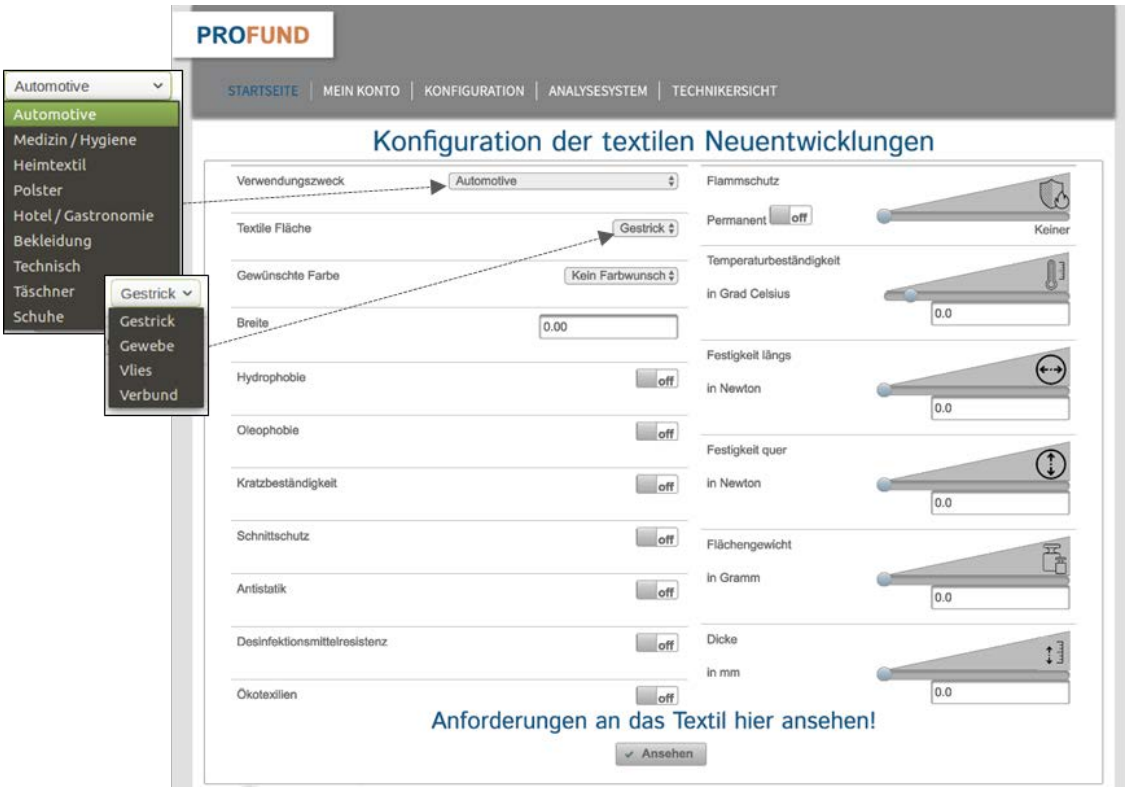

Figure 5. PoC of PROFUND platform – configuration form

The network idea is reflected in the PoC by the fact that we propose a platform which can be used by any number of providers for value creation process coordination (similar to a social network for value creation processes). The CC concept is taken into account, as the customers of the network also have access to the platform in order to be integrated into the CC process and to increase the quality of value creation. The CC process concept is supported to the extent that the platform accompanies the creation of value from the inclusion of the requirements to the completion of the project. The PoC addresses the issue of process modularity by storing the solutions as configurations of a production process instance (screenshot of PoC is shown in Figure 5). The knowledge base is populated with existing company data and can be further extended by newly created solutions on the platform, thus creating a learning system.

6. CONCLUSION

We showed how MC can be addressed in textile SME networks in practice. We addressed the near mass production efficiency by the IT-based configuration of modular CC processes in value creation networks. The customization aspect is addressed by our focus on the customer integration in the CC. Our research furthermore contributes to the discussion of CC in SME networks in the age of the digitalization.

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