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Modeling Transfer of Knowledge in an Online Platform of a Cluster

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Dealing with knowledge as a relevant resource and factor for production has become increasingly important in the course of globalization. This work focuses on questions about transferring knowledge when many companies work together in a cluster of enterprises. We developed a model of this transfer based on the theory of clusters from the New Institutional Economics' point of view and based on existing theories about knowledge and knowledge transfer. This theoretical construct is evaluated and adapted to praxis based on the online platform of the MAI Carbon Cluster in South-Germany.

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Keywords: Industrial cluster; knowledge transfer; modeling; collaboration**1. Introduction**

For hundreds of years questions about knowledge have been discussed in various sciences. While knowledge had been reserved for philosophy since ancient times, business economics recognized the relevance of knowledge and its deeper exploration later. Knowledge has become increasingly relevant as important resource and factor of production. It is a widespread and undisputable opinion that using knowledge will be the major factor for competitiveness in the near future [1]. In the trade-off between competition and cooperation, companies are looking for ways of using the benefits from sharing knowledge and creating a common knowledge base with other companies but simultaneously protecting their knowledge. The basic idea of knowledge as a factor of success, which shall not be shared, is in contradiction to the assumption that the overall performance is higher when people work together. Out of this experience, many intermediate forms of organizations have been established. One of these forms is the collaboration of several companies in clusters: In the course of globalization of worldwide markets, companies have to meet new types of challenges and are forced to find new ways of organizational thinking and new forms of organizations emerge – like industrial clusters. Since the transfer of knowledge between the participating companies and their members has an outstanding importance. Working in such clusters requires sustainable management of knowledge and of knowledge

transfer between the involved companies. We provide a model that describes the knowledge transfer in industrial clusters. It is based on theoretical principles of organizational theory and theory about knowledge. Furthermore, it is based on practical experiences with the MAI Carbon Cluster and its online platform “Carbon Connected”. The MAI Carbon cluster is located in South-Germany focusing on the distribution and the usage of carbon-fiber-reinforced plastics for various industries and applications. For being competitive, linking the knowledge of all involved companies is absolutely essential. In order to encourage the required knowledge transfer between companies, the online platform “Carbon Connected” was introduced in 2012 and has been evolved since then. Investigating the processes in this online platform allows to build up a model for this kind of knowledge transfer and to learn about fundamental aspects and problems. Many literature sources investigate knowledge transfer in general (see section 2), however, there is no model that focuses on knowledge transfer in industrial clusters.

2. Creating a knowledge transfer model*2.1. Intention of modeling: clusters as the underlying original*

In this chapter, we describe the original of our model – clusters of enterprises. The term of clusters has its origin in

computer sciences, where it is used in cluster-analysis: aim of this procedure is to form groups with similar objects so that dealing with high volumes of data becomes less difficult [2]. Using this term in business science differs in the issue that not forming but discovering generates a cluster of enterprises: Regions involving a set of cooperating and successful companies of an industrial sector have a positive effect on those companies' businesses [3]. Economic sciences do not provide a clear definition for the term cluster, however, Porter [4] gives the most common one: A cluster is a certain amount of companies belonging to a particular industry that have agglomerated in a special region and that are in maintained constant contact. Typically, there are companies of all stages of the value chain from related industries as well as suppliers of appropriate infrastructures and institutions as universities that focus on R&D (Definition based on [4], [5]).

2.1.1. Enterprise clusters: advantages of new organizational forms

The emergence of enterprise clusters is caused in the globalization: For remaining successful against the competitors, companies have to constantly launch new and better products fulfilling the required standards of quality and technology. Only very innovative, flexible, and knowledge-based companies with sufficient knowledge about markets and products, with compliance and financial resources, can survive on the market. Today, companies of certain industries do not seem to be able to rank among the best in all of these categories. Concentration on core competencies becomes mandatory and leads to growing division of labor and increasing economical linkages as found in clusters of companies. The resulting competitive advantages are various: Linking different knowledge bases results in advantages in the competition of innovations. Successful novelties help the companies to differ from competitive offers and to successfully launch the products on the market [6]. Linking to other companies provides benefits in time: Due to increasingly rapid succession of innovations and product life cycles, early stages of development require simultaneous engineering instead of sequential engineering in collaborations with suppliers. In addition, the risk of quality deficiencies especially for quality-sensitive products can be reduced by integrating both earlier and later production stages. This risk arises from insufficiencies of the markets in terms of missing control of purchased goods [6]. Building steady structures between companies gives a competitive advantage concerning the costs, e.g. costs of coordination of collaboration. Moreover, costs can be reduced by sharing production facilities, by cross-company R&D activities of several sectors, by common procurement and sourcing and due to reducing the risk compared to an individual company [7].

2.1.2. Enterprise clusters from the view of The New Institutional Economics

To get a profound understanding of clusters, we classify the phenomenon within the scope of the existing organizational landscape. In terms of organizational theory, organizations occur as a reaction to the fundamental problem of shortage of demanded goods. In order to meet this challenge, division of labor and specialization emerge [8] including positive

consequences: by executing a single task, the worker gets a higher level of skills, expertise, and experience, while his required qualification level and his recruitment costs decrease [9]. However, these increases in productivity are accompanied by the necessity of coordination and exchange of goods. Those aspects imply the organizational issue of coordination – information has to be distributed to all actors to overcome the unknowing of the individuals – and the issue of motivation – in order to overcome the unwillingness of the actors [8-10]. These problems also occur when several companies work together in a cluster. Hence, the closer examination of organizational theories delivers a basis for the classification and categorization and for the analysis of the phenomenon of enterprise clusters.

The theories of the New Institutional Economics as one of the organizational theories consider that institutions are built up in order to minimize the defects emerging from the lack of motivation and coordination [10]. The role of institutions now is to establish a system of rules showing the involved players' scope of action and expected consequences of the players' behavior. In the transaction cost theory – the partial theory of the New Institutional Economics that delivers an approach to illustrate the organization in clusters – the emphasis lies on the single transaction. The goal is to find the organizational form that minimizes the transaction costs arising with every exchange of services. This results in two extreme forms: Hierarchy and market. Within the concept of hierarchy – typically the organization in a company –, the collaboration is based on long-term contracts that determine the own action and make others' actions predictable. In contrast, the concept of markets is based on one-time, short-term relations and contracts, which lack further commitments [7]. Transactions costs in hierarchies mainly consist of fixed costs for building up the bureaucratic structure while variable costs are rising slowly due to a low level of uncertainty. In markets, the fixed costs are very low but since not knowing your transaction partner well causes a high level of uncertainty, variable costs rise quickly with the numbers of transactions [10].

The collaboration of several companies in cooperative connections tries to connect and use the advantages of both extreme forms by building an organization that is in the range between the extremes. So do networks of companies: Short-live changes on the market and in technologies resulted in a greater uncertainty and in a higher risk of unused capacities in companies. Thus, short-term transactions on the market were used more commonly – moving away from the hierarchical form of organization where all components were in the own company [11]. To avoid the disadvantages of the market, some hierarchical attitudes were maintained: Clusters of companies were born. They combine the advantages of both extreme forms of hierarchy and market: The benefits of markets on the one hand stem from the functional specialization: Corresponding to the situation on the open market, each member of a cluster performs the task for which it has the highest competence. Moreover, the efficiency pressure is adequate to the market situation: In order to survive in the enterprise cluster, the player has to be and to remain one of the best players. The main advantages of the hierarchy on the other hand lie in growing confidence and trust through cooperative behavior and through

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