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APPROACH FOR THE DEVELOPMENT OF LOGISTICS ENABLERS FOR CHANGEABILITY IN GLOBAL VALUE CHAIN NETWORKS

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ABSTRACT

Recently, logistics networks are increasingly faced with dynamically changing influences in their environment. In order to cope with these volatile trends, flexible adaptations with a short-term horizon are often used, but not sufficient. Rather, a permanent adaption of the network structures is necessary. In this context, our current research deals with the changeability of value chain networks triggered by internal and external influences. The general objective is the development of a methodology for changeable network structures to support or enable necessary changes. With the focus on logistics processes and network elements this paper describes an approach to analyse existing value chain networks and to identify all changeable objects and their specific change drivers. Furthermore, an approach for the development of change enablers and the evaluation of occurring change demands will be presented. The practical applicability of the approach will be assured trough the participation of two industrial partners.

KEYWORDS

value chain network, logistics, changeability, change drivers, change enablers

1. INTRODUCTION

The markets for production companies are increasingly dynamic, due to shorter product life cycles, increasing variety in small batches and changing customer requirements. (Wildemann, 2007) These dynamic influences do not only directly affect the product ranges and production systems, but also the entire value chain network. (Zahn, 2010) At the same time, the markets experience an increasing globalization. Thus, manufacturing companies are more and more associated within globally distributed value chains. Global value chain networks can be used for international locational advantages. (Stabell, 1998) However, the progressive global integration of internal corporation plants as well as external partners and suppliers leads to complex mechanisms within the networks. These mechanisms are partially or completely unknown and difficult to forecast. (Zahn, 2010) So that the effects of dynamic influences do not lead to negative emergences in value chain networks, these must be quickly reactive and adaptable. Consequently, changeability for global value chain networks is demanded. This paper describes an approach for the planning and optimization of changeable global value chain networks. Thereby, the focus lays on

the logistics structures and processes within value chain networks. The paper on hand describes firstly basic terms and definitions regarding value chain networks and changeability (section 2). Furthermore, the industrial partners that participate in the research will be introduced in section 3. The main part of the paper lays on the approach for the development of logistics change enablers that are described in section 4. Finally, a conclusion and outlook is given in section 5.

2. CHANGEABILITY OF VALUE CHAIN NETWORKS

As a result of out-sourcing non-core activities many companies are today much more reliant on external suppliers of goods and services. (Christopher, 2005) This trend is reinforced through an increasing globalization which offers new possibilities and risks. On the one hand, globalization provides new cooperation opportunities and business markets; on the other hand, globalization also leads to an increasing competition. In view of volatile environments and rising demands to the goods and services to be provided, networks are a more and more preferred „organization form of economic activities“. (Sydow, 1992) Subsequently, the competition does not only occur between single companies but between whole value added chains.

This trend also concerns the logistics processes and structures in different ways. The integration of single companies in globally dispersed networks leads to an increasing meaning of operational logistics processes as well as the planning and controlling of them. Furthermore, the concentration on the core competences reinforces the shifting of logistics tasks to logistics service providers. Thus, logistics has become an important part within global value chain networks. (Christopher, 2005)

The material flow within a network can be seen upstream over the different suppliers' levels as well as downstream over the direct customers up to the final customers. The total of the material flow is called supply chain or value chain. Besides, logistics within a value chain can be seen as a sequence of transformation processes of procurement, production and distribution logistics.

Today, value chain networks face numerous internal and external factors of influence. External influences are, inter alia, caused by changes in the suppliers market and outlet, social, political and economically basic conditions. These changes are caused by increasing product individualization, the internationalization of markets and short technical innovation cycles. Internal influences are entailed by employees and production methods, products, technologies and network partners. Caused by these influences, value chain networks are confronted with the challenge to adapt themselves to changing conditions and to react dynamically. A co evolution of value chain networks with their constantly changing fields of problems thereby becomes necessary. This requires that value chain networks inhabit the ability to change. (Zahn et al., 2010)

In literature there are, for different investigation objects, several attempts and definitions of changeability. This paper uses two definitions of changeability that describe the understanding on value chain networks at the nearest. On the one hand, changeability implies that companies from themselves dispose straight applicable process variability and structural variability as well as behavioral variability (Westkämper et al., 2000). They can react therefore reactively as well as anticipative to changes (Westkämper, 1999). Reinhart et al. (2002) and Zäh et al. (2004) on the other hand understand changeability as an enlargement of flexibility. Changeability shows the potential to carry out changes reactively and, if required, beyond available flexibility corridors proactively. Using these attempts changeability with the focus on logistics structures and processes can be understood on value chain networks as follows. Changeability is the proactive or reactive change of structures and processes beyond existing flexibility corridors within value chain networks. The necessity to change will be supported by the use of process-transcendent and structural-transcendent "change enablers". In this context, change enablers show a tool with whose help the change of a value chain network can be enabled and optimized. Heger (2007) describes, that changeability requires efficient change processes. These processes of change require an identification of the influences described above, named as "change drivers". Furthermore, it is necessary to generate the changeability by adequate change enablers on a value chain network.

3. INVESTIGATION OBJECT

General object of our research is the development of a methodology for the creation of changeable global value chain networks. The focus lays on the logistics structures and processes. The applicability will be assured by the participation of two industrial partners. This allows the practical use and evaluation of the developed methodology.

One of the industrial partners is a service providing company, which is active in the area of apparel logistics. The company owns three logistics centers in Northern Germany where the finished goods get stored, commissioned and handled according to incoming orders and customer requirements. The company is integrated in a global value chain network. The manufacturing of the

apparel goods occurs in four production locations in Eastern Asia. Some of these locations belong to the company's cooperation; the others are integrated in the network by a classical customer-supplier relationship. The customers are settled predominantly in Germany and Western Europe. A low quota is delivered, with rising trend, to customers in Eastern Europe and Asia. Besides bulk buyers like department stores and mail-order companies, numerous retail dealers and specialist suppliers are also amongst the customers. Further network partners are service providers for the transportation of the products. The process focus lays on the logistics distribution processes and the order execution. After the incoming customers' orders the demands are transmitted to the production centers. The procurement of raw materials and the production are controlled by the production centers. After the transport of the finished goods to Germany the goods get taken over by the distribution centers, stored and dispatched to the customers. This execution shows the core business of the company.

The other project partner is a leading manufacturer of telecommunication sea- and aerial-cables, as well as submarine power and offshore cables, and furthermore technical plastics and environmental products with its head quarter in Northern Germany. The main focus of the company lays on the cable production that is located at the head quarter. Besides that, the delivery of the finished products, the installation and the subsequent service provision are also part of the core competences. The companies' network includes approx. 50 suppliers that are located mainly in German and Europe. The customers are distributed worldwide with some focus on Europe and a high share of deliveries to Eastern Europe, Asia, North and South America regarding selected product lines. The network also includes service providing companies for the storage and transportation of the products. One of them is located directly besides the head quarter and responsible for the logistics handling beginning from the goods arrival until the finishing of the goods. The focus of the cooperation within the project lays in the evaluation of the logistics expiries of the company.

Both companies are part of a globally dispersed network of suppliers, customers and service providers. They face varied challenges, caused by a rising individualization of the products as well as changed market standards and customer requirements. In the past, varied efforts have already been started to adapt themselves to changing conditions and external influences. The analysis and utilization of these experience values is an important component of the research and is considered within the approach, which will be described below in detail.

4. APPROACH FOR THE DEVELOPMENT OF LOGISTICS CHANGE ENABLERS

The approach for the development of change enablers focuses on the logistics view and can be divided into four steps as pictured in Figure-1.

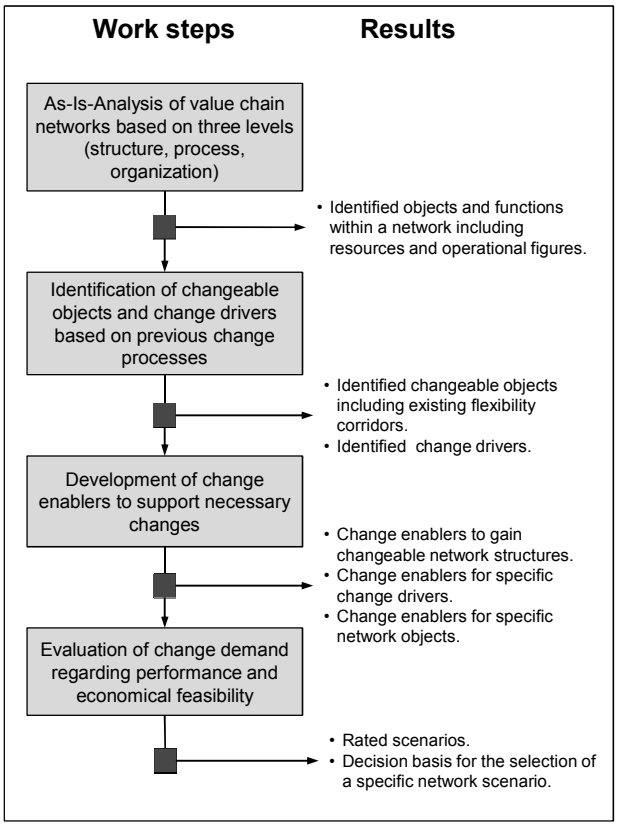

Figure 1 – Approach for the development of logistics change enablers

The approach starts with a detailed analysis of the existing network (section 4.1) in order to gain an understanding of the structures, processes and the interactions within the network. The next step is the identification of all objects within the network, which needs the ability of adaption. These objects underlie internal or external influencing factors that will also be identified (section 4.2). The result is the knowledge of all changeable objects including their existing flexibility and specific change drivers. Following up is the development of change enablers that are methods and concepts to support or enable necessary changes (section 4.3). These methods are named as change enablers. The results of this phase can be separate methods for specific objects or scenarios as well as general methods used over the whole value chain network. The development of overall methods leads to changeable network structures. Last step of the approach is the

evaluation of the potential change demand (section 4.4). A change has to be considered if defined action control limits of the changeable objects are over or below defined targets. Possible network alternatives including the as-is situation and particular necessary change steps have to be rated qualitatively and quantitatively, which results to a recommendation for one specific network scenario. Subsequently, the specific steps of the approach will be explained in detail.

4.1. AS-IS ANALYSIS

The as-is analysis for the logistics view onto the value chain network follows a three-level model. Within this model data regarding structure, processes and organizational matters of a network will be evaluated. Overall three levels operating figures and indicators will furthermore be identified. The result constitutes the aggregation of the evaluated data by the collection of all objects within the network, their specific functions including the resources that are necessary to fulfill the respective functions (Figure-2).

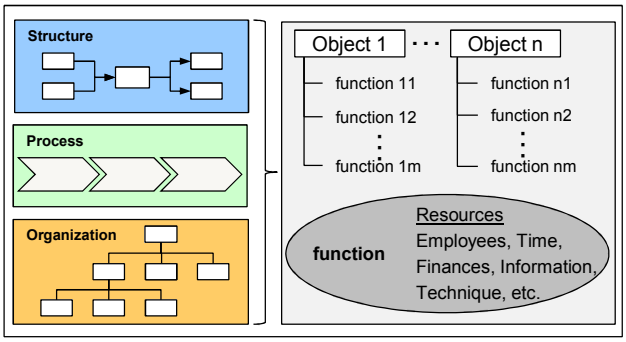

Figure 2 – Three-Level-Model for the as-is analysis

On the structure level the existing network and product structures will be examined. The evaluation of the network structures includes the identification of the function areas within the company in focus as well as external company sides and network partners including their function and geographical dispersion. Within the product structure the company's product range will be evaluated and analyzed regarding its specific characteristic. In order to link network and product structure it will be determined which network partners are relevant for which product areas. Additionally, the systems load will be determined by evaluating the quantities of final products, components and raw materials that have been purchased or produced over time for a specific product.

Within the process level the main processes that are necessary for the order processing will be identified. The processes will be assigned to the main categories procurement, production and distribution. Besides the working steps, the necessary resources and time demand will be evaluated. Additionally, the operating figures that measure the performance of the single part processes will be evaluated.

On the organization level the focus lays on the resources that are necessary for the fulfillment of tasks. These resources include, amongst others, the companies' employees as well as time and information aspects. One main point lays on the evaluation of the organizational structure. Here it will be analyzed how the functions that are responsible for the process handling are integrated within the organization. A comparison of the organizational structure with the process handling allows the identification of interfaces and communication channels. Overall the company, an analysis of information and communication structures will follow to figure out how information is exchanged within the network. The last point of the organization level is the evaluation of the companies' project handling. Here, it will be examined, how optimization projects are handled in general within the company. Other points of interest are the overall cooperation within the network and experience values out of previous optimization and change projects.

The data collected within the different levels will be aggregated as pictured in Figure-2. The functions pointed out of the process analysis will be assigned to the objects identified in the structure level. The organization level is included by the appointment of necessary resources to the respective functions such as employees, information and technique.

A short insight into the data that have to be evaluated during the as-is analysis is given by the introduction of the industrial partners in section 2. Here, the companies' network partners, product ranges and the main processes are outlined. The level of examination within the as-is analysis as well as in the following steps depends on the information transparency within the value chain network. For the companies in focus the evaluation of information can be executed on the level of single objects. In the case of external network partners the level of examination depends on the information transparency between the companies. In extreme cases the lowest vertical level of examination is the network partner itself.

4.2. IDENTIFICATION OF CHANGEABLE OBJECTS AND CHANGE DRIVERS

Based on the results of the as-is analysis the objects that can be effected by change drivers have to be identified out of the accumulation of all possible network objects. These objects are of great interest for the following development of changeable network structures. In the following these objects

will be named as “changeable objects”. With the identification of these changeable objects, the change drivers that lead to necessary changes will be evaluated. Besides that, it is necessary to identify their existing flexibility corridor to be able to recognize possible change demands. Normally objects inhabit a certain flexibility corridor. Within this corridor the objects can be adapted to changed conditions without undergoing general changes. In the case that operational figures constantly reach values over or below the flexibility corridor a change has to be considered.

To bring out these changeable objects, their specific change drivers and their existing flexibility corridor it is helpful to revert to experience values of the past. Those experiences can be used to educe general aspects that characterize changeable objects. This approach allows a thorough identification of all changeable objects within a network and their specific change drivers. For this reason previous change projects will be detected, analyzed and evaluated together with the industrial partners. First step of this analysis is the identification of the superior change driver that induced the decision to pass the examined change process. Examples for those change drivers are, amongst others, the adaption of the product range caused by changed customer demands or the sales of finished products in a new market based on the increasing spending capacity. Next step is the identification of the objects and functions that were affected by the undergone change. The changeable objects will be analyzed concerning their undergone changes and adaptations. Possible changes are e.g. the enlargement or diminution of objects’ functions as well as the transfer of functions to other objects. In addition the elimination of single functions can take place, too. In this context an analysis of necessary resources such as employees, time, financial aspects and information and an analysis of the demands to these resources within the change process will be executed. Moreover, an evaluation of the concerned objects’ performance trends will take place using the operating figures out of the as-is analysis. Thereby, the focus lays on the alteration of the characteristic lines in the time line before, during and after the change. This allows the finding of the objects’ flexibility corridors. To identify the change drivers within the change project, it will be examined which change drivers caused the documented operational figure trends and lead to the fact, that the operational figures have been below or over defined limits.

Based on the experiences from the previous change projects general aspects will be deflected that allow the identification of changeable objects through over the network. With the use of the changeable objects, the change drivers will be identified by the examination of the factors that have an impact on the performance of these objects.

4.3. DEVELOPMENT OF CHANGE ENABLERS

The described deviation of operating figures from the defined flexibility corridor implicates, that the concerned functions are not able any more to fulfill their tasks satisfyingly. In these cases it has to be evaluated if a permanent adaptation of the network is necessary or if it is possible to restore the performance by isolated concepts. If a permanent adaptation of a network is necessary the possible network scenarios have to be identified and evaluated qualitatively and quantitatively. This evaluation will be described in detail below. Beforehand, possible methods and concepts (change enablers) to support or enable permanent network changes will be described in detail. Regarding to their sphere of action three classes of change enablers can be differentiated.

The first class of change enablers stands for methods that can be implemented within the network. The target of these enablers is the attainment of changeable network structures. These change enablers will be implemented before a specific change demand occurs and support an efficient change process. The development of these enablers bases on the changeable objects. As described above, the identification includes the deduction of general demands to the resources that are concerned from possible changes. Possible change enablers could be concepts regarding the qualification of employees or the information flow within the network.

The second class of change enablers comprises methods that can be deployed in the case that specific change drivers occur. As the design and development of a change enabler can require high cost and time efforts it is not efficient to provide change enablers for every change driver. Thus, the development of these change enablers requires an evaluation and prioritization of the change drivers in advance. The evaluation considers, inter alia, the occurrence probability and the expected impact. Based on the evaluation the change drivers can be prioritized. This prioritization will serve as a basis to decide about the change drivers that have the need for a specific change enabler. An example for a specific change enabler is a method for the systematically selection of customers in order to reduce the risk of deficits in payment caused by a lack of credit-worthiness.

The last class of change enablers includes methods for specific network objects. These kinds of change enablers can be reasonable if a network contains critical objects, that are often concerned by

change drivers or that are important for the company's performance.

4.4. EVALUATION OF CHANGE DEMAND

As described above, the change demand has to be evaluated if the flexibility corridors of the changeable objects are not able to fulfill their function caused by change drivers. In this case possible scenarios of alternative value chain networks have to be developed and evaluated. To decide about possible adaptations and network scenarios, it is necessary to evaluate the change demand in advance. This evaluation includes two steps as pictured in Figure-3. Firstly, the network scenarios have to be analyzed and compared regarding their performance and costs. Secondly, the necessary change processes have to be developed and proved regarding time, resource and cost efforts.

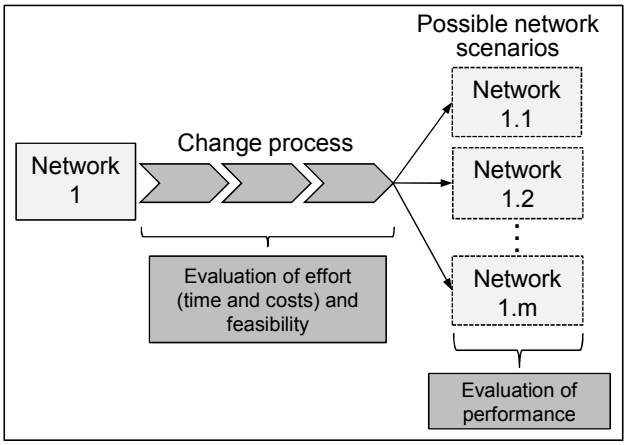

Figure 3 – Evaluation of change demand

For the evaluation of the different network scenarios, the characteristics of each scenario, including the current network, have to be analyzed under the changed conditions caused by change drivers. For the logistics target achievement it will be examined how the performance of the concerned objects emerges throughout the planned change. The local changing of performance for single objects within the value chain network is thereby subordinated to restrictions that can be induced by the performance of up- and downstream value chain levels. For the evaluation of the change effects it is therefore necessary to know about the interdependencies and reciprocal interactions of logistics target values, their characteristics and their mechanisms of action along the whole value chain network. According to Wiendahl (2007), these complex interactions are known as polylemma of the operations planning in production logistics and polylemma of materials administration in the areas of procurement and distribution. Here, not only the isolated active connections within the logistics area of the value chain network but also the linking between both logistics tension fields are considered. (cf. Fastabend 1997, Nyhuis 2003)

Thereby, the whole value chain network can be seen as a sequence of transformation processes regarding procurement, production and distribution logistics. Thus, for the identification the characteristics of the operational figures and characteristic curves in all different value chain steps have to be analyzed. Based on this, the reciprocal interactions of the operating figures and characteristic curves will be examined.

The result of this analysis is a parameterized value chain network that shows all characteristics of operational figures and characteristic curves of the network objects and their independences to up- and downstream value chain levels. With the use of these characteristics the effects of planned changes on the parameterized value chain network will be analyzed. The change of operating figures within the different value chain levels leads, through the examined interactions, to the planned change process. The evaluation allows the illustration of the changed logistics target achievement within the changed value chain network. In addition to the logistics performance, the performances of adjacent areas that can also be indirectly concerned from the change have to be examined, too. This is necessary to avoid isolated optimizations that lead to a deterioration in other areas.

In addition to the described evaluation of the network scenarios the change process has to be evaluated qualitatively and quantitatively. Therefore, it is necessary to identify and assess the change steps including participated resources, time, cost efforts and feasibility. If the change can be supported by specific change enablers for single objects or change drivers like mentioned above, the effort to implement the change enabler has also to be considered.

The result out of the change demand evaluation is a rating of the analyzed scenarios regarding their performance and economic efficiency as well as the necessary effort for the change process. This evaluation leads to a decision basis for the selection of a specific network scenario.

5. CONCLUSION AND OUTLOOK

So that value chain networks can react adequately to dynamically changing influences, changeable structures must be already developed in the process of its configuration. In this context our research pursues the aim to develop concepts and methods for the realization of changeable value chain networks. The presented paper describes an approach, which shows the development and

evaluation of changeable value chain networks and its change demands. Besides an approach for the as-is analysis of existing value chain networks and the identification of changeable objects, their existing flexibility corridors and specific change drivers, the paper introduces different classes of change enablers and an approach for the evaluation of occurring change demands.

The practical applicability of the approach will be verified by means of two industrial partners. This requires the knowledge about their existing network structures. Thus, further steps of investigation will be the detailed consideration of the network structure and the identification of changeable objects and their specific change drivers. A prototypical evaluation of potential change demands will be realized based on the possible change drivers within the partners' network. Following up is the evaluation of specific change enablers that enable the industrial partners to react to potential change drivers.

Besides that, a general characteristic of changeable objects will be deflected which serves as a basis for the following development of change enablers to gain changeable network structures.

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