Supply Chain Management in Industrial Symbiosis Networks

Sustainable supply chain management deals with the design and operation of profitable supply chains that also respect limitations on natural resources, do no harm to the environment, and consider the social systems they operate in. In academic research on sustainable supply chain management, as well as in policy documents from e.g. the European Union, the concepts of circular economy and closed-loop supply chains have received significant attention. One of the manifestations of these developments are industrial symbiosis networks. These networks are a collaborative effort to more sustainable production operations, and are characterized by a supply chain reconfiguration that uses one company’s wastes or by-products as a raw material for another company, avoiding waste disposal while also reducing material requirements. The resulting networks of relationships contribute to regional sustainable development efforts, and emphasize synergistic relations, community, and collaboration.

This thesis takes an operations and supply chain management perspective on industrial symbiosis networks. More specifically, the thesis elaborates on the collaborative and competitive characteristics of industrial symbiosis. First, it discusses the supply chain integration and coordination challenges that appear in industrial symbiosis, on both an organizational and operational level. Secondly, the thesis discusses the organizational capabilities and resources relevant for the competitiveness of industrial symbiosis networks on three dimensions: the level of the firm, the network, and the business environment. Finally, the thesis elaborates on supply chain resiliency based on a formal model with multiple concurrent suppliers. The model includes fairness considerations in different by-product allocation strategies, which turn out to have different requirements and consequences for the organization and facilitation of the collaborative efforts.

Overall, this thesis aims to ground industrial symbiosis in operations and supply chain management theory. The thesis thereby provides a basis for the improved organization and operation of industrial symbiosis networks, and supports the development towards resource-efficient closed-loop material flows.

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