

Organizational and institutional influences on industrial symbiosis

The case of Econova and its synergistic partnerships

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Background

Institutional and organisational factors have a key influence on the emergence and development of synergistic relationships. Furthermore, some of these can be effectively influenced by appropriate intermediaries within reasonable time-frames to create more fertile conditions for industrial symbiosis (IS) developments. Within the project, organizational and institutional enablers with key impacts on the emergence and development, and which can more clearly be influenced by local/regional intermediaries, of synergistic relationships were also investigated, along with the already experienced and potential future roles of public and private intermediaries. For this purpose, interviews were conducted with representatives of industrial partners. Key findings of this effort is summarised below.

Key findings

Regulatory landscape is accepted as a key institutional factor, with high influence the development of synergistic relations, and the cases studied in this project were no exception. Specifically, both fiber sludge and bottom ash from biofuel and waste combustion are subject to regulations incentivizing productive use of these materials, and CO₂ and energy taxes combined with emission limits on SO_x are key levers for substituting a greater share of fossil oil. There are, however, other factors in play and their importance is demonstrated by two important facts: 1) in our case, valorisation of fiber sludge into valuable compost was initiated prior to the regulatory requirements that eliminated the possibility of landfilling. 2) Although fiber sludge is widely generated elsewhere, up until recently Econova has been the only company who valorised it as a soil additive. Therefore, there are other organizational and institutional enablers, beyond formal rules and regulations, that need to be recognized. The important ones of these include the following:

High familiarity and mutual understanding

For the synergies between Holmen Paper and Econova, mutual familiarity has been the key enabler for the emergence of different synergistic relationship. In earlier days, was a mere logistic service provider to Holmen and the companies had an active interface which allowed them to grow familiar to each others' needs and resources that could be combined for mutual gain. For example, Holmen was faced with a growing need to landfill large quantities of solid waste and Econova had heavy machines and the skills to operate them. Thus, Holmen contracted Econova to manage their internal landfill for mutual gain. This further increased familiarity and enabled Econova to develop a thorough understanding of the mills operations and identify by-product streams that were problematic and/or underutilized. The first one of these was bark from the mill, which Econova offered to turn into soil products, marking the beginning of first by-product synergy between the companies. This brought the companies even closer, and enhanced their deeper familiarity. As a next consequence, Econova spotted the opportunity to process wastewater sludge that was rich in fiber content into a soil additive following dewatering and composting. What is critical to note in here is that these synergies developed within an institutional context where landfilling these waste streams would be the norm. This synergy was further improved, when an employee from a service provider to Holmen and with detailed knowledge of company's wastewater treatment operations joined Econova. This individual was able to identify and pursue new opportunities, which resulted in mutual gain for both parties.

Resource and competence complementarities

Both Holmen Paper and Tekniska Verken have other business priorities and their organizational resources are sensibly developed around, and guided towards, these. Thus, they are inadequately

equipped to identify and pursue innovative options for valorising their waste streams. Econova, on the other hand, has both technical and administrative resources and capabilities that allows the company to effectively handle transactions, which would be perceived too costly by other players. For this company, productive handling of by-products and increased value creation are among key foci and there are resources dedicated for developing new ideas. Thus, a service provider with specific capabilities can offer new opportunities to a large industry related to the improvement of non-core business activities. Add on services can be motivated because it is provided in areas where the industry sees little potential and incentives to invest. Moreover, unlike Holmen Paper and Tekniska Verken, Econova has active communication with a diverse range of actors, which allows it to access relevant customers and markets more efficiently and effectively. Easier mobilisation towards identified ideas. Such resource and competence compatibilities have been a critical element for the emergence and development of operational synergies. In our study, the effects of not combining such complementary resources were also captured, by comparing Holmen's similar operations in Braviken and Hallstavik. In the latter, fiber mulch is produced and marketed without the involvement of Econova. This was a case, where both parties were unable to correctly appreciate the value of resources and capabilities of each other. As a result, Holmen decided to take on the business of soil additives on their own. The question is if they can benefit from diverging into soil business too or rather try to negotiate a better deal with Econova and add value to their by-products? This question can be investigated, among others, under the lens of transaction costs theory, and can provide valuable insights.

Organisational priorities and perceived value of IS

The fact that regulations put pressure on the companies to find alternative ways of dealing with their waste streams is certainly a factor. But how do companies respond to this pressure is critical. More often, companies prioritise options that can solve residue and waste related problems in easiest and cheapest ways, without giving too much consideration to whether such resources are put into any productive use. However, as our study showed, creating long-term relationships with partners with a drive to create increased value from secondary resources can offer significant and dynamically evolving business value. This, however, requires actors to have a sufficient appreciation of the business value that can be derived from such partnerships – to which we tried to contribute in this project. It also requires companies to search for, and engage with, suitable partners with complementary resource endowments. As relevant information on this is scarce in the market, findings novel partners and solutions require social capital, that will allow access to relevant and valuable information. Put differently, actors need to have effective communication channels and routines and necessary levels of trust. They also need to have organizational capabilities to make sense of the information they access and should be able to turn this in the productive action. The latter is highly correlated to the level of knowledge regarding business value of such partnerships.

It needs to be noted that, despite showing higher concern to environmental impact and giving higher priority to environmental performance, the tendency to prioritise solutions that demand minimum amount of organizational resources in dealing with non-product problems also persists in Swedish industries. Thus, long-term relations entailing higher initial transaction costs are not often prioritised. This study shows that a historic partnership was initially build on cost reductions on the industrial partner. Econova recognized a business opportunity and Holmen could at the time offset a liability of having to deal with a by-product that offered little value. The symbiotic relationship was triggered by business value alone long before sustainability and environmental value entered the discussion and industries' licence to operate. There were advantages of being an entrepreneurial family business reacting to the needs of an industrial partner with strong financials. It was also a time when long-term contracts valued and mattered and mill managers sat during longer tenures. Today, in a changing business landscape reputational risk becomes increasingly important for many businesses to start paying attention to environmental mitigation as a consequence of their licence to operate. However, business priorities and dynamics look different. Contracts have a much shorter duration in order to

provide flexibility, motivated partly by the fact that new technical improvements or changing alternative costs of disposing fiber sludge or the utilization of ash may alter fundamental business value of cooperation. Moreover, the carrier paths of mill managers involve moving between sites and responsibilities in a faster and pre-determined fashion. These dynamics makes it much harder for suppliers to build long-term relationships and trust with decision makers.

Close communication and collaboration

Econova and Holmen have a rather close communication and collaboration, which is not common (although rapidly improving) in the waste management industry. For example, Holmen's development department closely monitors the changes in their processes that can affect the quality of the sludge, and informs Econova about important changes that can take place. Econova also provides feedback to Holmen regarding measures that can improve the processing of the material and product quality. These are assessed by Holmen, and feasible ones are implemented. Examples of changes implemented thanks to close communication and collaboration include improved dewatering of the sludge (which increased the dry mater content from the original levels of around 10% to >20%) and separate treatment of effluents arising from recycled fiber processing¹ (de-inking), the sludge from which would render the sludge unsuitable to be used as a soil additive. Also as regulations changed, the two companies worked together in understanding the sources of constituents, whose concentrations needed reducing. It needs to be noted that these companies maintain close communication and collaboration through quarterly meetings with a reoccurring agenda and follow-up.

Power imbalances and openness and fairness in benefit sharing

Differences in resource endowments, combined with partners scarcity, also creates power imbalances and lead to opportunistic behavior. Examples of such dynamics were encountered within our study, with different outcomes. In Econova's relationships with Holmen Braviken, handling fees were gradually reduced and a rent was introduced for land usage, indicating that Econova had operated with terms providing higher self-benefits. These were uncovered when the relative importance of this transaction increased for Holmen paper. However, this has not been as severe as to terminate the partnership. In the case of Econova's interactions with another mill, on the other hand, developments unfolded differently. At an important turning point of the dialogue between the companies, the terms put forward by Econova were perceived unfair by the other actor who decided to terminate the partnership. It is not clear, whether these terms were realistic but inadequately communicated or whether they were in fact opportunistic. All interviewed actors today agree that increased transparency and more equitable sharing of benefits would have led to closer collaboration benefiting all parties. Econova and Holmen have yet to enter the next level of business trust and information sharing. The concept of operating under "open books" is spoken of but seldom practiced. It offers the potential of two partnering businesses to benefit from equal profit sharing once operational costs are recognized and approved by both parties. One obvious challenge is that it requires both parties to give away business secrets before knowing what the advantages are.

Trust and terms of governance mechanism

Trust between the actors is accepted as a critical factor and recognised for its impacts on willingness to share information, make joint investments, conduct business together, develop more efficient and effective contracts. In some of the synergistic relationships we studied, actors

¹ By the time of this research, the mill is no longer using recycled fibers due to changed product specifications.

have taken steps that damaged the level of trust. As a consequence, terms of the relationship was changed so as to reduce operational flexibility for Econova. For example, Econova no longer holds the operational permit for the site where sludge composting and final mixing is performed. As the legal holder of the permit, Holmen controls what types of by-products can enter the facility and they can more easily switch the supplier. For Econova the processes to apply changes in the permit became more lengthy and tedious, impacting the ability to bring external by-products to the site negatively. As a result, opportunities that could benefit all partners (such as processing material from other sources, which can reduce costs) are today not possible to capture or entail high transaction costs.

Permitting processes

With closer ties to formal institutional factors, the regulations and the procedures in their implementation was found to be a critical element. Permit processes are lengthy and often uncertain. A striking example of this was observed with regards to the use of ash in industrial work surface development. Permit applications for similar development proposals within the same natural environment were made two different public authorities. However, while one authority granted the permit, the other one denied it. Such outcomes indicate uncertainty and inconsistency with permitting procedures, which makes initiatives for productive use of secondary materials costly, unclear and therefore less desirable. This case shows that the work of intermediaries working with bringing waste back into productive use can be considerably assisted if the associated transaction costs can be lowered and become more certain. There is a need to establish and communicate proper steps so that authorities recognize societal needs and environmental cost benefits of re-entering recycling materials back in the material life cycle.

Implications for intermediaries

The organisational and institutional factors discussed above have important implications, among others, for public and private intermediaries, who can facilitate additional industrial symbiosis developments. These are summarised below.

Familiarity and mutual understanding can be improved by creating platforms and introducing activities which can improve personal and professional relationships among actors. Here, public sector actors can take a leading role, due to their neutral and credible position and their natural strength in providing a platform. In particular, business development department of the municipality who has a relevant mandate and active channels, can be suitable for such functions. Regional actors from diverse backgrounds can be brought together and engaged in a collective dialogue around areas of common interest. This can build new relationships with diverse actors and improve existing ones. This can be complemented with collective study visits to individual companies. This will allow actors to get familiar with each others' operations, needs and capacities and help them identify areas of common concern, where mutually beneficial solutions can be developed. In addition, increased familiarity can also assist trust building. Universities or business associations can also lead or assist such intermediation.

Intermediaries can also help with increasing awareness of resource and competence complementarities. This can be done by systemically mapping resource and competence needs and capacities of regional actors and making this information available to all. This can be compounded with information on best practices for secondary resource utilisation. An institutional actor, such as municipality or the university, could serve as an effective intermediary for this. Compilation of best practices, on the other hand, can be a joint efforts of public and private intermediaries (such as waste, energy and water utility companies).

Institutional intermediaries can also improve dialogue between industrial actors and permit agencies in order to make permitting processes more clear, consistent and transparent.

Intermediaries can also help with capturing the diverse environmental, business, and socio-economic benefits of industrial symbiosis. Here, collaboration between public bodies, private actors, and universities and research institutions can provide optimum results. Experience from this study and others indicate that the social factor is very important in having businesses discuss mutual benefits of cooperation. There is very often the need for an industrial champion (eldsjäl) to be part of the venture. An individual with an undisputed industrial experience and authority which main concern is not always business value but rather the environmental argument.

These findings also have important implications for private intermediaries, and in particular waste-, energy- and water-utility companies. These actors hold unique technical, knowledge and administrative resources that can play a vital role in creating increased value from secondary resources. However, to be effective and successful, these actors need to change their mind-sets. They should first better recognise the value of their specific resources for secondary resource valorisation. Rather than choosing to deploy these in an opportunistic way, they should try to build long-term partnerships with focus on joint learning, collaborative innovation and equitable responsibility and benefit sharing and by ignoring temptations for short-term opportunistic behaviour.