CHAPTER 14

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Collaborative Waste Management

As in most industrialized countries, the challenges concerning waste management are increasing in Norway. Statistics confirm that the amount of waste generated is growing faster than the increase in gross domestic product (GDP). 'The total quantity of waste increased by approximately 45 percent between 1995 and 2007, while the GDP increased by 42 percent' (Environmental Directorates of Norway/ http://environment.no) during this period. At the same time global environmental problems have become more and more serious. This is partly due to the waste problem getting out of control, and partly due to extensive exploitation of natural resources. In other words, nature's source and sink capacity is being exceeded.

The most frequently used tools to solve these problems are governmental regulations and market mechanisms. A consequence of using competitive markets as an arena for problemsolving is that economic actors often implement incompatible solutions. When solutions are atomized and disintegrated the end results often prove to be unsustainable along any dimension. In this particular instance the result has been inefficient systems of waste handling, with regard to both economic efficiency and environmental and societal consequences. Even if the solutions can never be completely integrated because of differences in framework conditions, systems for redistribution must be seen as parts of integrated resource-based networks.

We elaborate on how to solve these challenges from the perspective of circulation economics (Ingebrigtsen and Jakobsen 2007),

accepting that waste is an integrated part of circular value chains. Our perspective integrates economic efficiency, environmental sustainability and development of local societies. To illustrate our arguments we present a case describing a system for collecting and reprocessing plastic waste from different actors in the Norwegian fishing industry.

Plastic is made of oil, therefore plastic waste is of special interest from both environmental and economic points of view. On the one hand, climate change due to the burning of fossil fuels is one of the most serious environmental problems we are facing today. On the other hand, since oil is a scarce resource it is of great economic importance to use it as efficiently as possible. Almost every kind of economic activity is based on oil, both as a source of energy and as a source of material in production. Such products as food, clothes, paint, shopping bags, computers, credit cards, and equipment used in fisheries (directly or indirectly) all depend on oil. In fisheries plastic waste represents a huge environmental problem today. Waste management based upon cooperation between the involved actors has the potential to turn problems into opportunities by introducing compatible systems where most of the plastic waste can be reprocessed. In the next paragraph we give a brief presentation of some of the most urgent challenges concerning waste management in Norway today.

Challenges Concerning Waste Management in Norway

As a member of the European Economic Area (EEA), Norway is committed to following most of the EU directives regarding waste management; that is, those rules for waste management ensuring protection of human health and the natural environment against

the harmful effects of collection, transport, processing and storage of waste (EU Directive 2006/12/EC of April 5, 2006). The EU argues that the best solution to the waste problem is to prevent waste from arising, and then ensure that products are constructed in a way that makes material recycling possible in relation to both economic and ecological criteria. The basis for giving priority to the reprocessing of different materials is, among other things, acceptance of the waste hierarchy, which prescribes the following in order of importance: waste reduction, reuse, material recycling, incineration with energy recovery, incineration without energy recovery, and lowest in the hierarchy – disposal. The waste hierarchy illustrates the priorities of both the EU and the Norwegian waste policy.

Hazardous waste requires special attention since it may cause serious pollution. Waste-containing PCB originates from insulating either glass or lighting fixtures. Hazardous substances can also be found in impregnated timber, flame-retardant materials and CFC gases from old refrigerators and freezers. Car wrecks and shipwrecks contain a number of waste components that are either dangerous or unsuitable for reuse. Hazardous waste comes from different sources such as subtoxic materials with infections from hospitals, pharmacies and dentists, etc. Even if hazardous fractions of waste most often emanate from industry, a lot of poisoned garbage originates in households, too, and this must be dealt with as well. Management of some of these waste fractions is regulated through laws established by the authorities, e.g., The Ministry of the Environment. Until now, waste not reprocessed, burned, or classified as dangerous has been dumped in landfills. Since July 1, 2009, the landfills have been officially closed by the authorities. Consequently the waste and reprocessing industry now meets extensive challenges of environmental, economic and practical character. The challenges are many, and the requirement to make use of sustainable principles as a basis for improvement is expected to result in excessive economic costs.

Given this situation we argue that it is appropriate to promote communication between the relevant stakeholders in order to achieve solutions that are economically efficient and, at the same

time, sustainable in the long term. From a short-term perspective, the easiest and cheapest solution to the landfill ban may be to burn all kinds of waste for energy production. Uncertainty with regard to prices on the global market concerning different kinds of materials indicates that the production of energy is considered a relatively safe bet by many economists. However, the waste hierarchy suggests it may be wiser to reprocess some materials. Characteristic of all waste management is that faulty treatment can result in major consequences for the natural environment and society.

Waste management for private households is carried out by municipalities or by the companies that the municipalities hire to take care of the waste. Waste management systems differ according to the source of the waste. It is common to distinguish among waste from households, production plants and distribution activities. In Norway, municipalities 'own' the waste from households and hence are responsible for developing proper routines for waste collection, treatment and re-cycling of different waste elements. Waste management organized by municipalities has a long tradition of cooperation. However, all waste management is controlled by the Norwegian Pollution Control Authority – a directorate under the Ministry of the Environment. In the 1990s, various return and recycling solutions were implemented based upon cooperation among different actors, local authorities and private firms. Some of these solutions arose as a direct result of government intervention.

Waste Management in the Perspective of Circulation Economics

Georgescu-Roegen (1971) sees a serious problem in waste being defined as valueless garbage in the field of mainstream economics. If waste is not handled in a proper way, it is classified as garbage.

The concept of garbage indicates that the material is even less valuable than waste. Referring to the second law of thermodynamics, Georgescu-Roegen (1971) argues that the difference between resources with high market price and 'valueless' waste is the amount of entropy. The second law of thermodynamics is commonly known as the law of increased entropy, defined as a measure of unusable energy within a closed system. As usable energy decreases and unusable energy increases, the amounts of entropy grow. However, today's high-consumption society is characterized by large amounts of waste with low entropy. The consequence of this situation is that recycling materials and energy recovery from incineration are both beneficial.

Circulation economics is inspired by Georgescu-Roegen's argument that all actors in the market are interconnected through networks of energy, matter, knowledge and values. The different participants in the networks live in symbiosis, meaning co-existence among diverse economic actors (organisms) in which each can benefit from interplay with the others (Ims and Jakobsen 2006).

Referring to the organic system approach (see Chapter 2), we argue that waste management based upon cooperation among involved stakeholders makes sense in order to find solutions that are both economic profitable, environmentally sustainable, and socially responsible (Ingebrigtsen and Jakobsen 2007). Referring to the efficient use of resources we find in nature's own ecosystems, we search for solutions based upon waste handling as an integrated part of circular economic value chains. From the perspective of circulation economics, resources used in production, distribution and consumption are interconnected. Hence, waste management is an integrated part of all value chains.

The idea is that companies use one another's 'byproducts' on a commercial basis. When one company's byproduct becomes the input resource to one or several other companies in the network, most stakeholders will gain economic advantages due to cheaper input costs and reduced transportation costs. The outcome here is reduced consumption of virgin resources and a significant reduction in environmental strain. We argue that cooperative, decentralized,

small-scale waste management leads to resource-saving processes. In addition the system should have a positive effect on the local societies involved. The result is better economic, environmental and societal performance.

The redistribution systems (collection, sorting, reprocessing) should be prepared to handle a variety of fractions of waste from different sources. The goal in redistribution is to 'establish routines for developing high quality collection, sorting, and recycling systems (combining economic, ecological, and cultural values)' (Ingebrigtsen ans Jakobsen 2007, p.122). Some manufacturers try to keep their hands on the circulation systems in their entirety from cradle to cradle (the reprocessed resources are used as input in production of new products).

The financing of circulation systems is often based on fees, e.g., monies paid for each unit sold. Specific examples are fees on packaging, electronic products, batteries, refrigerators, and cars. In some industries the cost of reprocessing waste is part of the price paid by the consumers. Industrial network symbiosis is an application of the concept of industrial ecology (van den Berg, Jeroen, and Janssen 2004). The purpose of industrial symbiosis is to establish economic networks that behave similarly to natural ecosystems, where almost all materials and energy are recycled and used. Using this perspective, cooperation generates better results and provides opportunities for companies to increase production without necessarily consuming more energy, water and virgin materials from nature.

IRIS, an inter-municipal company located in the northern part of Norway, was established to integrate waste management in ten small municipalities. Instead of establishing redistribution systems in every local municipality it is often more efficient to develop waste handling systems on an inter-municipal level. The company operated independently of the authorities economically. It had its own assets and income and responded in its own way to meet its obligations.

One of the specific characteristics of inter-municipal companies is that each of the participants is given the responsibility for

a percentage of the company's total capital or assets. This separates inter-municipal companies from other companies in which responsibility is limited. Moving on to industrial waste, this is usually handled by specialized private companies. A crucial challenge is how to introduce and implement a vigorous network of firms living on the same stream of resources.

Inspired by the ideas of circulation economics, NoFir (Norwegian fishery recycling) was established in 2009 to function as a communicative arena. The communicative arena is 'a prerequisite for circulation economics to function in practise' (Ingebrigtsen and Jakobsen 2007, p.249). By establishing integrated networks of communicative action it is possible to coordinate the interests of the different stakeholders. The task of NoFir was to establish well-functioning solutions concerning reprocessing of discarded equipment (ropes, fishnets, floats, etc.) from the fisheries and fish farming industry in Norway. The idea was to establish a network of local actors cooperating on a national level. The network includes, among others, fishermen, fishing companies, fish farming companies, transporters (at sea and on road and railway), waste companies, recycling facilities, and manufacturers of fishing tackle (over 40 plants in Norway). NoFir was to stimulate cooperation among actors from different parts of the value chain of plastic equipment used in the fishing industry. The reason for this was that it would reduce the environmental problems by minimizing transport, but even more importantly, the activities connected to waste handling processes could become a part of the development of local communities.

To develop a network and to implement practical solutions, 'café-dialogue' (theworldcafe.com) was used as a catalyst. In the café-dialogue stakeholders from different parts of the industry, local authorities and waste management met in order to develop solutions based upon integrative, communicative cooperation. Difficulties due to diversity concerning population, industry clusters, and natural conditions were turned into a prerequisite for fruitful dialogues.

Café Dialogue – A Catalyst for the Communicative Arena

The communicative arena should first and foremost become operative in areas 'where competitive solutions are not conducive to deal with the actual challenges' (Ingebrigtsen and Jakobsen 2007, p.250). Today 22,000 tons of plastics used in the fisheries end up as waste in one year; almost nothing is recycled. Most of the plastic waste from the fishing industry ends up as waste at landfills, or even worse, dumped illegally at sea. Waste management within the fishing industry is characterized by a lack of communication among the stakeholders. This leads to problems in efficiency as well as in the rational utilization of resources, in both the short-term and, even more so, the long-term perspective. Therefore it is important to establish communicative networks that can contribute to a flow of resources across the dividing borders. Knowledge concerning how to resolve complex challenges through communicative interaction has become increasingly important. Through café-dialogue it is possible to start discursive processes by initiating communication among participants anchored in different professions and areas of practice.

The best solutions are developed within the frameworks of cooperating networks, where all actors (at least in principle) agree on common solutions stretching beyond individual interests. This means that actors from all parts of the value chain of fishery equipment made from plastic must be represented in the communicative network. The participants are defined as stakeholders (Ingebrigtsen and Jakobsen 2007, p.251), hence, producers of fishery equipment, distributors, fishermen and the fishing industry, fish farming firms and firms taking care of redistribution (collecting, sorting, transporting, and reprocessing) must be integrated in the web of communication. In addition NGOs promoting the values of nature, and authorities representing the local community, are parts of the communicative network.

To establish NoFir as a hub in the communicative network, NoFir invited representatives from most of the stakeholder groups to a café dialogue. Café-dialogues have been summarized as being about 'awakening and engaging collective intelligence through conversations about questions that matter' (Hopkins 2009, p.184). To simplify, we can say that café-dialogues are organized activities in which the participants come up with solutions to problems based on communication rather than competition. In order to participate in café-dialogues the actors invited have to share their thoughts, experience and opinions with a view to improving understanding and insight. A guiding line for café-dialogues is that participants respect and comply with general requirements such as accepting the importance of equal opportunities and the right to participate and contribute opinions. The argument counts in its own right – not the power of the speaker.

Most participants found it stimulating to operate in this kind of creative network based on communication and cooperation. Café-dialogues also invite the participants to articulate tacit knowledge. This can result in a kind of integrated knowledge that is critical in most enterprises, institutions and public bodies for dealing with complex tasks and challenges. If tacit knowledge is lost through frequent restructuring and changes of the traditional lines of communication, it is necessary to institutionalize new arenas including both horizontal and vertical 'clusters' (see Chapter 13 in this book). Café-dialogues provide good examples of how such communicative arenas can be established and work in practice. Café-dialogues enable the process-oriented perspective on knowledge to be combined with reflection on values; i.e., it is a development involving both creativity and accountability.

The idea was to stimulate creativity by combining seemingly conflicting perspectives in a dynamic and reflective dialogic process. By highlighting the issues from different angles, NoFir wanted to encourage new approaches and spur practical solutions on how to handle the large amounts of plastic waste coming from the

Norwegian fisheries. In the following we will present and discuss some of the results from the café dialogue focusing on reprocessing of waste.

Representatives from the different actors in the fishing industry came together with people representing waste management and transport. The participants were confronted with the challenging task of determining how to handle the plastic waste from fisheries after the closing of Norwegian landfills.

Collaborative Waste Management in Norwegian Fisheries

Since the entropy in plastic waste is very low, and it is uncomplicated to reprocess, it was easy to motivate the actors in the value chain to find solutions high up in the waste hierarchy. The environmental consequences of establishing effective waste handling systems are very positive. Two kilos of oil is required to produce one kilo of plastics. In addition one kilo of oil is used to provide the energy for production processes. Hence, recycling plastic equipment from the fishing industry offers an environmental benefit of almost 44,000 tons of oil and 44,000 tons of CO_2 (Aleksandersen 2009, www.nofir.no).

As expected, the participants in the café dialogues came up with different opinions concerning the validity and relevance of using the waste hierarchy as a measure of waste management in Northern Norway. Some argued that the waste hierarchy is more suitable in heavily populated areas.

The dialogue concerning reprocessing of materials vs. combustion with energy production concluded that solutions based on the latter were more efficient from a cost-benefit perspective. When values related to the cultural and natural environment were introduced,

the participants in the dialogue argued that if using the recycled materials in local and regional production is possible, this must be prioritized. Many participants worried that the heavy focus on the reprocessing of waste would lead to less focus on the superior goal of waste reductio The main arguments expressed concerning local vs. centralized waste management were as follows. Some of the participants argued that centralization of reprocessing was to be preferred, because of economic profitability connected to economies of scale and the opportunities to make profits on recycled waste in a bigger market. The disadvantage was that centralized reprocessing results in more transport and increased negative environmental impact. The advantages of decentralized treatment of waste were the possibilities for adapting the activities to local conditions, with regard to both the availability of different waste fractions and to the use of recycled materials and energy in local small-scale production. It was also pointed out that pretreatment and transport is easier and cheaper using local solutions than centralized reprocessing facilities. The participants in the café-dialogue agreed on the ranking of arguments, giving priority to decentralized solutions because they are better suited to the scattered settlement pattern and the long distances involved. The precondition, however, was that affordable small-scale technology be made available. The participants also agreed that the most convenient solution was centralized combustion plants with energy production.

Making the participants conscious of their responsibility as actors in the value chain was also important in order to implement solutions that are both economically profitable and positive for the development of the cultural and natural environments.

Conclusions

The conclusions drawn from the café dialogues indicate that most participants in principle accepted the ranking anchored in the waste hierarchy. Because of scattered settlement in Northern Norway and the long distances to the EU markets, they found it difficult from an economic point of view to foresee implementing waste-handling systems based on local reprocessing of the plastic waste in the fishing industry. It is more profitable for the investors to build centralized incinerators. In a long-term perspective, where natural and cultural values are included, the conclusions are different.

In order to solve the challenges connected to reprocessing plastic waste from the fisheries, we argue that it is necessary to change from the perspective of mainstream economics (where all values are interpreted on a monetary scale) to a circulation economic perspective (based on value pluralism). An important point in circulation economics is that 'the interaction between economy, nature and culture must be based on value pluralism' (Ingebrigtsen and Jakobsen 2006, p.392). A prerequisite to developing a well-functioning redistribution system is the establishment of a communicative arena based on cooperation between all the involved actors.

Here we argue that solutions based upon mainstream economics lead to centralized incinerators with energy production because they enable the highest short-term profits for the shareholders. To come up with solutions ranking higher on the waste hierarchy we have to change the preconditions in the direction of circulation economics. If natural consequences and the cultural synergy effects of increased economic activity in the local societies are emphasized, the conclusion will be reprocessing plastic waste at the local level. (*Table 14.1.*)

Table 14.1.
Conclusions depend on the economic perspective

	Incineration with energy production	*Reprocessing of materials*
Centralized	Mainstream economics • Monetary scale • Competition • Short-term profits for shareholders • Atomized market	
Local/ Regional		Circulation economics • Value pluralism • Cooperation • Long-term well-being for stakeholders • Integrated market

According to Schumacher (1973), local and regional small-scale solutions are better than centralized large-scale systems on several dimensions. The challenge, then, is determining appropriate-sized 'local' communities, as well as developing customized small-scale technology. Some local communities in Northern Norway are very small, with less than 3,000 inhabitants. To develop solutions high up in the waste hierarchy it is necessary to expand to a regional perspective, including several municipalities. Customized technology means that the solutions are rooted in an organic, decentralized, nonviolent (both to man and nature) attitude. It is of great importance that the companies involved find their way to a network-based organization.

We find the initiative from NoFir very interesting, partly because it is inspired by the ideas of circulation economics, but even more so because we think these kinds of cooperative solutions on waste management can contribute to reducing the causes of human-made climate change and the forthcoming 'peak oil' challenge.

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