

*Ann-Kristin Bergquist, Magnus Lindmark, and  
Nadezda Petrusenko*

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## Creating Value Out of Waste: The Transformation of the Swedish Waste and Recycling Sector, 1970s–2010s

This article examines the growth of the waste and recycling sector in Sweden since the 1970s and seeks to identify the conditions for market growth and underlying business dynamics. The article identifies a slow growth pattern at aggregate level in the 1970s, while a major shift toward higher growth rates took place only in the mid-1990s. Resembling the findings of existing studies of German and US industry counterparts, Swedish recycling companies grew larger in the 1970s and more knowledge-intensive from the 1980s. Our study concludes that the growth of the Swedish recycling industry has been driven not only by government policies addressing household waste but even more so by large manufacturing firms that have increasingly demanded more complex recycling services over time.

**Keywords:** waste and recycling industry, circular economy, environmental regulation, Sweden

**T**his article examines the economic growth and transformation processes that allowed traditional low-tech waste-disposal services to develop into a technologically advanced recycling industry. Recycling is a part of the new business environment that has evolved in tandem with increasing environmental pressures over the last fifty years.

The authors would like to thank the participants at a session at the European Business History Association Congress in Rotterdam, 2019, and at the Ulvön Conference on Environmental Economics, 2019, for inspiring and critical comments. We also thank two anonymous referees for their constructive criticism and the editors of this journal for their helpful comments. Financial support from the Swedish Research Council is gratefully acknowledged.

*Business History Review* 97 (Spring 2023): 3–31. doi:10.1017/S0007680522000745  
© 2023 The President and Fellows of Harvard College. ISSN 0007-6805; 2044-768X (Web).  
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Besides that, recycling has been seen as instrumental to an emerging circular economy. This study focuses on the period from 1970 to 2016 and uses the example of Sweden to showcase these processes, by combining economic time series and business-level analyses. We look at the development of the waste and recycling sector as a historical process involving several development paths that eventually converged in the 1970s and led to a relatively rapid structural transformation of the sector in the 1990s. As will be demonstrated, this structural transformation was driven by a steadily rising demand for more advanced recycling services, propelled by both government policies and market forces.

Business and economic historians have not yet positioned themselves in the debate on the circular economy, although the number of studies on the business of waste and recycling has increased in recent years.<sup>1</sup> Sweden represents an interesting case, since the country belonged in the early 1970s to the group of the world's highest-income earners, implying both high technological standards and a high volume of waste emanating from production and consumption processes. Additionally, several studies have demonstrated that high incomes are associated with a demand for high environmental standards.<sup>2</sup> In contrast to other countries considered to be early movers in environmental protection, like the United States, the story of the Swedish recycling sector has remained an overlooked research subject.<sup>3</sup>

Sweden was part of the club of Western countries that responded to the environmental challenge early, in the 1960s, in building institutional capacity in the area of modern environmental protection. Sweden established the world's first environmental protection agency in 1967 and initiated a United Nations conference to focus on human interactions with

<sup>1</sup> See, for example, Geoffrey Jones, *Profits and Sustainability: A History of Green Entrepreneurship* (Oxford, 2017); Jones, *Varieties of Green Business: Industries, Nations and Time* (Northampton, 2018); Raymond G. Stokes, Roman Köster, and Stephen C. Sambrook, *The Business of Waste: Great Britain and Germany, 1945 to the Present* (Cambridge, UK, 2013); Finn-Arne Jørgensen, *Making a Green Machine: The Infrastructure of Beverage Container Recycling* (New Brunswick, NJ, 2011); Carl A. Zimring, *Cash for Your Trash: Scrap Recycling in America* (New Brunswick, NJ, 2005); Elmore J. Bartow, "The American Beverage Industry and the Development of Curbside Recycling Programs, 1950–2000," *Business History Review* 86, no. 3 (2012): 477–501; Simone Müller, "Hidden Externalities: The Globalization of Hazardous Waste," *Business History Review* 93, no. 1 (2019): 51–74. See also Chad Denton and Heike Weber, "Rethinking Waste within Business History: A Transnational Perspective on Waste Recycling in World War II," in "Waste Economies under Wartime Conditions: A Transnational Perspective on Recycling and World War II," special issue, *Business History* 64, no. 5 (2021): 855–81.

<sup>2</sup> Jette Bredahl Jacobsen and Nick Hanley, "Are There Income Effects on Global Willingness to Pay for Biodiversity Conservation?" *Environmental and Resource Economics* 43, no. 2 (2009): 137–60.

<sup>3</sup> On Germany, Britain, and the United States, see, for example, Stokes, Köster, and Sambrook, *Business of Waste*; Jones, *Profits and Sustainability*.

the environment, the Stockholm Conference, in 1972. The country also introduced comprehensive legislation – the Environmental Protection Act – in 1969, which regulated both air and water pollution from point sources, as well as the management of hazardous wastes.<sup>4</sup> The 1969 Environmental Protection Act, which took effect in 1970, ushered in changes that this article investigates and thus serves as the beginning of our story.

It is important to note that before the 1960s, the reuse of wasted materials was not explicitly integrated with concerns about environmental protection, although this changed as the modern environmental awakening took hold during the second half of the twentieth century. While Rachel Carson's 1962 book *Silent Spring* raised the alarm over a poisoned environment, economists like Kenneth Boulding highlighted critical concerns about biophysical limits to economic growth and called for a more circular economy.<sup>5</sup> Modern environmentalism merged the different aspects of environmental protection and resource conservation, which had previously remained isolated issues.<sup>6</sup> In Sweden, the development was mirrored in the Environmental Protection Act of 1969, as it targeted industrial pollution on the one hand and resource management through recycling on the other. A next step was the government "Recycling and Waste Disposal" bill, passed in 1975, which aimed at increasing the level of recycling and waste management practices in the country. This new governmental policy reflected not only concerns about a polluted environment but also awareness of the limitations of natural resources, including energy. The Swedish government saw recycling as a part of the solution to both problems.

When it comes to business responses and strategies, the complexity and magnitude of recycling activities in industrialized countries increased from the 1970s on, while recycling markets also became more regulated. Prior to the 1970s, as Geoffrey Jones has argued, entrepreneurial efforts in developing the recycling industry were typically handicapped by the unpredictability of recycling markets. These conditions were altered when new laws reframed waste as an environmental

<sup>4</sup> Måns Lönnroth, *The Organisation of Environmental Policy in Sweden: A Historical Perspective*, Naturvårdsverket Report 6404 (Stockholm, 2010); Eric Pagila, "The Swedish Initiative and the 1972 Stockholm Conference: The Decisive Role of Science Diplomacy in the Emergence of Global Environmental Governance," *Humanities and Social Sciences Communications* 8, no. 1 (2021): 1–10.

<sup>5</sup> Rachel Carson, *Silent Spring* (1962; New York, 2002); Kenneth E. Boulding, *The Economics of the Coming Spaceship Earth* (New York, 1966). On the call for a more circular economy, see also Barbara Ward, *Spaceship Earth* (London, 1966); Donella H. Meadows, Jorgen Randers, and Dennis L. Meadows, "The Limits to Growth (1972)," in *The Future of Nature: Documents of Social Change*, ed. Libby Robin, Sverker Sörlin, and Paul Warde (New Haven, 2013), 101–16.

<sup>6</sup> Clive L. Spash, "The Ecological Economics of Boulding's Spaceship Earth" (SRE-Discussion Papers 2013/02, WU Vienna University of Economics and Business, 2013).

issue in the 1970s, encouraging the industry to consolidate and reimagine itself as an environmental services provider.<sup>7</sup> Generally, the 1970s represented a pivotal period in *all* industrialized Western countries, as the longstanding practice of salvage was reconfigured as recycling. As highlighted by Raymond G. Stokes, Roman Köster, and Stephen C. Sambrook, recycling—in contrast to the historical practice of salvage—represented a broad qualitative change. While the salvage of traditional materials (such as rags and metal scrap) had been a low-tech enterprise, the recycling of a mix of new and old materials entering the waste stream since the 1960s required high-tech solutions.<sup>8</sup>

Competing explanations exist as to why countries are accomplishing different levels of recycling and have developed different strategies in dealing with waste. One factor the business history literature clearly stresses is the importance of governments in shaping business actions in waste and recycling markets.<sup>9</sup> Jones, for example, argues that European countries such as Germany and Sweden implemented policies in the 1980s and 1990s that targeted the producer's responsibility and supported recycling, which resulted in different structures and outcomes than in, for example, the United States. Jones suggests that these policy differences between Europe and the United States in balancing business interests and environmental action have endured to the present and contribute to the disparate outcomes and levels of recycling between the two regions.<sup>10</sup> In the case of Sweden, the "Eco-cycle" law of 1994 has been viewed as particularly important, since it mandated producer responsibility for the collection and processing of packaging waste and used products.<sup>11</sup>

Stokes, Köster, and Sambrook note in their study of municipal waste management in Great Britain and Germany that the two countries diverged in their responses to similar waste problems in the 1970s due to country-specific political, economic, and social factors.<sup>12</sup> Finn-Arne Jørgensen, who studied the role of business in developing beverage-recycling infrastructure in Norway, Sweden, and the United States, has also stressed the importance of national regulation. Jørgensen argues that the dynamic interaction between business and the political system largely explains why a successful deposit-refund system was achieved

<sup>7</sup> Jones, *Profits and Sustainability*, 161.

<sup>8</sup> Stokes, Köster, and Sambrook, *Business of Waste*, 215–16.

<sup>9</sup> For a comparison of Germany and Great Britain, see Stokes, Köster, and Sambrook, *Business of Waste*, 188–227; Jones, *Profits and Sustainability*, 138–51.

<sup>10</sup> Jones, *Profits and Sustainability*, 311.

<sup>11</sup> Thomas Lindhqvist, "Extended Producer Responsibility in Cleaner Production: Policy Principle to Promote Environmental Improvements of Product Systems" (Ph.D. diss., International Institute for Industrial Environmental Economics, Lund University, 2000).

<sup>12</sup> Stokes, Köster, and Sambrook, *Business of Waste*, 86.

in the two Scandinavian countries but failed to materialize in the United States.<sup>13</sup> In the United States, formal regulations were weaker; instead, regulatory pressure came from a social countermovement that stressed the responsibility of individuals and voluntary action by business.<sup>14</sup> As suggested by Elmore J. Bartow, who has studied the American beverage industry and curbside recycling programs from 1950 to 2000, powerful companies like Coca-Cola worked against any regulations that would make them responsible for their packaging waste, or for bearing the costs of recycling it.<sup>15</sup>

However, as previous research has demonstrated, the Swedish industry in general never developed adversarial relations with the environmental authorities or fought against national environmental regulation.<sup>16</sup> In Sweden, the mobilization of environmental interests did not result from environmental pressure groups of the late 1960s; instead, it was channeled through a level-headed policy process involving state agencies and industry experts as well as representatives of the scientific community.<sup>17</sup> Thus, recycling policies and legislation were never an issue of controversy. When the Swedish Society for Nature Conservation (Svenska Naturskyddsföreningen) started in 1962 to advocate against littering through an information campaign known as Keep Nature Clean (Håll Naturen Ren), it targeted citizens, not companies, as responsible for cleaning up their act.<sup>18</sup> The campaign had similarities to Keep America Beautiful in the United States, which began in 1953.<sup>19</sup> As we will see, the development of recycling in Sweden was characterized by a dynamic interrelation of three groups of actors: traditional scrap firms, large manufacturing companies, and municipalities, which were partly forced by government regulation to take action.

<sup>13</sup> Jørgensen, *Green Machine*; Heike Weber in Jacob D. Hamblin, ed., "Roundtable Review of *Making a Green Machine: The Infrastructure of Beverage Container Recycling* by Finn Arne Jørgensen," *H-Net Environment Roundtable Reviews* 3, no. 2 (2013), 10.

<sup>14</sup> Samatha MacBride, *Recycling Reconsidered: The Present Failure and Future Promise of Environmental Action in the United States* (Cambridge, MA, 2012), chap. 2.

<sup>15</sup> Bartow, "American Beverage Industry," 501.

<sup>16</sup> Ann-Kristin Bergquist and Kristina Söderholm, "Green Innovation Systems in Swedish Industry, 1960–1989," *Business History Review* 85, no. 4 (2011): 677–98.

<sup>17</sup> For example, when the Environmental Protection Act was implemented in 1969 it had been an ongoing process since 1963; in the years before the final bill was passed, a modern system of law and agencies for environmental protection had already been created. See Ann-Kristin Bergquist and Kristina Söderholm, "Transition to Greener Pulp: Regulation, Industry Responses and Path Dependency," *Business History* 57, no. 6 (2015): 862–84, 867.

<sup>18</sup> In 1982, the organization adopted its current name, The Keep Sweden Tidy Foundation (Håll Sverige Rent). See The Keep Sweden Tidy Foundation, accessed 27 March 2023, <https://hsr.se/keep-sweden-tidy-foundation>. Naturskyddsföreningen, *Håll Naturen Ren 1963–1968: En Redovisning* (Stockholm, 1969).

<sup>19</sup> Jørgensen, *Green Machine*, 75–76.

## Methodological Considerations

Studying the recycling industry is a different challenge than studying the greening of business firms in general. First, scholars have argued that recycling is an interindustry phenomenon that represents various products, companies, networks, and government policies, not only specifically waste or recycling firms.<sup>20</sup> Second, the boundaries of the waste and recycling industry are difficult to define, as the industry extends beyond businesses that can be defined as traditional waste and scrap firms. As Chad Denton and Heike Weber recently stated, exploring the business of waste challenges the traditional tools, methods, and sources of business and economic historians as well as their “often mono-sectorial focus.” Third, as Denton and Weber also asserted, exploring the history of waste is challenging because it involves actors that operated in the margins of the economy or within informal markets and therefore seldom left traces in public records or official statistics.<sup>21</sup>

Furthermore, some studies have looked at the physical waste streams and the treatment of that waste as indicators of the sector’s transformation. In such cases, household waste has often been used as an indicator.<sup>22</sup> It is important, though, to consider that household waste still only counts for a fraction of the overall amount of waste generated within the economy. Mining and quarrying, manufacturing, energy generation, and construction and demolition of other economic activities constitute a much higher proportion of the total amount of waste.<sup>23</sup>

To overcome these problems, this study uses data from the Swedish National Accounts in order to indicate the economic growth of waste management and recycling services in Sweden. More precisely, we are using production data for the sector known as “sanitary and similar services, except sewage disposal,” corresponding to Standard Industry Classification (SIC) Code 4953: “Refuse Systems.” Statistics Sweden, which produced the original data, based its classifications of business activities on international standards and definitions. These data help to identify

<sup>20</sup> Yong Geng, Joseph Sarkis, and Raimund Bleischwitz, “How to Globalize the Circular Economy,” *Nature* 565 (2019): 153–55; Pierre Desrochers, “Regional Development and Inter-industry Recycling Linkages: Some Historical Perspectives,” *Entrepreneurship & Regional Development* 14, no. 1 (2002): 49–65; Shinichiro Nakamura, “An Interindustry Approach to Analyzing Economic and Environmental Effects of the Recycling of waste,” *Ecological Economics* 28, no. 1 (1999): 133–45.

<sup>21</sup> Denton and Weber, “Rethinking Waste,” 20.

<sup>22</sup> See, for example, Stokes, Köster, and Sambrook, *Business of Waste*.

<sup>23</sup> Eurostat, “Waste Statistics,” Jan. 2023, accessed 17 March 2023, [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste\\_statistics#Total\\_waste\\_generation](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics#Total_waste_generation).

long-term development, any major shifts in the demand for more advanced recycling services, and ultimately the increasing importance of waste and recycling services for the economy as a whole. Then, we use qualitative sources to analyze the conditions and driving forces behind these changes, including the recycling industry's own industry magazine, company monographs, government material, and interviews.

### The Macroeconomic Transformation of the Swedish Waste and Recycling Sector

It is widely recognized in the historical literature that the reuse of wasted products has been present for most of human history and that collecting and reusing waste has served different purposes in different periods.<sup>24</sup> The Industrial Revolution changed these traditional practices, and waste generated in manufacturing industries and by household consumption became one of the first environmental problems to result from modern industrial growth.<sup>25</sup> The postwar consumerism that embodied everything from home appliances and automobiles to various disposable goods and packaging resulted in an unprecedented growth in the volume of waste.<sup>26</sup> Sweden was no exception. The rise of consumption coupled with the strong growth of manufacturing industries put Sweden among the top producers of per capita waste in Europe by the 1970s.<sup>27</sup>

The production of waste services, shown in [Figure 1](#), demonstrates that the Swedish waste management sector grew during the 1970s, a decade characterized by sluggish growth of private consumption.<sup>28</sup> Between the early 1970s and 2004, the output increased roughly tenfold. Waste generation also grew, but at a lower rate. In 1970, household waste generation was estimated at 270 kilograms (about 595 pounds) per capita, while official data for 2004 reports 411 kilograms (906 pounds) of waste per capita.<sup>29</sup> The higher volume of growth in waste management services as compared with waste generation suggests that more advanced waste management services, such as recycling,

<sup>24</sup> Simon Warrett, "Recycling in Early Modern Science," *British Journal for the History of Science* 46, no. 4 (2013): 629–49, 692.

<sup>25</sup> Jones, *Profits and Sustainability*, 138.

<sup>26</sup> Zimring, *Cash for Your Trash*, chap. 5; Stokes, Köster, and Sambrook, *Business of Waste*.

<sup>27</sup> Government Bill on Recycling and Disposal of Waste, 1975:32 (hereafter Government Bill 1975:32), 43–44.

<sup>28</sup> The private consumption volume increased by 25 percent between 1970 and 2004, while "waste sector" output volume grew tenfold over the same period.

<sup>29</sup> Government Bill 1975:32, 43–44; Statistiska Centralbyrån (SCB) Statistikdatabasen, "Uppkommet avfall efter näringsgren SNI 2007 samt hushåll och avfalls slag" [Generated waste by industry (classified according to Swedish SIC code 2007) and households and type of waste].

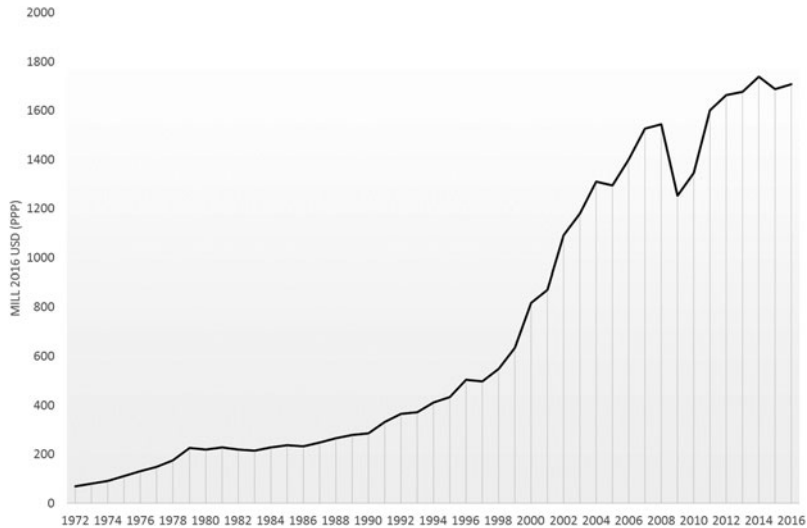


Figure 1. Value added of the waste management, recycling, and remediation sector. Sweden 1972-2016. Fixed prices. Note: Data for SNI E38-E39 (Swedish Industry Code) have been used. (Source: own calculations based on Statistiska Centralbyrån (SCB), Statistiska meddelanden ser N, Nationalräkenskaper [National Accounts], SNI E38-E39.)

replaced waste disposal in landfills. The reason behind this change is that recycling entails more production steps, and thus more input factors, than simple landfill dumping, for example.

From the data in [Figure 1](#) it can be deduced that output growth in waste management services in Sweden grew, albeit from a historically low level, at an average annual rate of 16 percent between 1972 and 1979. Accordingly, substantial development also took place during the 1970s, preceding the sustained growth of the sector from the 1990s to the mid-2000s. Output more or less stagnated over the period from 1979 to 1983 but increased again from the mid-1980s until the early 1990s, at an annual growth rate of 6 percent. Thus, the growth rate was considerably higher than GDP growth, which indicates that waste management was part of a process of structural change at the macro level of the Swedish economy. The growth spurt in the early 1990s also shows that the pressure for transformation in waste management suddenly increased. This spurt was followed by a sustained period of growth at approximately the same rate as during the 1980s, indicating that a more mature industry had developed. The result was a sixfold increase in output volume between the mid-1980s and the early 2010s. Overall, these developments are compatible with the sustained pressure



for transformation driving the demand for waste management services from the 1970s until the 2009 economic crisis, with increases during the early 1990s followed by lower growth rates from the mid-2000s, completing a standard S-formed diffusion pattern of waste treatment and recycling.

Volume series does not, however, capture qualitative changes. Qualitative changes may, however, be indicated in the development of relative prices since providers of waste management services can charge higher prices for high-quality services. Figure 2 shows the development of the price of waste management services in relation to general manufacturing and construction industry prices.

Since the relative price increased from the beginning of the 1970s, and especially so during the 1990s, it is possible to conclude that there was a steady growth of more advanced services throughout the period, with a pronounced shift in the 1990s. These changes are especially interesting given the volume growth shown in Figure 1. In normal circumstances volume growth would take place as relative prices fall. Concerning waste management, it appears to have been the other way around. Higher prices went with higher volumes, indicating a shift in demand for high-quality waste management services. Despite the oil

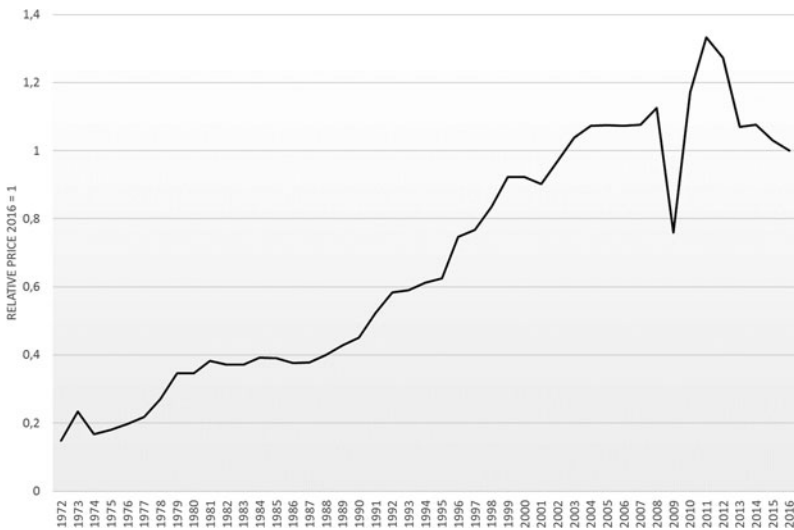


Figure 2. The development of relative prices for waste management, recycling, remediation. Sweden 1972-2016. Index 2016 = 1. Note: Denominator is the price index for manufacturing industry investments in the National Accounts. (Source: own calculations based on SCB, National Accounts series Na SNI E38-E39.)

price shocks and generally high inflation during the 1970s and 1980s, there was no trend of rising raw material prices over the period as a whole, which could explain the increasing demand for waste treatment at higher prices. The conclusion is that it was clean environments that became scarcer and therefore costlier. As a healthy environment is a public good, the environmental demand had to be channeled through new regulatory frameworks for making business opportunities appear. This leaves us with the task of explaining how these changes occurred during the 1970s and the 1980s, leading up to the spurt of the 1990s.

### Long-Term Drivers: Market versus Governmental Policy

In this section, the growth pattern of the waste and recycling industry will be analyzed in terms of underlying historical trends or lines of development, which constituted the context or business environment out of which the Swedish recycling and waste industry developed and changed. These lines of development that underpinned the Swedish waste and recycling sector initially evolved independently of each other, driven by different economic, environmental, and business motives. The analysis below identifies key interrelated areas of development: the development of traditional scrap and waste into recycling companies, central infrastructures such as the Swedish district heating system, demand for recycling services in manufacturing industries, and institutional change.

*Scrap firms.* Swedish scrap firms were closely linked to the national iron and steel industry in the early twentieth century, as their main suppliers of secondary material. It was also the iron and steel producers that shaped market conditions for scrap firms. The iron and steel producers created a cartel-like organization in 1917 to agree on purchasing prices and to coordinate the scrap market.<sup>30</sup> In order to secure the supply of scrap for the iron and steel industry, the Swedish government also imposed a national ban on iron scrap exports in 1927, which lasted until 1993.<sup>31</sup> The links between the Swedish scrap dealers and the iron and steel industry had a long-lasting impact on the Swedish market for iron scrap. By the 1980s, Swedish scrap firms provided about 50

<sup>30</sup> The iron and steel producers formed the joint-stock company Aktiebolaget Järnbruksförnödenheter (JBF) with the purpose of coordinating the scrap market. See Aktiebolaget Järnbruksförnödenheter (JBF), *JBF: Centrum för Skrotinköp 1917–2007. Ett stycke Svensk Industrihistoria under 90 år* [JBF: center for scrap purchases 1917–2007. A piece of Swedish industrial history for 90 years] (Solna, 2008).

<sup>31</sup> Anders Wallberg, *Järn och metallskrotning: Företagsstruktur i skrotbranschen samt olycksfall och arbetsförhållanden vid arbete med järnskrot* [Iron and metal scrapping: company structure in the scrap industry and accidents and working conditions when working with scrap metal] (Stockholm, 1985), 7.

percent of the Swedish steel industry's demand for scrap materials.<sup>32</sup> The wastepaper market connected the pulp and paper industry, which was also significant, but as explained below, the market for wastepaper only grew larger in the 1970s.

Before the 1970s, the scrap-trading and processing industry predominantly consisted of a number of small firms that were diverse in nature. They typically treated several secondary goods and materials, including iron.<sup>33</sup> But only a few of these scrap firms survived in the long run. One of the companies that managed to transform into a modern recycling company was Stena Metall (hereafter Stena), today a large conglomerate that includes subsidiary companies with 173 locations in the Nordic countries and Poland. The entrepreneur behind the company, Sten Allan Olsson, began with a small-scale scrap-trading business in 1939 and integrated into scrap processing in the 1950s after investing in its first scrap yard.<sup>34</sup> However, the market-leading scrap dealing and recycling company in Sweden was AB Gotthard Nilsson (hereafter Gotthards), founded in 1915. From the 1950s on, Gotthards dominated the business of scrapping everything from locomotives to aircraft, owning the only facility in Sweden capable of smelting scrap aluminum. Additionally, Gotthards recycled textiles and rags. The business model was based on large-scale and mechanized recycling systems, and in the mid-1950s the company owned one of the largest recycling facilities in Europe.<sup>35</sup> Stena, which was still just a large scrap yard, and Gotthards thus co-existed with a large number of smaller firms in the market.<sup>36</sup>

Scrap dealers made money off their superior personal knowledge about metal contents and qualities, as compared to the sellers. Even in the 1960s, the Swedish scrap-processing industry was overall a small-scale business, which suffered from low economies of scale and hence low productivity growth. As more technical tools for determining metal contents started to appear in the 1980s, it became necessary to utilize

<sup>32</sup> JBF, *JBF: Centrum*.

<sup>33</sup> AB Gotthard Nilsson, *En man och hans verk: [av styrelsen för AB Gotthard Nilsson utgiven som en minnesgåva dels till företagets grundare på hans 70-årsdag, dels till kunder, leverantörer och medarbetare vid bolagets 50-årsjubileum]* [A man and his work: [issued by the board of AB Gotthard Nilsson as a memorial gift partly to the company's founder on his 70th birthday, partly to customers, suppliers and employees on the company's 50th anniversary]] (Ålmhult, 1955), 30, 31, 89; AB Gotthard Nilsson, *Scrap Serves Production* (Kristianstad, 1966), 4, 6.

<sup>34</sup> Thomas Taro Lennerfors, *Eros, Thymos, Logos: A Study of the Spirit of Entrepreneurship and Innovation at Stena* (Göteborg, 2015), *Eros*, 38.

<sup>35</sup> *Nordisk Skrottidning* [Scandinavian reclamation industry review], no. 1–2 (1985): 12–14.

<sup>36</sup> AB Gotthard Nilsson, *En man och hans verk*, 30, 31, 89; AB Gotthard Nilsson, *Scrap Serves Production*, 4, 6.

economics of scale, which required both investments in machinery and equipment as well as a more consolidated market structure, in order for scrap dealers to stay in business. In this context, Stena departed from collaborating with other firms, in order to engage in scrap deliveries to Swedish steel manufacturers. Besides this new focus, Stena also began to acquire other small scrap firms to gain shares in the Swedish metal scrap market.<sup>37</sup> In order to expand its operations even more, Stena also engaged in wastepaper.<sup>38</sup> Although the Swedish pulp and paper industry had previously considered wastepaper a significant raw material, the demand for it increased significantly in the early 1970s. This was due to the fact that the Swedish pulp and paper industry experienced soaring timber prices and feared a future shortage of wood. In 1970, 415,000 tons of Swedish wastepaper were collected by scrap dealers for recycling, but it represented only about a third of the amount that was considered possible to collect and process. Compared to some other Western European countries, these figures were considered far too low by observers from the Swedish pulp and paper industry.<sup>39</sup> Thus, high demand from the Swedish paper industry drove Swedish scrap firms to enter or expand their business in the wastepaper market.

Stena's expansion strategies continued into packaging. In 1979, Stena acquired PLM, a company that had started as a tin can manufacturer in 1918, and moved into plastic containers and glass jars and bottles in the 1950s and 1960s. As a packaging producer, PLM had a natural connection to the recycling industry and decided in the early 1970s to expand its business operations into this domain. By the mid-1970s, PLM was involved in virtually all sub-areas of the recycling industry: household waste, commercial waste, industrial waste, all types of secondary materials, especially iron and paper, but also automatic car fragmentation and complex scrap.<sup>40</sup> Thus when Stena acquired PLM recycling in the late 1970s, it meant that it had reached a position as a major actor in the Swedish scrap and wastepaper market, at the same time as the company became involved in other types of recycling,

<sup>37</sup>Taro Lennerfors, *Eros, Thymos, Logos*, 39–40; Klas Brogren, Anders Bergenek, and Rickard Sahlsten, *Stena Line: The Story of a Ferry Company* (Gothenburg, 2012).

<sup>38</sup>Stena Metall, *Annual Report 1988/89*, 2.

<sup>39</sup>"The Government Inquiry Proposes Extensive Changes for Recycled Paper and Car Scrap," *Nordisk Skrottidning*, no. 8 (1974), 3.

<sup>40</sup>As a packing producer, PLM had a natural connection to the recycling industry and decided in the early 1970s to expand its business operations into this domain. In 1970, PLM engaged in the construction and operation of the Swedish Recycling Foundation and a new company called Recycling Systems (Återvinningssystem AB). These two businesses were focused on information and consultation regarding citizens' voluntary collection and separation of household waste, mainly paper, glass, and sheet metal. See "PLM-Persöner Kan Utveckla Miljötekniken" [PLM-Persöner can develop the environmental technology], *Nordisk Skrottidning*, no. 6 (1974), 11.

including cans and bottles.<sup>41</sup> Stena's expansion and diversification of its business operations broadly mirrored the dynamics of consolidation in the recycling industry, a process which has been noted in previous studies of the German, British, and US industry.<sup>42</sup>

*District heating.* A second line of development that played an important role for waste management in Sweden from the 1970s on involved the construction of district heating systems, the first of which were constructed in the late 1940s. The typical context, which drove district heating in Sweden, was a combination of high demand for residential area heating during the cold winter months and a geographically dispersed manufacturing industry, which produced substantial amounts of surplus heat.<sup>43</sup> Paper mills were the most common type of heat-producing industries involved in district heating projects. A common setup was to establish a local energy company, jointly owned by the industry and the municipality, which distributed district heating to households, public, and commercial buildings.<sup>44</sup> Accordingly, there was a situation of mutual benefits between the municipalities and industry interests, where industries could sell the heat, which otherwise would have been wasted. The municipalities, on the other hand, could offer heating services at competitive prices. Also, the extensive state-sponsored housing program of the 1960s, with the aim to construct one million apartments in new suburbs of major cities, contributed to the expansion of the Swedish district heating system. By 1970, district heating delivered around 10 Terawatt hours (TWh), by 1980 more than 25 TWh, and by the mid-2010s, around 45 TWh. Subsidies, tax incentives, and other policy tools aided this expansion.<sup>45</sup> The heating plants did, to some extent, offer less environmentally damaging energy, as compared to central heating and heating of individual houses, which utilized oil. Still, district heating provided an energy infrastructure that formed the cornerstone of the Swedish strategy to incinerate a high share of its household waste. This was in turn driven by both the need to substitute for increasingly expensive oil after 1973, and by the increasing problem of growing waste dumps in urban districts.

<sup>41</sup> Taro Lennerfors, *Eros, Thymos, Logos*, 70–71.

<sup>42</sup> Jones, *Profits and Sustainability*.

<sup>43</sup> Jane Summerton, *När fjärrvärmern kom till stan: Ett energisystem växer fram* [When district heating came to town: An emerging energy system] (PhD diss., Linköping University, 1992); Thomas Kaiserfeld, "Värme från när eller fjärran?: Henrik Bohlin, Att välja energisystem. Processer, aktörer och samverkan i Helsingborg och Gävle 1945-1983" [Heat from near or far?: Henrik Bohlin, choosing an energy system. Processes, actors and cooperation in Helsingborg and Gävle 1945-1983], *Historisk Tidskrift (S)* 125, no. 3 (2005): 516–24.

<sup>44</sup> Kaiserfeld, "Värme från när eller fjärran?"

<sup>45</sup> Stefan Grönkvist and Peter Sandberg, "Driving Forces and Obstacles with regard to Cooperation between Municipal Energy Companies and Process Industries in Sweden," *Energy Policy* 34, no. 13 (2006): 1508–19.

Furthermore, the incineration of waste was also made possible by improved end-of-pipe abatement technology developed by the manufacturing industry. District heating thus provided an energy infrastructure that was partly in place ahead of recycling demand.

*Growing and Changing Waste Streams.* A third factor had, of course, to do with the increased amount of waste, which, besides the general growth of consumption, was due to the expansion and restructuring of the packaging industry in the 1950s and early 1960s. The leading national packaging company was Tetra Pak, which revolutionized the Swedish and the global market with the introduction of paper containers for dairy products such as cream and milk in the 1950s. Single-use glass packages were also becoming more common at the time. As private consumption grew rapidly during the prosperous 1950s and 1960s, the generation of household waste increased even more. While GDP had four-folded between 1950 and 1970, the Swedish packaging industry output six-folded.<sup>46</sup> Already in the mid-1950s, it was forecasted that the combination of urbanization, increased levels of consumption, and non-recyclable packaging would lead to a tremendous increase in waste over the coming decades.<sup>47</sup> A continuous trend in the 1960s was an expansion of plastics as packaging material, mainly at the expense of glass and metal.<sup>48</sup> By 1970, Sweden was, as mentioned, among the top producers of per capita waste in Europe, as seen in [Table 1](#).

For a century before the 1970s, Swedish municipalities had responsibility for collecting and disposing of household wastes. The very first law stating the municipalities' responsibility for waste collection and sanitary measures goes back to 1874.<sup>49</sup> The municipalities' first strategy to manage the escalating waste streams in the postwar period was to find new locations for waste dumps and to improve the capacity of municipal waste collection. As urbanization gained momentum in Sweden during the 1950s and 1960s, there was a clear tendency for urban sprawl. City centers were planned for commercial activities, while new residential areas were constructed in the urban outskirts. In some fast-growing cities, this meant that it became increasingly difficult to find suitable locations for waste dumps. The Board for City Planning (Statens Planverk) pointed out that unsuitable localization of waste dumps could

<sup>46</sup> Government Bill 1975:32.

<sup>47</sup> Ulf Af Trolle, *Ett Andfått Liv: Mina Ekonomiska Memoarer* [A breathless life: my economic memoirs] (Stockholm, 1996).

<sup>48</sup> In beverage packaging, sheet steel was also replaced with aluminum. Swedish Environmental Protection Agency (SEPA), *Aufallet och Miljön* [waste and environment] (Stockholm, 1988).

<sup>49</sup> Public Health Act of 1874, *Svensk författningssamling* [Swedish code of statutes] (hereafter, SFS) 1874: 60.

Table 1  
Annual Household Waste Generation per Capita in 1970

Country	Kg/person
Sweden	270
Norway	200
Denmark	230
France	290
West Germany	200
Italy	200
Luxembourg	400
The Netherlands	270
Switzerland	150
Britain	272

Source: Government Bill on Recycling and Disposal of Waste, 1975:32, 43-44.

lead to incalculable future consequences.<sup>50</sup> In some cases, old waste dumps effectively blocked the expansion of new residential areas. Moving landfills farther out of cities meant potential conflicts with neighboring, rural, municipalities or villages. The Swedish Nature Conservation Association (SNF) was altogether skeptical about the deposition of wastes as an appropriate method.<sup>51</sup>

By the mid-1960s, the garbage disposal problem gave rise to the idea of modifying existing district heating plants for the combustion of household wastes. Combusting waste in the close proximity of residential areas was, however, not without difficulties.<sup>52</sup> Air pollution abatement technologies were still poorly developed, although important steps had been taken in the manufacturing industries.<sup>53</sup> At the same time, the waste streams turned more complicated as synthetic materials, plastics, and various chemical compounds became more common in them.<sup>54</sup> New types of textiles that contained a mix of synthetic and natural fibers made traditional textile recycling more or less impossible. On top of all these problems, the health effects of the synthetic components in the waste

<sup>50</sup> Government Bill 1975:32, 14.

<sup>51</sup> Government Bill 1975:32, 14.

<sup>52</sup> Authorities with responsibility for healthcare already opposed garbage combustion in the proximity of the hospital in Umeå in the mid-1960s. See "Handlingar tillhörande stadskansliet: ärende sopförbränningsanläggning Ålidhem, 1964/65," Umeå Municipality City Archives.

<sup>53</sup> Ann-Kristin Bergquist, Kristina Söderholm, Hanna Kinneryd, Magnus Lindmark, and Patrik Söderholm, "Command-and-Control Revisited: Environmental Compliance and Technological Change in Swedish Industry 1970-1990," *Ecological Economics* 85, issue C (2013): 6-19.

<sup>54</sup> SEPA, *Avfallet och Miljön*, 25-32.

streams were still vaguely understood. Finally, the OPEC oil embargo in 1973 created strong pressure to phase out oil from the Swedish energy system.<sup>55</sup> As one of the most oil-intensive economies in the world, Sweden swiftly formed a national energy strategy, which also had implications for the structure of the waste management system. In order to reduce oil dependency in the 1970s, many municipal energy companies started to replace oil with waste as fuel in the heating plants. Thus, the trend toward increased waste incineration was not initially induced by new waste policies, but rather by the oil crisis that made the municipalities look at waste as a substitute for oil.<sup>56</sup>

*Institutions supporting recycling.* The advancing recycling sector in Sweden was to be reinforced by new government policies that created a demand for advanced recycling services. Particularly, the demand for recycling services from the Swedish manufacturing industry was important. Three lines of development stood out as areas of great significance for Swedish recycling firms in the 1970s and the 1980s: collecting and processing wastepaper, scrapping and defragmentation of end-of-life vehicles, and creating a system to recycle single-use containers. Although different manufacturing industries faced dissimilar technological challenges, single recycling companies were engaged in developing infrastructures for each industry. Municipalities that were given a monopoly on collecting paper from Swedish households according to law, were also involved in the system for paper recycling.

In 1969 and 1975, the Swedish government introduced new regulations that either supported or forced firms to act in advancing recycling infrastructures. As well as other Western countries, Sweden advanced forcefully from the 1960s on developing new regulations and administrative capacity to protect the natural environment. In 1969, the Swedish parliament passed the Environmental Protection Act as previously mentioned, and before that, the Swedish Environmental Protection Agency was founded in 1967.<sup>57</sup> More important for inducing recycling activities in Swedish industry, however, was the governmental bill “Recycling and Waste Disposal,” in 1975. The aim of the bill was to improve both the level of recycling and waste management practices in the country. As the government stated, Swedish economic development, so far, had been coupled with the heavy use of limited natural resources and such development could not be allowed to continue. The concept of

<sup>55</sup> Government Bill 1975:30; Magnus Lindmark, “Rethinking the Environmental State: An Economic History of the Swedish Environmental Kuznets Curve for Carbon,” in *In Search of Good Energy Policy*, ed. Marc Ozawa, Jonathan Chaplin, Michael Pollitt, David Reiner, and Paul Warde (Cambridge, UK, 2019), 139–64; Bergquist and Söderholm, “Energy Transition.”

<sup>56</sup> SEPA, *Aufallet och Miljön*.

<sup>57</sup> See, for example, Bergquist et al., “Command-and-Control Revisited,” 6–19.



“recycling” entered Swedish policy, when waste was redefined as a resource that must be “reused” to the extent that it was possible.<sup>58</sup> The working group behind the bill as well as the consultative bodies suggested that household waste should be seen as a resource, pointing to the need for recycling in general with regard to both environmental protection and limited natural resources.<sup>59</sup>

The Environmental Protection Act did not require considerations of recycling as such, but stipulated regulation of the disposal of several types of hazardous wastes. Hazardous waste was defined as an environmental problem, which would not be left to the private sector alone to manage.

The company SAKAB was established in 1969 and was jointly owned by the state and business with the purpose of managing various forms of hazardous wastes generated by the Swedish industry. An organizational setup where the state covered some of the management costs was seen as important for avoiding a situation where hazardous wastes ended up in illegal markets.<sup>60</sup> The 1975 government bill then gave the municipalities the responsibility to organize a system to take care of chemical waste, while SAKAB was responsible for the long-term storage of such hazardous wastes.<sup>61</sup>

An important feature of the 1975 government bill concerned the recycling of paper. Swedish paper mills had before the 1970s covered parts of their need for wastepaper by imports. The Swedish government wanted to change this situation for various reasons. Firstly, paper disposed of by households constituted a fast-growing problem that needed to be managed and recycling was the optimal strategy. Secondly, improving paper recycling was part of the government’s overall strategy to reduce material consumption in the economy.<sup>62</sup> Thirdly, after the OPEC oil embargo in 1973, the paper industry’s energy consumption became a concern for the Swedish government, due to its large size and since oil imports threatened the balance of trade, and, thus, the fixed exchange rate currency policy.<sup>63</sup> Thus, the Swedish government wanted a strong grip on paper recycling. However, for the paper mills, the use of newsprint and other wastepaper required significant investments in new technologies, such as methods to remove ink, plastic,

<sup>58</sup> Government Bill 1975:32, 10. One noticeable effect of the government’s decision was the construction of government-subsidized recycling plants in various parts of the country, where the waste was sorted into fuel, compost, and metal. SEPA, *Aufallet och Miljön*, 20.

<sup>59</sup> Government Bill 1975:32.

<sup>60</sup> SEPA, *Aufallet och Miljön*, 102–3.

<sup>61</sup> Government Bill 1975:32, 11.

<sup>62</sup> Government Bill 1975:30, *Regeringens Proposition om Energihushållning m.m.* [Government bill on energy conservation etc.] 15–18.

<sup>63</sup> Lindmark, “Rethinking the Environmental State.”

and wax from the paper.<sup>64</sup> To make the required investments, the paper industry needed to be guaranteed a long-term stable supply of wastepaper not the least from Swedish households. A key issue in the 1975 government bill was that households should separate their own newsprint, i.e., “sorting at source,” while the municipalities would be responsible, by law, for the collection of wastepaper.<sup>65</sup> The recycling firms were thus excluded from managing the collection of household paper.

However, many Swedish municipalities did not manage to organize cost-effective paper collection, while recycling firms had capabilities to function as an intermediary of wastepaper. Although the Swedish municipalities were given a monopoly, they eventually started to contract private paper recycling firms for the task.<sup>66</sup> Gotthards and Stena along with other smaller companies began to engage in both collection and sales of household wastepaper. A symbiotic business network that involved the paper industry, recycling firms, and municipalities thus *co-created* the infrastructure that enabled a scaling of paper recycling in Sweden in the 1970s. The campaign driven by the Swedish Society for Nature Conservation against littering also worked in favor of a paper recycling system in Sweden at the time.

In contrast to paper, the market for recycled metals was not of particular concern for governmental intervention in the 1970s, except for one major issue, namely the management of end-of-life vehicles (ELVs).<sup>67</sup> Sweden witnessed a rapid increase in its private car fleet in the postwar period, and between 1950 and 1960, annual car sales tripled. Before the 1970s, many vehicles were dumped in forests, lakes, and rivers, although a number of them also ended up at scrap yards, where the vehicles were stripped of spare parts, while the rest were burned. Already in the 1950s, Sweden saw the emergence of specialized car dismantlers, while in the 1960s, a second group of actors was formed around a central piece of physical infrastructure, namely fragmentation.<sup>68</sup> Again, recycling firms became involved in creating a recycling system for ELVs in the 1970s. In 1971, the company Bilfragmentering AB was founded by Gotthards and Persöner AB with a factory built in

<sup>64</sup> Bergquist and Söderholm, “Energy Transition.”

<sup>65</sup> The municipalities could give permission to nonprofit associations, such as sports associations, to collect the paper. See Government Bill 1975:32, Bilaga 1 [Appendix 1], 73–74.

<sup>66</sup> “Kommunerna har redan tröttnat på att svara för pappersinsamlingen” [The municipalities are already tired of being responsible for the paper collection], *Nordisk Skrottidning*, 10 (1975), 10.

<sup>67</sup> Government Bill 1975:32, 12–13.

<sup>68</sup> Magnus Andersson, Maria Ljungren Söderman, and Björn A. Sandén, “Lessons from a Century of Innovating Car Recycling Value Chains,” *Environmental Innovation and Societal Transitions* 25 (Dec. 2017): 142–57.

Halmstad, on the Swedish west coast.<sup>69</sup> A year later, Stena, Volvo, and Statsföretag (through Procordia) also bought shares in the company.<sup>70</sup> By 1975 Bilfragmentering, which had organized business arrangements with about seventy dismantlers, was treating close to 70 percent of the Swedish ELVs and set in motion a partly endogenously-driven system development.<sup>71</sup> However, the 1975 government bill furthered the development significantly. The bill included the Scrap Car Ordinance (*Bilskrotningsförelöningen*), which stipulated a licensing system for scrap yards dealing with cars as well as a scrap car premium, from 1976.<sup>72</sup> Among other things, dismantlers had to guarantee that they had access—by ownership or through business arrangements—to machinery capable of converting ELVs into steel scrap, and as a result, reinforced the growing network between dismantlers and the shredder company.<sup>73</sup> The new policies not only improved the organization of the dismantlers. The scrap car premium incentivized an increased rate of auto recycling and involved both traditional scrap businesses such as Gotthards and Stena, as well as large multinational companies such as Volvo. Although paper recycling and recycling of automobiles appear as very different businesses, traditional scrap firms became involved in both.

An additional issue of great concern for the Swedish government was the beverage packaging industry. In 1973, the Swedish government introduced a tax on both returnable bottles and disposable beverage containers, which led to higher prices on disposables and a drastic increase in the deposit on returnables (from 0.10 to 0.40 SEK). As the tax was only applied to the container once, it made reusable containers cheaper in the long run, and within just two years, the use of returnable bottles increased from 79 to 91 percent.<sup>74</sup> As demonstrated by Jørgensen, the previously mentioned company PLM, acquired by Stena in 1979, played a big part in creating the infrastructure for recycling beverage cans and bottles. In 1973 PLM embarked on a collaboration with the Norwegian company Tomra, which had invented a reverse vending machine (RVM). PLM saw an opportunity to improve the

<sup>69</sup> “Ystads Fornminnesförening,” n.d., accessed 27 March 2023, <https://www.ystadsfornminnesforening.se/Verkstadsf-091118.pdf>. Persöner was taken over by the firm Plåtmanufaktur AB (PLM) in 1974–1975.

<sup>70</sup> JBF, *JBF: Centrum*, 41–42.

<sup>71</sup> Andersson, Söderman, and Sandén, “Lessons,” 151.

<sup>72</sup> Swedish Code of Statutes (SFS) No 1975:348. *Bilskrotningsförelöning* [Ordinance on car scrapping]; Energimyndigheten/Naturvårdsverket, “Ekonomiska styrmedel i miljöpolitiken. Rapport från Naturvårdsverket och Energimyndigheten,” [Economic policy tools in environmental policy] ER 2006:34.

<sup>73</sup> Andersson, Söderman, and Sandén, “Lessons,” 151.

<sup>74</sup> Jørgensen, *Green Machine*, 53.

recycling rate of their products by getting the machine installed in Swedish grocery stores and started to distribute and sell Tomra RVMs in the Swedish market.<sup>75</sup>

Regulations in this area were tightened in 1982. One reason was that PLM opened a large-scale aluminum can factory in 1979 in alliance with Sweden's largest brewery, Pripps. The establishment of the new factory resulted in the mass production and consumption of aluminum cans, where PLM's production capacity amounted to 900 million aluminum cans in 1981. Based on both environmental and energy concerns, the Swedish Parliament passed a new law in 1982 that required a system that could handle a 75 percent return rate of aluminum cans, or else the production of aluminum cans would be banned.<sup>76</sup> PLM organized a consortium called Returpack, which included itself, the Swedish Brewery Association, and the retail industry.<sup>77</sup> In short, Returpack became responsible for creating a system for recycling aluminum cans, and it based the system on thousands of Tomra's RVM machines and a refundable deposit system. In 1994, Returpack introduced a deposit system for plastic bottles called Returpack-PET.<sup>78</sup>

Additionally, there was a focus on glass packages in the early 1980s. This trend was not primarily driven by environmental concerns, but by the fact that incineration of waste had become more common in the municipal energy sector. Glass melted in the combustion chambers and created a hard and heavy mass of glass that had to be removed in frequent intervals and at high costs. In 1982, the municipality of Gothenburg therefore invested in containers for voluntary glass recycling, and the glass was thereafter recycled by PLM. Svensk Glasåtervinning AB was established in 1986 as a subsidiary of PLM and other glass manufacturers.<sup>79</sup> A fee on glass bottles had also been introduced to finance recycling. The need for collusion in the recycling business and the need for a fee, points to a principal difference as compared to the scrap dealers. Whereas metal scrap was a private good, environmental quality was a common good, riddled with typical free-rider problems. While metal scrap could be recycled by the market, glass jars, aluminum cans, and PET bottles required either cooperation or legislation.

While PET bottles entered a recycling system, plastics as such remained a major issue. Plastics had for decades been a challenge for

<sup>75</sup> Jørgensen, 54, 73.

<sup>76</sup> Government Bill 1981/82:131, Lag (1982:349) om återvinning av dryckesförpackningar av aluminium [Act on recycling of aluminium beverage packaging], SFS 1982:349.

<sup>77</sup> Jørgensen, *Green Machine*, 74.

<sup>78</sup> Government Bill 1981/82:131; Jørgensen, *Green Machine*, 125.

<sup>79</sup> Svenska Renhållningsverksföreningen, *Avfall blir värme och el: En rapport om avfallsförbränning. Rapport 2005:02* (Malmö, 2005).

the Swedish recycling industry, since it was difficult to make plastic recycling profitable, especially plastics in household waste along with the industrial waste that had ended up at the waste treatment plants. Plastics in the waste streams were still in the late 1980s too mixed and dirty to be reused for new products using current technology. The technological challenge lay in the mixing of plastic qualities in the waste streams, and the problem was how to separate these qualities.<sup>80</sup>

In 1991, Sweden applied for membership in the European Union (EU) and joined the European Economic Area (EEA) in 1992, which included the European Council Directive on waste from 1975.<sup>81</sup> When Sweden joined the European Union in 1995, the EU Council had in 1994 passed a new Directive that covered all types of packaging placed on the common market as well as all packaging waste.<sup>82</sup> In short, this meant that Swedish measures concerning the management of packaging and packaging waste from the early 1990s had to be harmonized with EU directives in order to provide a harmonized level of environmental protection to ensure the functioning of the internal market and to avoid obstacles to trade and distortion and restriction of competition within the Community. Altogether, these trends paved the way for an extended Producer Responsibility Ordinance, or, the Eco-cycle Law, in Sweden in 1994.

Finally, the growth of the Swedish recycling industry was supported by a growing number of business associations created by the recycling companies themselves, such as Svenska Järn- och Metallskrothandlareföreningen (Swedish Iron and Steel Scrap Trading Association), Sveriges Bilskrötares Riksförbund (Swedish Car Scrap Association), Svenska Återvinningsföreningen (Swedish Recycling Association), and others.<sup>83</sup> Svensk Återvinning (Swedish Recycling, SÅF) was founded in 1972 with Återvinnings System AB (Recycling System Co, ÅSAB AB) as the executive body. At the beginning, members of the foundation included Svenska Kommunalförbundet, Persöner AB, PLM, and Supra. Later Stora Kopparbergs Bergslags AB joined the foundation. The purpose of the foundation was to promote recycling by initiating research and development (R&D) focused on making final products more appropriate for recycling and to broaden the use of recycled materials. The foundation was also supposed to gather information about important research on recycling and convey that information to its stakeholders.<sup>84</sup> In the

<sup>80</sup> SEPA, *Avfallet och Miljön*, 141–42.

<sup>81</sup> Council Directive 75/442/EEC of 15 July 1975.

<sup>82</sup> Official Journal of the European Communities No. L 365/10. European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste.

<sup>83</sup> Wallberg, *Järn och metallskrotning*, 8, 13.

<sup>84</sup> Stiftelsen Svensk Återvinning, *Återvinning Genom Hushållens Medverkan* [Recycling through the participation of households] (Stockholm, 1975), 3.

1980s, SÅF represented the interests of smaller recycling companies, that did not possess the network resources to deliver scrap directly to the steel industry.<sup>85</sup>

*Scaling of the Recycling Industry: Drivers and Dynamics.* The Eco-cycle Law of 1994 mandated producer responsibility for the collection and processing of packaging waste and used products.<sup>86</sup> The Law would have a tremendous impact on firms since it stipulated the responsibility for packaging, tires, recycled paper, electronics, batteries, pharmaceuticals, vehicles weighing less than 3.5 tons, and radioactive sources. As a direct response to the Eco-cycle Law, Swedish manufacturers developed a self-regulatory organization and non-profit enterprises to collect their waste.<sup>87</sup> Five producer-led non-profit recycling enterprises (the so-called Materialbolagen) established REPA Registret AB, to which many producers, manufacturers, and retailers paid a fee.<sup>88</sup> The company FTI (Förpackings- och tidningsinsamlingen AB), which merged with REPA, had the responsibility for the collection and recycling of products under the Eco-cycle Law. The regulation meant a significant volume growth of recycling services, while the development of prices suggested a considerable qualitative development of the services (see Figure 2).

The dynamic impact of reforms in the Swedish recycling industry was clearly mirrored in the transformation of larger commercial firms, like Stena and Gotthards. These companies established contacts with producers who under the new law became responsible for their own waste, including large multinational companies like Volvo and Electrolux. The Eco-cycle Law boosted the demand for recycling services, which created new market opportunities, not the least in relation to green branding.

The demand for recycling services further shifted when companies could obtain standardized environmental certifications such as ISO 14001 and EMAS. The combination of growing market opportunities and the opportunity for the recycling industry to obtain ISO 14001 and EMAS certifications, and brand themselves as “green,” created further incentives to develop new, more environmentally friendly recycling

<sup>85</sup> Wallberg, *Järn och metallskrotning*, 8.

<sup>86</sup> Lindhqvist, “Extended Producer Responsibility”; Thomas Lindhqvist and Karl Lidgren, “Modeller för förlängt producentansvar” [Models for extended producer responsibility], in Ministry of the Environment, *Från vaggan till graven - sex studier av varors miljöpåverkan* [From the cradle to the grave - six studies of the environmental impact of products], (Stockholm, 1990), 7-44, Ds 1991:9.

<sup>87</sup> In 2019, FTI (Förpackings- och tidningsinsamlingen AB) was the main recycling company for household waste.

<sup>88</sup> Claes Bernes and Lars Lundgren, *Bruk och missbruk av naturens resurser: en svensk miljöhistoria* [Use and misuse of nature’s resources: an environmental history of Sweden], (Stockholm, 2009), 200; Jones, *Profits and Sustainability*, 318.

technologies and methods.<sup>89</sup> “Environmentally friendly” and cost-effective recycling became a competitive advantage also for manufacturing firms like Volvo, which was reinforced by the existing legislation requiring them to deposit their waste in an environmentally friendly manner and try to sell products to more environmentally aware final customers. As one of the managers at Stena Recycling put it, “we started to encounter environmental managers [at the companies requesting recycling services] when negotiating deals.”<sup>90</sup> Through this mechanism, innovation became more important in the Swedish recycling business. Typically, the recycling company would negotiate solutions with the client, usually companies within the manufacturing industry, as well as governmental authorities.

The new type of recycling design emerging in the 1990s tended to be large-scale, technical systems. Stena’s large car fragmentation factory was developed in close dialogue with Volvo.<sup>91</sup> This meant that there was a feedback loop of information that not only affected how the recycling plant could be designed, but also what types of materials should be used in the cars, in order to economize the car defragmentation. From this evolved a business format in which business administrators, economists, and lawyers left the process to the engineers of Stena and the client company after the initial contacts, and came back to the process after the technical issues had been solved. The approach created a business model that gave engineers a high degree of discretion, and favored process-level innovations.<sup>92</sup>

In the 1990s, there was also a further consolidation of the Swedish recycling industry as Stena eventually acquired AB Gotthard Nilsson, including Gotthard Aluminium AB, Gotthard Returdäck AB as well as Rylanders Skrotaffär AB from Electrolux Contracting AB. Through these acquisitions, Stena became by far the largest recycling company in the Swedish market.<sup>93</sup> The consolidation both reflected an underlying opportunity for scale and scope and R&D competence, as well as a wish from manufacturers such as Electrolux, to outsource recycling from their own business.<sup>94</sup>

<sup>89</sup> AB Gotthard Nilsson, *Annual Report 1995*, 7, 8; AB Gotthard Nilsson, *Annual Report 1996*, 5–6; 11; Stena Metall, *Annual Report 1993/94*, 4; Stena Metall, *Annual Report 1994/95*, 1; Stena Metall, *Annual Report 1995/96*, 2; Stena Metall, *Annual Report 1996/97*, 1, 7.

<sup>90</sup> Lars Håkansson, interview by Ann-Kristin Bergquist, Magnus Lindmark, and Nadezda Petrusenko, Stena Metall, Gothenburg, 29 Nov. 2018.

<sup>91</sup> Stena Metall, *Annual Report 1995/96*, 6–7; Stena Metall, *Annual Report 1996/97*, 6; Stena Metall, *Annual Report 1997/98*, 6.

<sup>92</sup> Håkansson, interview.

<sup>93</sup> Stena Metall, *Annual Report 2000/2001*, 6.

<sup>94</sup> Konkurrensverket [Swedish Competition Authority], Dnr (No.) 878/1998, “Anmälan om företagsförvärv - återvinning av freon, elektronik m.m.” [Notification of business acquisition -

The 1994 legislation was again reformed in 1999 as fifteen separate legal acts were unified in a single Environmental Code, which came into force on January 1, 1999. The intention was to coordinate and make uniform the patchwork of legislation built up over the years in response to a succession of environmental problems.<sup>95</sup> This new legislation stimulated the recycling industry toward investing more in circular and green solutions. R&D projects were undertaken by big recycling companies, such as Stena, together with Swedish research institutions.<sup>96</sup> R&D and investment in new technologies finally came to create a new trend in the Swedish recycling industry in the first decade of the 2000s.

As we saw, Sweden enforced legislation regarding ELVs beginning in the mid-1970s. Sweden was the only EU member state that had any legislation regarding ELVs prior to the 1990s.<sup>97</sup> After the European Union began enforcing Directive 2000/53/EC on end-of-life vehicles in 2000, Sweden took a further step in stressing the producer's responsibility for ELVs. In 2007, the country introduced legislation that made car manufacturers responsible for ensuring that cars were both designed and manufactured to prevent the generation of waste. Car manufacturers were, among other things, made responsible for providing systems for receiving ELVs and to ensure that at least 95 percent of the weight of the car was recycled from 2015.<sup>98</sup> This new legislation increased the demand for advanced recycling services significantly. And to meet the demand, Stena invested in a large new plant—Stena Nordic Recycling Center—which began operating in 2016. The plant was designed in close collaboration with Stena and its client companies, including in the car industry.<sup>99</sup> Plastic recycling, however, remained a major challenge due to various degrees of plastic qualities, while the car industry preferred to use more of it, to save on weight.<sup>100</sup>

At the same time, China emerged in the early 1990s as a major global player in plastic recycling. For waste exporting countries such as the

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recycling of freon, electronics, etc.], accessed 27 March 2023, <https://www.konkurrensverket.se/diarium/sok-i-Konkurrensverkets-diarium/arendedata/file?pdf=98-0878.htm>.

<sup>95</sup> Bernes and Lundgren, *Bruk och Missbruk*, 279.

<sup>96</sup> See, for example, Stena Metall, *Annual Report 1988/89*, 16.

<sup>97</sup> Helena K. Forslind, "Implementing Extended Producer Responsibility: the Case of Sweden's Car Scrapping Scheme," *Journal of Cleaner Production*, 13, no 6 (2005): 619-629, 621.

<sup>98</sup> Swedish Code of Statutes (Svensk Författningssamling: SFS) No 2007: 185 Förordningen om producentansvar för bilar [Ordinance on producer's responsibility for cars], SFS No 2007:186 Bilskrotningsförordningen [Ordinance on car scrapping].

<sup>99</sup> Stena Metall, "Grand Opening of Stena Nordic Recycling Center," accessed 22 March 2023, <https://www.stenametall.com/news-insights/newsroom/2016/grand-opening-of-stena-nordic-recycling-center/>.

<sup>100</sup> Krister Forsgren, interview by Ann-Kristin Bergquist, Magnus Lindmark, and Nadezda Petrusenko, Stena Metall, Gothenburg, 28 Nov. 2018.



United States, China and surrounding countries provided an outlet for the management of plastic waste, which prevented it from going to domestic landfill or incineration.<sup>101</sup> However, China relied on manual labor in the separation process of different wastes.<sup>102</sup> Stena focused instead on developing high-tech, capital-intensive solutions, and gradually learned how to recycle various plastic qualities, and how to make the products pure enough to be commercially viable. This meant that a larger fraction of the plastic waste, previously a zero or low-value waste, developed to be a valuable product for Swedish recycling companies.<sup>103</sup> High-quality recycled plastics were in 2019 selling for around five EUR per kilo, as compared to one EUR per kg for aluminum. Before this technological shift, the collection of plastics used to be a collective good.

It can be argued that plastics would never have started to be collected without a regulation forcing some kind of actor to do so. The Eco-Cycle Law in 1994 implied that the producers had the physical and economic responsibility for packaging waste and became obliged to provide systems for collecting and recycling it, and to inform households and firms about these systems or engage different collection entrepreneurs to perform necessary tasks. Households were obliged to clean and sort out plastic packaging waste from other waste and transport the used packaging materials to assigned drop-off stations. It also turned out to be a good business to first charge the households for collecting garbage, then recycle the plastics in the municipal heat power plant, and then finally sell the heat back to the households through the district heating system. The Eco-Cycle Law and the new plastic recycling technologies have, however, transformed plastic waste collection into a private good. As plastic waste became more valuable in the twenty-first century, it also becomes profitable to collect it, especially since households sort their own waste.

The Swedish experience demonstrates, however, that the recycling industry has faced great challenges in tackling design complexity, which involves a need to collaborate with other industries, such as the automobile industry, at the early stages of their product development. Another quite different challenge relates to competition between private recycling firms and municipal waste- and energy firms. Many municipalities have a monopoly on household waste management and use waste for heat generation in district heating systems. At the same time, recycling firms like Stena seek business opportunities through recycling plastics and other materials. The historical development of

<sup>101</sup> SEPA, *Avfallet och Miljön*, 141–42.

<sup>102</sup> Jones, *Profits and Sustainability*, 321–22.

<sup>103</sup> Forsgren, interview.

the Swedish district heating system and vested interest interrelated with it thus helps to explain why Sweden today combusts more waste and recycles less than Germany. Yet, the way the waste streams are being treated is more diversified than in Japan, which since the 1990s has seen a strong development of a waste-to-energy strategy after the Basic Environmental Law of 1993 was enacted.<sup>104</sup>

### Concluding Discussion

This study confirms in many aspects what has been reported from existing business history research on the waste and recycling industry: that governmental regulations played a key role in creating recycling markets and shaping the conditions for the recycling and waste industry in Western countries to scale and transform from the 1970s on. As the existing literature has already indicated, these policies have evolved differently with regard to designs as well as timing for implementation and have also mirrored the situation of business-government relations, which ultimately helps to explain different outcomes. But quite unlike the United States, where counterculture-like communities were pushing for more recycling in the 1970s and asked for voluntary business action, it was rather a combination of public policy and the interest of big business that drove the development of the Swedish recycling industry.

The first and most obvious line of development identified in this study was the transformation of the early twentieth-century's scrap dealing businesses which in the 1970s saw new market opportunities emerging beyond the traditional salvage of metals. But the transformation of the recycling industry was part of a larger structural change, that involved the development and scaling of an essentially new type of industrial service activity directed toward producers in big manufacturing industries, households, as well as the energy sector. The second line, which appears to have played a particular role in shaping the management and treatment of Swedish household waste, was the expansion of the district heating systems from the 1960s. The third line was the increased demand for waste management and recycling services, which was interrelated with a fourth line of development that involved governmental regulation, which substantially increased the market demand for knowledge-intensive recycling services. Our study demonstrates in quantitative terms a profound increase in value creation in the waste and recycling sector in the late 1980s and the early 1990s,

<sup>104</sup> Geoffrey Jones, "Asia's Waste Management Failures Reach Crisis Levels," *Nikkei Asian Review*, 5 Sept. 2018, accessed 27 March 2023, <https://asia.nikkei.com/Opinion/Asia-s-waste-management-failures-reach-crisis-levels>.

while the processes leading up to this breakthrough started already in the 1960s or earlier. A number of complementary regulatory developments outside the immediate recycling sector played formative roles, such as the oil crises in the early and late 1970s, but also a political redefinition of waste as something that should be treated as a resource to be reused and not discarded or buried in the ground.

While we can conclude that governmental regulations, such as the Eco-Cycle Law of 1994, clearly created a much larger market demand for advanced recycling services, the formative steps were taken already in the 1970s. Early motives for increased recycling were not only rooted in environmental regulatory drivers. Rather, regulatory drivers coincided with more traditional economic motives, as the first regulation that stipulated recycling, appeared in the 1970s. For instance, the pulp and paper industry's demand for wastepaper was essential for developing an infrastructure for wastepaper collection in the mid-1970s. The steel industry's demand for iron scrap was instrumental for other actors to invest in car dismantling and fragmentation. The municipalities' wishes to combust waste in the district heating power plants were also motivated by the urgent need to substitute expensive oil, but also by the need to avoid urban planning problems associated with garbage dumps. This created an overall situation of common interests among key actors, involving recycling firms, manufacturing firms, and municipalities, as well as NGOs focused on the problem of littering. But although governments and big business demands for increasingly complex recycling services were driving technological development and scaling of the recycling industry from the 1970s, the gradual consolidation of "everyday environmentalism" among Swedish households greatly supported waste and recycling firms in sorting the waste, starting with paper recycling.

Later steps, such as recycling glass, aluminum cans, and plastics in the 1980s were therefore relatively easy to take, especially since can producers, who were under pressure from regulation, created an infrastructure that included a refunding system for aluminum cans and later PET bottles.

The Eco-Cycle Law was the last big step in a chain of events that finally turned recycling into a modern, technically advanced industry that could charge more for its services. Governmental policy in these regards was essential, since waste collection was (and is) a collective good. The industry could hardly have self-regulated into recycling on a large scale. The essential part of the Swedish historical development lies perhaps instead in the dynamics that the law enabled within both the manufacturing and recycling service sectors. Dominant firms, such as Stena, which had been established long before the 1970s, expanded

during this decade, while a clear consolidation of the market developed in the 1980s and 1990s. As manufacturers, including Volvo, Electrolux, and others, started to implement recycling strategies under new environmental quality schemes and as a direct consequence of the Eco-Cycle Law, the market for recycling services expanded. In broad terms, we show that the Swedish recycling industry, although its main business model was to profit from waste materials, strongly co-evolved with the greening of large, domestic manufacturing firms.

When the Swedish recycling industry transformed to become more knowledge-intensive, it was not only a result of governmental regulatory reform targeting household waste recycling. The growing demand for recycling services in manufacturing industries played at least as big of a role. At the same time, the Swedish recycling industry followed an international trend, where the recycling industry in other countries such as Germany and the United States became more technologically advanced during the 1980s and 1990s.<sup>105</sup> However, with the rise of China as the largest importer of global waste in the 1990s, particularly plastics, a division of recycling capabilities between countries emerged. From having imported a cumulative 45 percent of plastic waste since 1992, China's "national sword" policy to ban many recyclable imports in 2017 disrupted the global waste trade.<sup>106</sup> While several countries, including the United States, lacked strong institutional frameworks to support recycling of their domestic waste streams, other countries such as Sweden and Germany had, over several decades, created them. Historical explanations behind today's situation thus deserve more research attention, not the least with regards to the role that country-specific regulations have played. Understanding how business systems have restricted, or enabled, a coordination of economic activities between firms and across industrial sectors might be equally important to identifying why the level of recirculation of materials in the economy differs between countries.

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*ANN-KRISTIN BERGQUIST, Uppsala University, Uppsala, Sweden*

*Ann-Kristin Bergquist is associate professor in economic history at Umeå University, and from April 1, 2023, professor in Economic*

<sup>105</sup> See, for example, Jones, *Profits and Sustainability*, chapters 4 and 6.

<sup>106</sup> Leslie Hook and John Reed, "Why the World's Recycling System Stopped Working," *Financial Times*, 25 Oct. 2018, accessed 27 March 2023, <https://www.ft.com/content/360e2524-d71a-11e8-a854-33d6f82e62f8>.

*History at Uppsala University, Sweden. Her research focuses on the history of business sustainability and environmental governance. Among her recent publications are “Renewing Business History in the Era of the Anthropocene” (Business History Review, 2019) and “Safe before Green! The Greening of Volvo Cars in the 1970s–1990s” (Enterprise & Society, 2023), with Mattias Näsman.*

*MAGNUS LINDMARK, Umeå University, Umeå, Sweden*

*Magnus Lindmark is professor in economic history at Umeå University, Sweden. He has published on energy and environmental history as well as financial history and economic growth. Recent publications include “Rethinking the Environmental State” (in In Search of Good Energy Policy, ed. M. Ozawa, J. Chaplin, M. Pollitt, D. Reiner, and P. Warde, 2019).*

*NADEZDA PETRUSENKO, Umeå University, Umeå, Sweden*

*Nadezda Petrusenko, PhD in history, is currently a lecturer in history at Umeå University, Sweden. Her research interests include business history with a focus on the discursive greening of Swedish businesses as well as the history of recycling in Sweden.*