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Working Paper 18-050



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## **Business and Green Knowledge Production in Sweden 1960s -1980s**

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### **Abstract**

This working paper contributes to the burgeoning historical literature which has transformed our understanding about the relationship between big business and the environmental regulation. It used to be believed that corporate managers resisted the extra costs imposed by environmental regulation from the 1960s. This argument was primarily based on empirical evidence from the United States. It has now been established by a new generation of researchers that corporate responses were not homogeneous. There were major variations between individual managers, companies, industrial sectors and national business systems. This working paper supports this re-interpretation by examining the case of Sweden, where the relationship between big business and government turns out to be different from that in the United States. It shows that big business emerged as a constructive player in environmental policy in the 1960s, when it persuaded the government to establish a joint research institute known as the IVL and a closely connected consulting company to address pollution. IVL developed an important role as knowledge producer and as an intermediary of environmental knowledge between the late 1960s and the 1980s. The proactive response of Swedish big business is shown to have been based on a belief that efficient pollution control policies and regulations needed to be based on hard science and engineering knowledge. To achieve this, collaboration with the Swedish government was seen as instrumental and joint R & D was regarded as a means to share knowledge and costs. The study ends by noting that in the 1980s the pivotal role of IVL transitioned as environmental challenges evolved, Swedish universities assumed leadership in creating environmental knowledge, while conventional management consultancies entered the market of environmental management.

# **Business and Green Knowledge Production in Sweden 1960s -1980s<sup>1</sup>**

**Ann-Kristin Bergquist & Kristina Söderholm**

## **1. Introduction**

Until recently historical research has stressed that as environmental concerns rose after the 1960s, the response of big business was primarily reactive rather than proactive. Managers resented and resisted the extra costs imposed by environmental regulation. However this argument was primarily based on empirical evidence from the United States. A more recent literature has demonstrated that business responses have been far more varied, with considerable variations between individual managers, companies, industrial sectors and between national business systems. This working paper builds on this evolving new interpretation by exploring the case of Sweden where big business emerged as a constructive player in the area of environmental policy in the 1960s, and took the initiative in persuading the government to establish a joint research institute known as the Institute for Water and Air Pollution (IVL) to address pollution problems.

The first research debates about the historical dynamics between business and the natural environment was driven by environmental historians, where the seminal work of Worster delivered a harsh critique against capitalism.<sup>2</sup> The one-sided perception of business and capitalism as only a destructive force turned out to be more complicated and diverse when business historians like Christine Meisner Rosen began to take a closer look into processes

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<sup>1</sup> Material from this working paper will be published in Larsen, Katarina (2018) (eds.) *Emerging Roles of Technical Research Institutes: A Social Contract of Innovation*, Routledge. The book covers the role of technical institutes in the Nordic countries.

<sup>2</sup> Worster (1979). For an recent overview, see Rome (2017). See also Rosen and Sellers (1999).

“inside” the business community.<sup>3</sup> The importance of awareness of the variety of business responses among individual entrepreneurs, managers, industries and countries were stressed by Christine Meisner Rosen and Christopher Sellers when they argued for an “ecocultural” history of business.<sup>4</sup> During the past decades or so, an emerging literature has focused on these diversities.

The management scholar Andrew J. Hoffman’s work on the US history of corporate environmentalism has been frequently cited to describe different modes of business responses to the environmental issue from the 1960s. Hoffman’s framework covering the 1960s to the late 1990s were based on empirical studies of the US chemical and petroleum industry, who responded reactive and defensive towards environmental regulations in the 1970s.<sup>5</sup> This view has also been supported by Archie B. Carroll et al. who have argued that most American companies were resisting environmental regulations in the 1970s along with delaying investments as long as possible. Only a minor part of the American executives perceived that they had major responsibility towards the natural environment during this period.<sup>6</sup>

Business history research gives however no clear and coherent picture of how manufacturing companies did respond elsewhere to the new complex of environmental issues emerging from the 1960s and in the 1970s. For instance, Jones & Lubinski who explored the development of environmental strategies in the German chemical industry in the 1950s to the 1980s, could demonstrate that the German firms started to act proactively in the 1970s and using public relations strategies not only to avoid criticism, but also as opportunities for

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<sup>3</sup> Rosen (1995). For a recent overview covering this research debate, see Bergquist (2017a).

<sup>4</sup> Rosen & Sellers (1999).

<sup>5</sup> Hoffman (2007).

<sup>6</sup> Carroll et al. (2012), 254-255, see also Fisher & Shot (1993).

changes in corporate culture.<sup>7</sup> In Jones's comprehensive study of the giant multinational Unilever, a contrasting development was identified. The company experienced increased environmental pressures from the 1960s, and by the 1970s some senior directors were active champions of the need to be proactive on environmental strategies. Yet Unilever's highly diversified and decentralized organization handicapped the development of a strong corporate-wide environmental strategy until the 1980s.<sup>8</sup> Boulett, who studied environmental strategies in French heavy industry, found that firms remained reactive in addressing environmental issues until the late 1970s.<sup>9</sup> More similar to the German case, Söderholm & Bergquist have demonstrated that Swedish pulp and paper industry embarked on a proactive strategy already in the 1960s, which was reflected particularly in its mobilization of environmental research and development (R & D) activities and strategies to integrated cleaner technologies with long-term planning for industrial renewing.<sup>10</sup> Bergquist & Söderholm have in a previous study suggested that IVL, along with the pulp and paper industry's own joint R & D programs, filled an important function as an intermediary of knowledge in the green innovation system that emerged around the Swedish pulp and paper industry from the 1960s.<sup>11</sup>

Sweden is known for taken an early world leadership in environmental policies from the 1960s, establishing the first environmental protection agency in the world in 1967, raising the issue of long-range transport of acidic compounds causing "acid rain" on the international agenda, and initiating and hosting the United Nation Conference on the Human Environment

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<sup>7</sup> Jones & Lubinski (2014).

<sup>8</sup> Jones (2005), 342-347.

<sup>9</sup> Boulett (2006).

<sup>10</sup> Söderholm & Bergquist (2012).

<sup>11</sup> Bergquist & Söderholm (2011).

in Stockholm in 1972.<sup>12</sup> Unlike Sweden's role as leading state in pushing for international collaboration in environmental politics, less international attention has been given to how the Swedish industry responded to the raising concerns about industrial pollution business in the 1960s. While today Scandinavian corporations are seeing as global leaders in corporate sustainability and social responsibility, there is very unclear when such developed started. This working paper explores how a couple of individuals in the Swedish industry proactively initiated a joint financed a research institute with the Swedish government to address air and water pollution, its knowledge production, organization and its outcomes. The initiative to establish a research institute was taken at a stage in Swedish history when scientific and applied research on industrial pollution and environmental technologies was still in its infancy.

## **2. The Origins and Start Up of IVL and IVL Co.**

The creation of IVL begins in 1963, when two influential men from Swedish industry paid a visit to the Swedish government offices to meet with the minister of finance, Gunnar Sträng. They had a proposal, which involved a creation of a new research institute; a plan that had been outlined by representatives of the Federation of Swedish Industry [Industrieförbundet]. The purpose of the institute would be to conduct research on industrial air and water pollution problems, based on co-financing between the industry and the government. One of the industrialists was Ingmar Eidem, chairman of the Water Pollution Committee of the Forest Industries and a driving force behind the forest industry's engagement in pollution issues, as

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<sup>12</sup> In 1968 the Swedish scientist Svante Oden published a paper arguing that the long-range transport of acidic compounds from the European continent, and in particular the UK and Germany was causing damage to Scandinavian lakes. OECD pushed for international research to conclude whether this could be true, and released a report in 1971. Both UK and Germany dismissed the idea as ridiculous, and some researchers have argued that the acid rain issue was the primary reasons behind Sweden's initiative to organize the UN conference. See Schereurs, Miranda A. (2002). *Environmental Politics in Japan, Germany, and the United States* (Cambridge: Cambridge University Press), 92-95.

well as the chairman of the Federation of Swedish Industry 1969-1971. The other person was Stig Freyschuss, CEO of the Water Laboratory of the Forest Industry [Skogsindustriernas Vattenlaboratorium], which had been founded already in the mid-1950s. The Swedish forest industry was in other words already working on its air and water pollution problems, although it was still only on small scale.<sup>13</sup> The Federation of Swedish Industry, the association representation all major industries in Sweden, had also created a water pollution committee in 1953, which include air pollution in 1958, named the Water and Air Pollution Committee.

The Swedish government turned out to be positive about the initiative, and Freyschuss and Eidem were asked to organize a more detailed proposal. Olof Palme, at that time minister “without portfolio”, was commissioned by the prime minister Tage Erlander to investigate in which ministry a research institute that targeted industrial pollution could be subordinated. Palme, who in a few years would be the Swedish prime minister to host the UN conference in Stockholm, recommended the Ministry of Agriculture.<sup>14</sup> Two years later, in 1964, the Federation of Swedish Industry submitted an extensive proposal on the funding and organization of a new research institute signed by the majority of the key industrial organizations in Sweden. The proposal also included a plan for the creation of a consulting company, which purpose would be to work directly with individual companies but in close connection with the institute. Negotiations began with the Social Democratic government and eventually, through a government bill in 1965, it was decided that the Institute for Water and Air Pollution [IVL in Swedish] and a consulting company, the IVL Company [Hereafter IVL

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<sup>13</sup> For a historical overview, see Söderholm & Bergquist (2012).

<sup>14</sup> Interview with Stig Freyschuss, president of the Water Laboratory of the Forest Industry from 1958 to 1964 and of IVL from 1966 to 1982, Stockholm, Oct. 8, 2009; IVL Annual Report (2016), p 2.

Co., should be established with operations starting in January 1966.<sup>15</sup> The establishment of IVL came in other words to predate the implementation of the Swedish Environmental Protection Act (1969) by three years. The creation of IVL thus reflected the on-going mobilization within the Swedish manufacturing industry as well as the government to enhance knowledge on the relationship between industrial production and its environmental consequences and how to identify and develop effective solutions.<sup>16</sup>

However, although increasing concerns about industrial pollution emerged in the 1960s, incipient steps to advance knowledge of environmental degradation caused by industrial pollution had been taken much earlier. The Swedish pulp and paper industry had a long tradition of industry collaboration in R&D.<sup>17</sup> Among other things, this industry appointed a committee already in 1908 (active in 1908-1909) to investigate methods to reduce odor problems in the Swedish sulfate pulp industry.<sup>18</sup> Initiatives such as the Water Pollution Committee [Vattenföroreningskommittén] followed in 1940, which was further developed into the Water Laboratory of the Forest Industry [Skogsindustriernas Vattenlaboratorium] (SIV) in 1954, which in many ways was a predecessor to what would later become IVL.<sup>19</sup> A vibrant R & D activity also emerged around one single industrial project related to the construction of a copper smelter in the north of Sweden during the interwar period, which was focused on preventing air pollution of arsenic and sulfur. The mining company Boliden, who constructed the smelter could not, unlike Swedish pulp and paper industry, collaborate with

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<sup>15</sup> His Royal Majesty's Bill, no. 154, 1965; See also "Skrivelse från Sveriges Industriförbund till regeringen 9 september 1964" [Letter from the Federation of Swedish Industries to the Government 9 September 1964], Immissionsakkunniga [Expert witness in public nuisances], Vol. 1, National Archives, Stockholm, Sweden.

<sup>16</sup> Bergquist & Söderholm (2011).

<sup>17</sup> Söderholm (2007); Söderholm & Bergquist (2012).

<sup>18</sup> Söderholm & Bergquist (2012). A more comprehensive research on water pollution caused by the pulp and paper industry emerged in Germany. See Mutz (2009).

<sup>19</sup> Söderholm & Bergquist (2012).

other Swedish companies simply because there was no company in the country who had the same challenges or shared the same processes. Instead, knowledge that about how develop a metallurgical process that to control (only some of it) air pollution was transferred mostly from the copper industry in the United States and partly from Germany.<sup>20</sup>

IVL's inception in its co-financed (50/50 industry/state) form is not unique in itself. The Swedish system of collective research institutes has its background in the 1940s, when a number of collective research institutes were formed for the purpose of strengthening Swedish industrial competitiveness. This was not a typical Swedish phenomenon, but inspiration was drawn from other countries, especially Germany.<sup>21</sup> Among the new collective research institutes in the 1940s was the Swedish Pulp & Paper Research Institute [Svenska Träforskningsinstitutet] (STFI).<sup>22</sup> STFI was organized with the economic framework determined through multi-year contracts between the government and a foundation formed by the affected companies.<sup>23</sup> Overall, it was the Swedish pulp and paper industry that was in the lead in organizing research on water pollution, and in the 1950s the Federation of Swedish Industry wanted to establish a service platform, which could serve all industries. In 1953, a water pollution committee was established as a first stage and five years later, the committee was also working with air pollution issues.<sup>24</sup>

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<sup>20</sup> Bergquist & Lindmark (2016).

<sup>21</sup> Sörlin (2006), p 24.

<sup>22</sup> The original idea of STFI was to pursue research on forest products in close cooperation with the Royal Institute of Technology in Stockholm, and to advance methods for their rational refinement and exploitation. Eventually, in the 1970s, the R&D activities at STFI were directed towards improved material and energy utilisation from the wood, as well as on developing new systems of process control and more environmentally friendly bleaching methods. So, even though STFI was not established to address pollution issues, it ended up doing so as improved material utilisation and process control became an important strategy to combine pollution reduction with production expansion from the late 1960s and onwards (Eriksson 2010; Söderholm, 2007).

<sup>23</sup> Sörlin (2006).

<sup>24</sup> Federation of Swedish Industry Archive (hereafter FSIA), Environmental Affairs Issues 1959-1960, F9: 1, Stockholm: Center for Business History. "Internal memorandum concerning the Federation of Industry's

In 1958, Swedish Federation of Industry's Water and Air Pollution Committee reached out to the industry federations in Denmark, Norway and Finland to access information whether they had similar ongoing service activities. It turned out that the industry in neither Norway, Finland nor Denmark had organized a joint service to support water pollution control, and it was only in Denmark where water pollution had emerged as concern.<sup>25</sup> During the same year, the Federation of Swedish Industry decided to work more active on water pollution issues and hired the water protection engineer Leif Bruneau for full time service. A year later, a round table conference focused on water pollution was held in Paris, with industry associations participating from Sweden (with Bruneau representing the Federation of Swedish Industry), Denmark, Germany, the UK, Austria, France, Italy, the Netherlands, Belgium, and Luxemburg. The initiative had been taken by the German industry, who suggested that it would be beneficial to share knowledge and collaborate, especially between industries based in countries who shared the same lakes and rivers. In the UK and Germany, the industry associations had established committees for air and water pollution, while it was only the Dutch industry who had established an actual research institute centered on water and air pollution.<sup>26</sup> Although the Federation of Swedish industry now turned more and more attention towards both air and water pollution, there was yet no research organized on the issues. The only going research was driven by the Swedish pulp and paper industry

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continuing water treatment activities on August 20, 1958, to be discussed at the meeting of the Water and Air Pollution Committee on September 15, 1958.”

<sup>25</sup> FSIA, Environmental Affairs Issues 1959-1960, F9: 1, Center for Business History. “Letter from the Federation of Norwegian Industry (Knut Hald) to the Federation of Swedish Industry September 9, 1958; Letter from the Federation of Finnish Industry (Veikko Reinikainen) to the Federation of Swedish Industry, September 8, 1958; Letter from the Federation of Danish Industry (E. Klæbel) to Federation of Swedish Industry, September 10, 1958”. All Letters attached to the minutes passed at the meeting of the Water- and Air Pollution Committee on September 15, 1958.

<sup>26</sup> FSIA, Environmental Affairs Issues 1959-1960, F9: 1, Stockholm: Center for Business History. ”Report from a round table discussion in Paris concerning water pollution, September 9, 1959, by Leif Bruneau. Appendix to the protocol, of the meeting at Water- and Air Pollution Control Committee, November 11, 1959.

who already in 1945 had established the *Water Pollution Committee* to examine the pollution of water courses.<sup>27</sup>

In a Swedish context, the leading industry associations appears to have realized already in the early 1960s that sooner, or later, stricter and more challenging environmental policies would emerge, and chose cooperation over confrontation as a strategy.<sup>28</sup> The Swedish business system formed from the late nineteenth century was centered on engineering industries and an infrastructure of smaller service organizations, equipment suppliers, and research organizations developed around core exporting commodities such as pulp and paper.<sup>29</sup> Against this background, it is not surprising that the emerging knowledge production around the industry's pollution problem came to evolve in an engineering and manufacturing context. The idea of cooperation and joint efforts between several types of manufacturing industries and the government, and the focus on addressing both water and air pollution fitted well into this this business system.

In the late 1960s, the environmental awaking was in full swing in the US and was rising in Europe. Sweden, however, emerged as a forerunner in environmental policies, when *Naturvårdsverket*, the Swedish Environmental Protection Agency, was established in 1967 as the first EPA in the world, soon followed by counterparts in the US and Japan.<sup>30</sup> Two years later, the Swedish Environmental Protection Act was enforced, which radically changed the conditions for how key Swedish industries, such as the pulp and paper, iron and steel industry and other highly polluting industries could operate in the future.<sup>31</sup> But indeed, the

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<sup>27</sup> This was partly a response to the reform of the Swedish Water Act in 1943. See Söderholm & Bergquist (2012).

<sup>28</sup> Lundqvist (1971); Lönnroth (2010).

<sup>29</sup> Edquist & Solvell (1993)

<sup>30</sup> Jänicke (1992).

<sup>31</sup> Bergquist (2017b).

Swedish industry was not taken by surprise by this legislation. In the early 1960s, investigations for stricter pollution control regulations were ongoing in countries like Germany<sup>32</sup>, and the Swedish industry had been involved in preparations for stricter regulations in Sweden from the mid-1960s.

### **3. A position between the industry and the state**

In 1966, the same year as IVL started its operations, the Swedish government appointed a set of different committees to elaborate so called *acceptable requirement levels* (riktvärden) for a various types of industries. Representatives from the concerned industries, government agencies and scientific expertise gathered in these committees to develop benchmarks for technologies and emissions standards for different industries. The purpose with developing these benchmarks was to use them as guiding principles during the implementation of the Environmental Protection Act. The Act in itself, was a framework legislation built on a licensing system administrated by the Franchise Board of Environmental Protection (FBEP) who was established the same year as the Environmental Protection Act came into force 1969.<sup>33</sup>

The Swedish regulation to control industrial pollution developed with obvious elements of corporatism.<sup>34</sup> Another feature was that the Environmental Protection Act allowed for flexibility. Any required level of emission reductions required from a mine, a smelter or a pulp mill, had to be balanced between three criteria; what was viewed as “technically feasible, economically reasonable and environmentally motivated”.<sup>35</sup> Science

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<sup>32</sup> Schreurs (2002).

<sup>33</sup> For a review of the committee work, see e.g. Lundqvist (1971; 1980).

<sup>34</sup> Rothstein (1992); Lundqvist (1997);

<sup>35</sup> Bergquist et al (2013).

based information about emissions, their effects in the ambient environment as well as technology became therefore extremely important knowledge. The government and the industry shared the belief that the enforcement of the Environmental Protection Act should be based on natural science and engineering knowledge.<sup>36</sup> By engaging in basic and applied research on the quantity, content, and environmental impact of emissions, knowledge that indeed was equally important to industry and the environmental authorities, IVL came to underpin the implementation of the Swedish environmental protection regulation and the greening of Swedish industry in the 1960s and '70s.

One of the rationales behind IVL's establishment in 1966, was to pool financial and human resources housed under one roof. Here, industry and authorities could collaborate to identify and search for solutions to the most acute environmental problems. As mentioned, a number of industry associations joined the pulp and paper industry to form IVL, including the mining and utility industry associations and Sweden's chemical industry office. Many water and air-quality problems were common to different business sectors, and by coordinating specialized research programs, IVL was able to accommodate a number of business interests at the same time. Access to in-house specialists enabled various industries to assess their environmental problems and to participate in developing solutions.<sup>37</sup>

IVL and IVL Co. shared facilities and were jointly administered, although the IVL Co. was not governed or funded by the state in any way. While IVL's primary task was to conduct research on the relationship between industrial production and its environmental

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<sup>36</sup> Lundqvist (1971); Bergquist et al (2013); Lönnroth, (2011).

<sup>37</sup> His Royal Majesty's Bill, no. 154, 1965; "Skrivelse från Sveriges Industriförbund till regeringen 9 september 1964" [Letter from the Federation of Swedish Industries to the Government 9 September 1964], Immissionssakkunniga [Expert witness in public nuisances], Vol. 1, National Archives, Stockholm, Sweden.

impacts in order to find effective solutions, the IVL Company supplied consulting services and further advised and assisted in negotiations between industry and government agencies.<sup>38</sup>

IVL Co. represented the most direct link between IVL and the firms, and was also hired by IVL to conduct fieldwork. In turn, IVL Co. hired IVL experts to conduct investigations and perform assessments. Hence, IVL Co. not only transferred scientific knowledge from IVL to individual firms, but also undertook a more entrepreneurial task in translating this knowledge into practical solutions. IVL Co. furthermore communicated the experiences from one mill to another and sometimes even encouraged different companies to share experiences. One central function was also to bring information about the challenges facing the industry, back to IVL.<sup>39</sup> Through their practical work ‘on the floor’ at individual mills, IVL and IVL Co. also gained practical knowledge that helped them identify core issues to address.<sup>40</sup> Through the combined efforts of IVL and the IVL Co., individual firms could in other words access a range of specialist services without taking on the costs and risks of developing such expertise on their own.

During the institute’s early years, it housed about twenty employees in a leased laboratory and office space at the Royal Swedish Academy of Engineering Sciences (Kungliga vetenskapsakademien, KVA) in Stockholm, where it shared facilities with IVL Co. The number of employees expanded to 44 in 1970, in 1974, the institute and the company needed to move to larger facilities due to the growing workforce, and in 1979, the number of employees had expanded to as many as 150. Activities were funded by grants from research

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<sup>38</sup> See, for instance, IVL annual report 1980/81, archive of Swedish Environmental Research Institute (IVL), Stockholm.

<sup>39</sup> Interview with Arne Jernelöv, research leader of IVL in the 1970s, Stockholm, 19 May 2010; interview with Stig Freyschuss, president of the Water Laboratory of the Forest Industry from 1958 to 1964 and of IVL from 1966 to 1982, Stockholm, 8 Oct. 2009; interview with Björn Lundberg, president of IVL in the 1980s and 1990s, Sollentuna, 11 May 2009.

<sup>40</sup> Interview with Arne Jernelöv; interview with Stig Freyschuss.

councils and from the industry. However, the number of external commissions grew rapidly, and by the late 1970s these commissions accounted for more than a half of IVL's operations.<sup>41</sup> As the research manager in the 1970s, Arne Jernelöv, noted, "when we got the first results, it was much easier to get research funded [from] other environmental research-supporting organizations."<sup>42</sup> Hence, IVL played an important role in conducting basic research, which would have been too costly and risky for individual firms to engage in.

IVL's research activity was directed early on at water quality and so-called recipient studies. This was natural, as the institute took over research projects as well as personnel from SIV, the former water laboratory of the Swedish forest industries. Another explanation for this direction was that the legislation that was current at the time of IVL's founding in 1966, i.e., before the implementation of the Environmental Protection Act, was directed on water protection issues. This concerned a number of well-established problems that were handled during water rights court hearings, not least related to pulp and paper manufacturing, such as emission of oxygen-consuming substances. The water protection research was divided into a chemical and a biology department. The chemical department took over personnel from SIV and was primarily devoted to chemical-technical activities while the biology department, naturally enough, focused on environmental impacts from industrial emissions.<sup>43</sup>

Arne Jernelöv was employed by IVL as a biologist in 1966, and later became research director for the institute. By his own words, he was surprised that he was even offered a position at IVL, as he was interested in researching issues which he believed was not

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<sup>41</sup> IVL annual report 1966–1979/80, archive of IVL, Stockholm.

<sup>42</sup> Interview with Arne Jernelöv.

<sup>43</sup> Interview with Arne Jernelöv; interview with Stig Freyschuss.

“in the interest of industry” at least not in the short term.<sup>44</sup> It was however exactly these issues that he would later be given the opportunity to research. When Jernelöv was employed they were three employees in total at the biology department, which hence was much smaller than the chemical department. After only a few years, however, the biology department grew larger than the chemical department as effect/recipient research grew in importance at IVL.<sup>45</sup>

In April 1966, the IVL board decided to set up a separate research department for air quality research<sup>46</sup> in connection to the operations of Professor C. Brosset at Chalmers University of Technology in Gothenburg.<sup>47</sup> Hence, a working group was built up in 1967, with Brossett as the “head” and with other personnel financed by the Swedish Environmental Protection Agency.<sup>48</sup> A few years later its operations had developed, and now also included a separate consulting company.<sup>49</sup> During the leadership by Brossett and later of Peringe Grennfelt, primarily regional air pollution problems, such as acidification and those related to oxidants and heavy metals, constituted the most central research activities.<sup>50</sup> By the late 1970s, IVL had furthermore established subsidiary experimental and research stations in various parts of Sweden.

The various departments at IVL, which turned into research groups in the mid-1970s, were populated by both natural scientists and engineers. Every year these researchers presented proposals to the IVL expert committee, outlining their views on what the research at

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<sup>44</sup> Interview with Arne Jernelöv.

<sup>45</sup> Interview with Arne Jernelöv.

<sup>46</sup> IVL board minutes 14/4 1966, archive of IVL, Stockholm.

<sup>47</sup> IVL board minutes 1/9 1966, Annex 1, archive of IVL, Stockholm.

<sup>48</sup> IVL board minutes 13/2 1969, Annex 2, archive of IVL, Stockholm.

<sup>49</sup> IVL annual report 1973/74, archive of IVL, Stockholm.

<sup>50</sup> Interview with Arne Jernelöv; IVL annual report 1986/87, IVLA

IVL should concern. The committee consisted of about twenty representatives from industry, mainly managers, and a slightly larger share of representatives from government agencies, such as the Swedish Environmental Protection Agency (SEPA), universities, and other research institutes. A proposal was subsequently endorsed by the IVL board, which in turn consisted of ten representatives, five state agency officials, such as the general director of SEPA (from 1971), and five industry representatives.<sup>51</sup> The direction of IVL's research programs was thus decided by state agency officials and representatives from different industry sectors in concert with various natural scientists and engineers. Together they identified, what they perceived as, the most urgent environmental problems.

#### **4. Operational Focus**

The debate on mercury has been identified as a major trigger behind a broader public environmental debate in Sweden in the 1960s.<sup>52</sup> Toxic mercury emissions also emerged as an early issue to address in IVL. In a joint project with the trade association of the chlorine industry in 1966, IVL and IVL Co. investigated the presence of mercury in lye and sediments in the immediate vicinity of chlorine mills across the country. In the course of these investigations, IVL developed methods for determining mercury levels and examined the tendency of oxidized mercury to bind chemically to different kinds of sediments.<sup>53</sup> IVL's research on mercury did not only concern the extent and effects of the mercury emissions from the chloralkali mills, but also included determination of the biological methylation of mercury. In connection to this, studies on the effects of biogenic and synthetic methyl mercury on cats were undertaken. The results showed that cats that had been fed with fish

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<sup>51</sup> IVL annual report 1966–1979/80, 1986/87, archive of IVL, Stockholm.

<sup>52</sup> Lundgren (1999) p 242.

<sup>53</sup> IVL annual report 1966/67, archive of IVL, Stockholm.

caught in some of the Swedish waterways proved “minamata symptoms”, such as dragging legs, and eventual death.<sup>54</sup> In Sweden this led to a quick blacklisting of the concerned waterways, and authorities quickly issued rules which limited the amount of fish from freshwater lakes that could be consumed. IVL also developed further methods for the analysis and also the decontamination of mercury.<sup>55</sup>

Issues that clearly received most attention both at IVL and IVL Co. in the 1960s concerned the identification of the flow and amount of contaminated discharges. Most of their operations were thus carried out at individual mills, especially in the pulp and paper industry. It might be hard to imagine today, but when IVL arrived at the old mills, it could be a total jumble of old pipes. There were seldom any drawings to speak of that could give information about what was running in the pipes, in which direction, and where. As Jernelöv puts it: “usually, the best way to get information was to call in some old retired foreman who had worked there for 40 years”.<sup>56</sup>

Early operations also involved the development of methods, standards and devices to measure and assess the character, extent, and impact of industrial emissions. Activities furthermore entailed restoring the receiving water body and develop and install methods for treatment of industrial waste, especially of wastewater. During the 1970s, and as an outgrowth of the early efforts, control of purification plants became a growing business. Designing these plants and participating in industrial development projects accounted for an expanding part of the activities of the institute and the consulting company. Basic research on the environmental damage caused by specific pollutants also expanded – a shift that was reflected in the growing number of natural scientists employed by IVL. It made sense to

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<sup>54</sup> IVL annual report 1968/69, archive of IVL, Stockholm.

<sup>55</sup> Interview with Björn Lundberg.

<sup>56</sup> Interview with Arne Jernelöv.

assess in depth the effects of emissions before developing measures to reduce the most damaging effects.<sup>57</sup>

Although most of the operations took place at individual mills, IVL managers continuously discussed how the institute could improve interactions with user-firms.<sup>58</sup> A key action in line with this was the organizing, from 1966 and onwards, of conferences held annually that were attended by industry and government authorities from Sweden and other Scandinavian countries in order to encourage communication among all interested parties.<sup>59</sup> In the 1970s, IVL further intensified its efforts to become more inclusive by engaging IVL Co. representatives in its management.<sup>60</sup>

Operations for addressing the environmental impact of wastewater systems were to a lesser extent also driven by local authorities. Thus, e.g., in the early 1980s, IVL investigated the possibility of using household waste-disposal sites as anaerobic filters for purifying leach water. In a parallel project, IVL worked with SSVL to investigate the possibility of using bark for the same purpose.<sup>61</sup> Such efforts illustrate how IVL simultaneously explored similar solutions to similar problems but in widely diverse sectors.

Both IVL's the IVL Co.'s activities grew in the 1960s and '70s to an extent that could not have been foreseen at the time of its founding. The activity of IVL grew by an average of 30 and 45 percent annually during the 1960s and 1970s, respectively.<sup>62</sup> The large

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<sup>57</sup> IVL annual report 1966–1979/80, 1986/87, archive of IVL, Stockholm; interview with Arne Jernelöv; interview with Stig Freyschuss.

<sup>58</sup> IVL annual report 1975/76 and 1978/79, archive of IVL, Stockholm.

<sup>59</sup> IVL Conference 1975.

<sup>60</sup> IVL board minutes 31 Jan. 1975, archive of IVL, Stockholm.

<sup>61</sup> IVL annual report 1980/81.

<sup>62</sup> In current prices, the activity of IVL grew by an average of 30 and 45 percent annually during the 1960s and the 1970s, respectively. See Bergquist and Söderholm (2010).

number of commissions and research projects carried out at this time reflects the gap in Swedish specialist knowledge on industrial pollution that IVL was created to fill. The growth further reflects a great demand from both industry and government, as well as their joint mobilization to measure the scale and impact of emissions which formed the basis for industrial adaptation to take place.

### **5. A Broader Role as National and International Expertise**

Apart from assisting Swedish industry in measuring the scale and impact (and remedy) of emissions, IVL worked more broadly as an organization of national and in some cases international environmental expertise. Before environmental research gained a place in the curriculum of Swedish universities, IVL was the only organization in Sweden with the requisite knowledge and research capabilities to operate within the environmental field. IVL thus became a central resource for Swedish authorities to consult on a wide range of environmental issues, and it also organized and conducted a number of environmental courses at Swedish universities.<sup>63</sup> Another critical feature of IVL and IVL Co. was that the knowledge they gathered on industrial pollution formed the basis for environmental policies, such as plant specific emission permits granted by the FBEP, and made them consistent with the latest technological insights. IVL furthermore offered an open arena for knowledge-exchange between government and industry interests. Meetings took place in boardrooms, within the expert groups, in the laboratories, at individual firms, and jointly with the IVL Co. The strong agreement between the government and industry on IVL's value also conferred legitimacy on the knowledge and technology developed there.<sup>64</sup> The institute thus came to play an important

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<sup>63</sup> See e.g. IVL Board minutes 1 Sept. 1966, 24 Jan. 1967, and 17 Sept. 1971, archive of IVL, Stockholm; IVL annual report 1966–1979/80, archive of IVL, Stockholm.

<sup>64</sup> Interview with Arne Jernelöv; interview with Stig Freyschuss; interview with Björn Lundberg.

role as a mediator of environmental knowledge in the public sphere. Its broader societal role is further reflected in the research it conducted on the environmental effects of emissions caused by consumer products, such as Sulphur dioxide, a byproduct of residential heating oil, petroleum spills, and detergents.<sup>65</sup>

In the 1960s and 1970s, IVL was noticed outside Sweden for its environmental expertise, and as such, at a number of occasions, IVL was employed by the United Nations (WHO and UNESCO, the United Nations Educational, Scientific and Cultural Organization).<sup>66</sup> The UN-institutions hired IVL in matters concerning, not least, the analysis and remediation of oil spills and mercury. Oil damage protection research was initiated at IVL in June 1971, for the purpose of studying effects of oil pollution on the brackish water system of the Baltic Sea.<sup>67</sup> The research, however, became international after only a few years. Thus, in the 1970s IVL, at the request of the UN and in part together with the Group of Experts on Scientific Aspects of Marine Pollution (GESAMP) and affected governments, studied the effects of oil in marine environments in Guatemala, Belize, Colombia, and especially in connection with the very large release of oil in May 1976 at La Coruna in Spain.<sup>68</sup> Later the group went under the name Oljejouren [“Oil On-Call”] and continued during the 1980s to study effects of oil spills.<sup>69</sup>

We have already observed that the mercury issue became a catalyst for the environmental debate in Sweden in which IVL developed methods for both the analysis and decontamination of affected waterways. For one thing, IVL developed cutting edge methods

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<sup>65</sup> IVL annual report 1966–1979/80, 1986/87, archive of IVL, Stockholm.

<sup>66</sup> Interview with Arne Jernelöv; IVL annual report 1967/68, 1975/76, 1976/77, and 1981/82, archive of IVL, Stockholm; IVL Board minutes 20 Sept. 1973 and 3 Oct. 1974, archive of IVL, Stockholm.

<sup>67</sup> IVL annual report 1971/72, 19, archive of IVL, Stockholm.

<sup>68</sup> IVL annual report 1975/76, archive of IVL, Stockholm.

<sup>69</sup> See for example IVL annual report 1986/87, archive of IVL, Stockholm.

for taking care of mercury-contaminated sediment. This involved developing methods for moving the sediment out of the water, and separate the mercury.<sup>70</sup> In connection to this IVL was hired to help out in the Japanese Minamata disaster. Hence, Arne Jernelöv and others made a study trip there in the spring of 1968.<sup>71</sup>

At the request of the UN, IVL also ran projects that were aimed at creating a basis through application of mathematical modelling for planning of various environmental decontamination and environmental protection measures. In the fall of 1974, IVL was also appointed by WHO as principal for an International Reference Center for Environmental Planning and Services to be located in Stockholm. For a few years in the 1970s, Arne Jernelöv, the research director at IVL, also worked at WHO.<sup>72</sup>

IVL's international network and reputation is also mirrored by the fact that it organized a large international conference in Stockholm on industrial water pollution in 1970. The conference was organized in collaboration with the *The International Union of Pure and Applied Chemistry* (IUPAC). Basically all industries perceived as relevant in this connection were represented. Over one hundred lectures were presented during the conference, where almost one-fourth concerned the paper and pulp industry's water pollution problems, and an almost equally large percentage the problems of the food industry. The oil, coal, mining, metal and chemical industries were represented to a smaller extent.<sup>73</sup> However, the Swedish government was overall building a strong international reputation as a leader in environmental politics in the late 1960s and the early 1970s. In 1972, the first United Nation Conference on the Human Environment was held in Stockholm, and the Social Democratic Government

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<sup>70</sup> Interview with Björn Lundberg.

<sup>71</sup> IVL annual report 1967/68, archive of IVL, Stockholm.

<sup>72</sup> See e.g. IVL Board minutes 20/9 1973, archive of IVL, Stockholm; interview with Arne Jernelöv.

<sup>73</sup> IVL-nytt (1970c, no. 3) and IVL-nytt (1970d, no. 4, p. 9f).

would take a lot of credit in the long run. At the same time the Swedish industry was excluded from having any representation in the Swedish delegation. The business historian Geoffrey Jones have argued that the perceived role of business at the Stockholm conference was decidedly unglamorous. There was a widespread assumption that markets were unable to address the environmental externalities which were so damaging on their own, and that “producers”—their terminology for firms—were polluters. Business was not perceived as part of a solution, but rather as central to the problem.<sup>74</sup> Instead, the Federation of Swedish Industry organized together with the European Chamber of Commerce the “World Industry Conference on the Human Environment” in Gothenburg, Stockholm, with 100 delegates from 14 countries.<sup>75</sup> The conference, however, did not receive much attention in media. Although the Swedish industry and government had formed a collaborative social contract in solving issues of environmental protection in Sweden, this approach would however not be applied within the realm of international environmental politics in the 1970s.

A central explanation behind IVL’s international engagements, were they often were hired as an “emergency service”, was likely the shortage of skills around the world within areas such as oil spills and mercury. What made IVL interesting from an international perspective was however also the way in which IVL worked with the whole spectrum of environmental problems, from identifying them in industry and in the rest of society – in waterways as well as in the air – to solving them with environmental technology. Björn Lundgren, president of IVL in the 1980s and ’90s, pointed out that if you have the whole picture of a problem, you solve it in a different way than if you are only looking at a small part of it.<sup>76</sup>

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<sup>74</sup> Jones (2017), p 90.

<sup>75</sup> *Vår Industri* (1972c no 4); *IVL-nytt* (1972c no 2).

<sup>76</sup> Interview with Arne Jernelöv; interview with Stig Freyschuss; interview with Björn Lundberg.

## **6. Competition and Changing Business Opportunities in the 1980s**

In the late 1970s and early 1980s, IVL faced a growing need to change its organization and to redefine its operations. There were both internal and external pressures behind this. The initial work with the rough mapping of emissions and decontamination of industry, where much had been achieved simply through improved measurement and analysis through new methods/-devices along with relatively basic and interchangeable (between different lines of businesses) purification methods, was now coming to an end. Remaining industrial environmental challenges were more complex and differed more between the different lines of industries, meaning fewer assignments and projects for IVL. In addition, there was a recession which further contributed to fewer and fewer lines of businesses being interested in contributing to the financing of IVL. At the same time, the environmental issue in general was entering a new phase, where diffuse emissions from transport and consumption emerged and needed more attention. Hence, the government-industry base was no longer as obvious. In parallel, environmental research started to gain ground at the universities and competed for public funding with IVL. Environmental issues also started to become a lucrative business for consulting firms with focus on environmental technology, with one of the large consulting companies being ÅF-Energi-Konsult-AB. Thus, increasing competition also became a problem for the IVL Co.'s consulting services.<sup>77</sup> The activities of IVL and IVL Co. had also grown increasingly distinct as IVL became more engaged in natural science research connected to research at universities, while IVL Co. concentrated on activities related to

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<sup>77</sup> Interview with Björn Lundgren.

industry.<sup>78</sup> Furthermore, the practice of the IVL Co. of representing individual firms while they were being licensed by the FBEP was in time considered problematic for the credibility of IVL.<sup>79</sup> For all these reasons, IVL Co., was taken over by ÅF-Energi-Konsult-AB in 1980.<sup>80</sup>

IVL's research operation subsequently continued without the consulting company, but fairly soon IVL realized that a consulting department was needed, i.e., a need for applying research results to practical solutions at the firm level. Therefore, a consulting department was re-launched. The consulting operation grew quickly and soon constituted almost 80 percent of the operations, meaning the institute became rather sensitive to shifts in business cycles. In the event of a recession, IVL was even on the brink of going into bankruptcy, which entailed a peculiar situation because the organization was a foundation, not a company or an economic association or other legal entity that was covered by legislation in the event of bankruptcy. For that reason, in 1982, IVL was reorganized into Sweden's first incorporated research institute under the name AB IVL. As IVL over the years had become an environmental research institute (the term "environment" did not exist in that sense in the 1960s) the organization was eventually renamed to IVL, the Swedish Environmental Institute.<sup>81</sup> Today, environmental research is well established and dispersed at Swedish universities as well as universities and research institutions elsewhere, a situation that is significantly different from the time when IVL was founded in the initiative of the Federation of Swedish Industry. IVL now represents one of the smaller research institutes in the country. In addition, the consulting industry has been expanding in the field of the environment since

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<sup>78</sup> IVL annual report 1966–1979/80, archive of IVL, Stockholm; interview with Arne Jernelöv; interview with Stig Freyschuss.

<sup>79</sup> Interview with Arne Jernelöv.

<sup>80</sup> IVL annual report 1980/81, archive of IVL, Stockholm.

<sup>81</sup> Interview with Björn Lundberg.

the 1980s, where IVL hence now is one of many. In 2016, IVL had a revenue of close to 275 million SEK (33 million USD) and about 250 employees. Besides the parent company IVL, its organizational structure also included the subsidiary companies Bastaonline AB, EPD International AB, IVL Environmental Technologies (Beijing) Company Ltd and the joint venture-company Sino–Swedish Environmental Technology Development Center, SEC, China.<sup>82</sup> The story of IVL mirrors in many aspects how business challenges related to the natural environment have changed and been growing in scope and complexity far beyond concerns around pollution in the 1960s. Sustainability, with climate change as the most pressing issue, has grown into a mega challenge that cuts across all sectors in society. The basic idea which formed IVL: the idea of collaboration and cost sharing between firms and between firms and government to learn and advance sustainable technologies and services, has however not been more relevant.

## **Conclusions**

Sweden acquired an international reputation from the 1960s as a leader in environmental policy, which was symbolized by its role as the host of the first UN conference on the human environment in Stockholm in 1972. This working paper has shown the importance of big business in the process, which stands in contrast to the experience of the United States.

Swedish big business became interested from the 1950s in accumulating environmental knowledge. Starting with an initiative taken by the Swedish Industry Federation in 1963, it convinced the government to establish a joint research institute, IVL, and a closely related consulting company IVL Co., to address industrial pollution. IVL was launched three years later. It came to fill an important role as knowledge producer and as an

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<sup>82</sup> IVL (2016).

intermediary of environmental knowledge. A central element in Swedish regulation was the idea of the advantages of cooperation and consensus-seeking decision-making, and the ambition to base environmental policy on a knowledge platform of both natural science and engineering competence. IVL aimed to fill a void as scientific knowledge on many environmental issues was still scarce. The government conceptualized the problem as needing to accomplish objective assessments based on scientific evidence, as well as obtaining consensus around solutions. It was a matter of providing basic and applied research on the measurement and assessment of the character, extent, and impact of emissions, as well as of creating legitimate instruments and standards for methods of routine analysis.

The involvement of the government in IVL gave legitimacy to the new methods that IVL developed to measure environmental impacts. One important achievement was the development of methods, standards and devices to measure and assess the character and impact of industrial emissions, and methods for treatment of industrial waste, especially waste water. IVL also conducted research on, among other things, the effects on the environment of packaged consumer products. Hence, IVL emerged as a central resource for Swedish government officials to consult on a wide range of environmental issues, and to make policy consistent with the latest research, especially when related to plant specific licenses. IVL enabled bureaucrats to access information from 'inside the gates' of industry and could access central information. As for big business's motives for engagement in IVL, it was significant that the pulp and paper industry already had decades of experience from early pollution legislation implemented over their activities. This industrial sector had learned from this experience of the importance of making the right investment from start, to avoid unnecessary costs, as well as the need for basic research in this context. The pulp and paper industry early on realized the value of jointly investing in basic- as well as applied research in order to share both costs and risks, and therefore became a key factor behind the Swedish industry's

initiative to engage with the state in IVL.

The Swedish industry took a proactive approach to deal with the evolving environmental issue when it together with the Swedish government formed behind IVL in 1966. With the initial division of IVL into a research institute and a consulting company, IVL could work directly on identifying problems as well as solutions that targeted industrial processes and not only abatement technologies. This in turn benefited both individual firms, which currently received the assistance of IVL, as well as the overall knowledge development at the institute. Hence, IVL Co. could transfer science based knowledge from IVL to individual firms and at the same time bring back information to IVL of applied experiences at the firm level. The fact that IVL participated in development projects along with individual firms, consultants, equipment suppliers and research institutions further contributed to a flying start of environmental policies and the greening process of the Swedish industry in the late 1960s and the early 1970s.

However, over time, the rationale behind IVL and particularly its government-industry base grew less obvious as the environmental challenges faced by both society as a whole and the individual firms changed character. In addition, competition grew for both the institute and the company. Still, only shortly after IVL Co. had been acquired by a competing consulting company in 1980, the obvious benefits of a consulting operation (for applying research results to practical solutions at the firm level) became clear, whereupon the consulting operation retained a central place in IVL's activities.

Today, IVL remains one of multiple actors working with consulting activities in the environmental field for industry and the Swedish society. Consulting in the area of business sustainability is, in contrast to the 1960s, a large global business. However, the original idea with IVL was to accomplish effective collaboration between firms and authorities, and this idea is even more relevant today than it was in the 1960s.

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