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**Dioxins: An Easy Problem to Solve or a Hard-Fought Battle for the
Environment? a Case Study of How and Why the Pulp and Paper Industry
in Sweden Transitioned Away From Chlorine-Bleaching**

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ABSTRACT

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The situation for the environment is in many ways dire. However, amidst all the negative environmental developments it is easy to neglect the successes that have actually happened. With the aim of better understanding what factors facilitated such a success this thesis analyses one such case, namely emissions of dioxins and chlorinated waste from the pulp and paper industry in Sweden. Dioxins were discovered in the wastewater from mills in the mid-1980s and in the span of just a few years emissions were drastically reduced to the point of becoming a non-issue. Using a single case study design this thesis analysis this case using middle-range theorizations of the Treadmill of Production and Ecological Modernization Theory, both prominent theories from environmental sociology most frequently thought of as macro-theories. Two methods were utilized to examine the case: expert interviews, and qualitative content analysis of newspaper articles. The findings suggest that regulation, and the regulatory style of Sweden, which eschews national regulation in lieu of actor-by-actor regulation, played important roles in creating the conditions for transitioning and as drivers in the early stages of transitioning, which is also supported by previous research on the topic. Regulation as a main driver was later replaced by consumer pressure, both in Sweden and in export markets, which demanded chlorine-free products in part based on fears of dioxin contamination of the products. The power of citizens was found to have been crucial in reaching a positive outcome.

Keywords: environmental sociology, ecological modernization, treadmill of production, middle-range, industrial transition

Popular Science Summary

The situation for the environment is in many ways dire. However, amidst all the negative environmental developments it is easy to miss out on the successes that have actually happened. Hoping that there are potential lessons to be learned from how earlier environmental problems have been more or less solved this project examines one such case of success. The problem selected as the focus of this research project is that of dioxins and chlorinated waste emissions from the pulp and paper industry in Sweden. Dioxin is the group name of a family of environmental toxins that are byproducts of certain industrial processes, such as the chlorine-bleaching of pulp and paper; and chlorinated waste is a measurement of the chlorine-related waste emitted which is essentially a proxy for dioxins as this is both difficult and expensive to measure. This problem was discovered in the mid-1980s and in the span of only a few years, emissions of dioxins and of chlorinated waste in general from the pulp and paper industry were reduced to such a degree that it was turned into a non-issue. In other words, the problem had successfully been solved.

This project aims to gain an in-depth understanding of exactly how this problem was solved by looking at underlying social, economic, and political factors. The approach to this was by conducting interviews with experts from different perspectives of the matter who were actively working on the issue when it was a hot topic, and analyzing newspaper articles also from the relevant time frame. After analyzing this material the results show that the unique regulatory style of Sweden, where each pulp mill was given its own emission permits instead of country-wide limits, was very important in creating the conditions that would foster change. Another important factor was the cooperation within the industry and between the industry and government agencies to solve the problem. But most importantly there was substantial pressure from consumers who did not want to buy products made using chlorine-bleaching based on fear of dioxins, both in Sweden and in export markets.

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List of Abbreviations

AOX – Halogenated organic compounds (measurement of chlorinated organic waste)

ECF – Elemental chlorine free

EM – Ecological Modernization

EMT – Ecological Modernization Theory

NLB – National Licensing Board

PPI – Pulp and paper industry

SCA – Swedish Chemical Agency

SEPA – Swedish Environmental Protection Agency

TCF – Total chlorine free

TOCl – Total organic chlorine (earlier measurement of chlorinated organic waste)

ToP – Treadmill of Production

1. Introduction

The situation for the environment is in many ways dire. We are failing to live in a sustainable way within the planetary boundaries (Rockström et al., 2009). We are currently at a 1.1°C warming compared to pre-industrial levels and emissions of greenhouse gases are still climbing globally (Friedlingstein, et al., 2022; IPCC, 2023). Moreover, the status, trajectory, and implications of, for example, biodiversity loss (Newbold et al., 2016), and pollution of plastics and chemicals (Persson, 2022), appear at least as terrifying as climate change. It is easy to get bogged down in the general bleakness of the situation. However, amidst all the negative environmental developments it is easy to miss out on the successes that have happened. In addition to offering respite in the doom and gloom of ecological issues, it is important to acknowledge that we can and have actually successfully addressed environmental problems in the past. Moreover, by examining these successes there are potentially important lessons to learn from the process of how these were addressed for contemporary and future environmental problems. In this paper, I will examine the transition away from dioxin emissions at the industry level as well as the economic, regulatory, and political processes behind the transition. Two prominent theories from environmental sociology will be utilized to better understand this transition, the Treadmill of Production (ToP) and Ecological Modernization Theory (EMT). In turn, as these theories are argued to correspond to more publicly prevalent perspectives, this examination can hopefully serve, in some respect, as input to the debate between green growth and anti-growth perspectives both located within and outside of environmental sociology. The methodological approach is a case study to be described below.

1.1 What Are Dioxins?

Dioxin is the collective name for 210 polychlorinated dibenzofurans and polychlorinated dibenzodioxins. Dioxins are not intentionally produced and have no use; they are byproducts of certain thermal or chemical processes. These compounds vary in toxicity, the most toxic being 2378 tetrachlorodibenzodioxin – the numbers indicate where the chlorine atoms are placed. Assessing the dangers of these compounds to human and ecological life is complicated as they vary greatly in toxicity between species; a guinea pig is 500 times more sensitive compared to a rabbit, for example (Hites, 2011). To calculate the relative toxicity of each of these compounds, they are assigned a toxicity equivalency factor based on how its toxicity compares to the most toxic of the group (Van der Bergh et al., 2006). This procedure is what

allows for standardized assessments of emissions as well as recommended intake levels. What is also important to note is that dioxins are categorized as ‘persistent organic pollutants’ meaning they are stable in nature and travel upwards through the food chain resulting in higher concentrations of dioxins in predators (SEPA, 2021).

Dioxins have often been called the most toxic substances ever created, given their lethality at very low levels – it takes only 0.6 picograms (one picogram is one trillionth of a gram) to kill male guinea pigs (Hites, 2011). There is not, however, a clear picture of all of the effects of dioxins on humans and animals. According to the World Health Organization (2016) dioxins “can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer.” The latter of these, the carcinogenic properties of dioxins, have been somewhat challenged. Kogevinas (2001) reports that excess risks of developing cancer were found for all variations of the disease. Yet, a later study by Tavakoly Sany et al. (2015) posits that there is not enough evidence that dioxins by themselves increase the risk of cancer arguing that the participants in the studies that show an increased risk of cancer were also exposed to other chemical agents which in tandem with the dioxins acted carcinogenic. Another unclear set of effects are epigenetic alterations, meaning alterations in genetic activity. Viluksela & Pohjanvirta (2019) shows that conceptually there is potential for dioxins to cause multigenerational epigenetic alterations, but the health effects of this are unknown. To sum up, dioxins are clearly detrimental for humans and the environment, but in what ways and exactly how bad is not well established.

Finally returning to the categorization of dioxins as an “environmental success”. While this label is suitable, it needs some problematization and qualification for the sake of completeness. While emissions have dropped dramatically in the global North, they have remained stable or even increased in the global South (see Figure 1 below) (Lei et al., 2021). In addition, because of the persistence of dioxins in nature, there are still plenty of dioxins stored in sediments which risk becoming reactivated with changing weather patterns and other ecological events (Assefa et al., 2019). Thus, there are some reservations about labeling dioxins as an unmitigated success. However, the emission reductions in the global North cannot be called anything other than a remarkable success. One sector where this categorization is appropriate is the pulp and paper industry (PPI) in Sweden which managed world-leading reductions of emissions of dioxins that

were achieved at a tremendous speed after the problem of dioxins in the wastewater from mills was discovered.¹

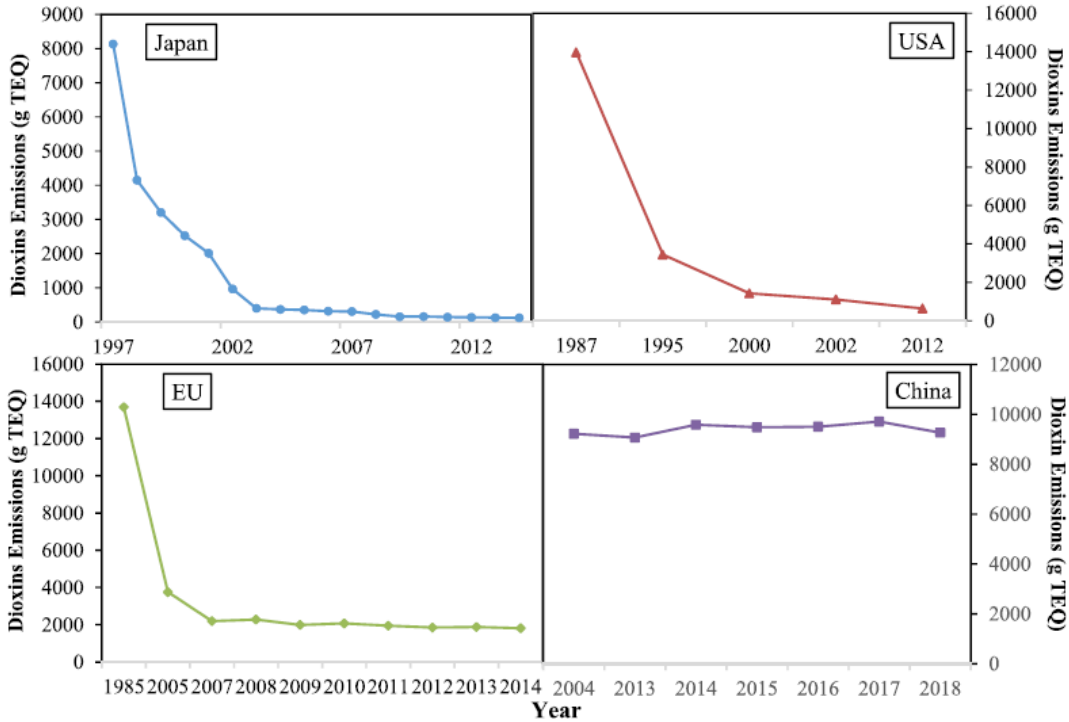


Figure 1: dioxin emissions over time. (Lei et al., 2021)

1.2 Introducing the Focus of This Project

Social science research into dioxins and other environmental issues can either go wide or deep given the limitations of time and resources; the former could potentially include multiple national contexts as well as different sectors of polluters, whereas the latter takes a more in-depth look at a particular case of emissions. For this project, I have chosen the latter, and the focus of choice is the PPI in Sweden which is interesting because of the highly successful trajectory of emission reductions.

The problem with dioxin emissions from the PPI is more specifically related to the bleaching process. Through the early to mid-20th century the bleaching process of pulp and paper became increasingly sophisticated allowing for highly bleached white products. Demand for pristinely white paper and packaging products grew in tandem with the technological possibilities (the

¹ See Rajotte (2003) and Reinstaller (2005). However, it must be noted that emissions of dioxins cannot be separated from the issue of emissions of chlorinated waste in general, which also represented the means to measure and address dioxin emissions. This will be further explained in the ‘Background’ chapter of this text.

bleaching process is described in more detail in section 2.1 of this text). It should be noted, however, that there are multiple other relevant sectors when it comes to dioxin emissions, e.g., waste incineration, and metal smelting. For an in-depth examination of emissions reductions of dioxins, it makes sense to focus on one particular sector because stakeholders, regulation, and the public debate does not necessarily transfer across sectors.

There is a range of previous academic work on the transition of the PPI to a chlorine-free bleaching process (see literature review chapter of this text), mainly from the field of economic history, that has implications for this project. However, no previous social scientific work has sought an in-depth understanding of how these reductions were realized, much less a sociological inquiry into industrial transitions away from dioxin emissions in general. The goal of this project is then to nuance, build upon, and problematize the conclusions and insights of previous work while adding to the sociological understanding of how past environmental problems have been ameliorated.

Lastly, for this introduction, it should be reiterated that this project was undertaken from the perspective of environmental sociology. In the past few decades, there has been a debate in environmental sociology about the possibility, feasibility, and expediency of, what could be called, green growth theoretical perspectives versus more socially radical perspectives in solving the environmental issues facing us today. This specific debate never moved outside of academia. However, a very similar debate with its roots in the degrowth movement is starting to make ripples in non-academic contexts. This thesis utilizes theories from both ‘sides’ of the aisle of growth critical perspectives versus green growth perspectives from environmental sociology. Due to the similarity to the fundamentals of this debate, it is also relevant for the degrowth versus green growth debate, which is far more vivid today.

1.3 Research Design and Aims

The thesis follows a single case study design with the case being treated as a case of industrial transition away from detrimental practices to more sustainable ones. Employing two methods of data collection: expert interviews, and qualitative content analysis of newspaper content from a relevant time frame. By using multiple methods and, more importantly, multiple sources giving different perspectives it is possible to triangulate the evidence collected allowing for a richer and more accurate interpretation (Yin, 2018, pp. 126-129).

An abductive data collection and analysis approach was utilized (see Tavory & Timmermans, 2014). Essentially, this approach eschews adherence to either an inductive or deductive process in favor of a mix of the two. In practice, this means that the author did not start with a specific theory or concept in mind, nor with extensive data collection and coding. Rather, in the process of data collection and coding, there was a dialogue between data, theory, and previous research which I argue aided in making the coding and ultimately the analysis richer and more deliberate.

The purpose of this thesis is first and foremost to examine the case in order to understand how and why this transition happened. Furthermore, to evaluate and discuss which, if any, potential lessons can be learned from how this particular environmental issue was addressed. In addition, by utilizing what are theories from conflicting schools of thought, in a middle-range capacity, in regard to how environmental issues can (and should) be addressed I aim to contribute to the ongoing debate between these theories, and related contemporary perspectives.

The research questions that guide this project are as follows:

- What are the economic, regulatory, and political factors that led to reduced emissions of dioxins from the pulp and paper industry in Sweden?
 - How did these factors influence emissions reductions?
- What, if any, are the implications of this case for the debate between growth-critical and green growth perspectives?

1.4 Delimitations

There are noteworthy delimitations of this thesis. For starters, as a single case study the thesis cannot test theories as compared to a multiple case study with different outcomes where conditions and indicators would be possible to be set against each other and analytically compared. The single case study was chosen as it allows for a greater immersion into the outlier case utilized in this thesis. Another delimitation is the national context of Sweden and the specific focus on the PPI in this context. As is mentioned above, there were a number of highly problematic emitters of dioxins that operate under different circumstances and therefore are in some respects not transferable either across nation-states or to other industries. Related to this is another contextual element, namely the environmental movement in Sweden, and in many other Western nations in the 1980s. From this perspective, the case of dioxins is a part of a

greater whole, and plucking it out of this context loses some nuance in understanding the case. Ultimately, the case of dioxins and the PPI is heavily embedded in different narratives and trajectories, and far be it for this thesis to account in full for all of these. However, that is not to say that the influences of these narratives are not, at least in some way, accounted for in this thesis through the data.

1.5 Structure and Outline

The thesis is structured as follows. Following this introduction is the background chapter which covers some of the more crucial contextual aspects, such as regulatory style and history, as well as necessary technical factors regarding the bleaching process. After this comes a chapter featuring a literature review of industrial transitions with a focus on environmental improvements, and previous research on the transition away from chlorine use in the Swedish PPI. Following that is the chapter covering the relevant theory utilized in this thesis, describing the two different theoretical schools utilized in this thesis, what sets them apart and what the similarities are between them. This chapter is succeeded by the methods and data chapter. Next in order is the analysis chapter where the data is presented and analyzed. Lastly, the thesis is closed with conclusions and end discussions which also feature suggestions for future research.

2. Background

This chapter covers the relevant background for this thesis. The first section is a brief technical description of the bleaching process and how it evolved. This is followed by a section discussing the developing knowledge of dioxins as well as how emissions from the PPI are measured. Lastly, there is a section that covers the general timeline of regulation. When it comes to measuring and regulating dioxins, which are both hard and expensive to measure, these are discussed and decided in terms of emissions of TOCl (total organic chlorine) and later AOX (halogenic organic compounds). However, dioxins were not the only reason to regulate these emissions, but it was a highly influential issue in the public debate and is obviously inextricably intertwined with the use of chlorine and emissions of chlorinated substances.

2.1 The Bleaching Process

While there are multiple processes for producing pulp, the dominant one in Sweden has long been the sulfate (or kraft) process (Bergquist & Söderholm, 2015). This process produces a strong but dark pulp that, depending on its use, requires an intensive bleaching process (Bajpai, 2012, p. 6). From the 1940s chlorine was used as the main bleaching agent in sulfate pulp bleaching (Waluszewski & Håkansson, 2004, p. 220). However, R&D into more efficient bleaching techniques or added “steps” in the bleaching process was ongoing and two main results came from this; (1) the addition of an oxygen bleaching stage (Bajpai, 2012, p. 20), and (2) the use of chlorine dioxide instead of elemental chlorine as a bleaching agent (Waluszewski & Håkansson, 2004, pp. 220-221); both of which were initially developed as means to increase efficiency in the bleaching process mainly for economic reasons, but also because of early concerns about chlorinated waste (Kinneryd, 2010; SEPA, 1993, p. 153). Thus, before it was known that there were dioxins in the wastewater from pulp and paper mills tentative steps were taken to address the overall issue of chlorinated waste as a part of broader investments in addressing environmental issues. The environmental emphasis of the Swedish PPI switched into high gear in 1970 and in that year investments towards addressing various environmental issues (among them chlorinated waste) were estimated at the time to cost around 9 billion SEK in 2022 monetary value. The increasing costs related to internalizing environmental consequences of production motivated the launch of the first major research project funded by the forest industries and the Swedish government on environmental care with a budget of 228 million SEK in 2022 monetary value (Jerkeman & Norrström, 2017, pp. 127-129).

In the mid-1980s, researchers discovered that dioxins were present in wastewater and in consumer products made using bleached pulp. In response to demands from regulators and the public, the PPI initiated deliberate efforts to reduce chlorinated waste. In time, the industry developed two general approaches: (1) elemental chlorine-free (ECF) bleaching, using chlorine dioxide instead of elemental chlorine; and (2) totally chlorine-free bleaching (TCF), a technique that does not use any chlorine chemicals at all but instead uses peroxide or ozone stages as the main bleaching agent. Of these two, ECF offered an easier and cheaper route to environmentally friendly production because the capital investments needed to adjust the process were smaller compared to TCF. Moreover, there are no clear environmental benefits of TCF over ECF – wastewater from both processes is virtually free of dioxin contamination (Bajpai, 2012, pp. 263-283).

2.2 Dioxins Now and Then – a Developing Field of Knowledge

Eventually, it became clear that dioxins were emitted continually by certain polluting industries. Earlier, however, dioxins were more linked to discrete, isolated incidents, such as in the small town of Times Beach, Missouri, which was contaminated in 1970 through spraying the streets with contaminated water and evacuated in 1983, and the Seveso chemical plant incident in 1976 in Italy (Hites, 2011). Reports began to emerge in 1977 of dioxins in the fly ash from waste incinerators (Rappe, 1989). With this discovery, dioxins were no longer only connected to accidents, but also became a problem of emissions. Soon other sources of continual emissions of dioxins from industry processes were discovered, and in 1985 came the first reports that dioxins were found downstream from pulp and paper mills. However, it was not until dioxins were found in everyday products using pulp and paper that the issue became a hot topic also in the public debate, according to Waluszewski and Håkansson (2004, p. 223). Intermittent reports that dioxins were found in some new household products, e.g., diapers, tampons, coffee filters, etc., became an issue of concern that was directed at chlorine use in the PPI. In addition, high levels of dioxins were found in the breast milk of mothers (see Figure 2 below for the trajectory of dioxins in breast milk). The dangers of dioxins in household products were exaggerated, at least in part, due to what could be called sensationalist media practices. However, the emissions from the PPI were still identified by experts and other influential individuals as the single most worrying source of dioxins (Rappe, 1989).

Because of the extremely small quantities, measuring dioxins is a bit problematic, and expensive. Therefore, other measurements were used as indicators for dioxin emissions whilst also addressing the larger issue of chlorinated waste. The first of these in use was TOCl, developed in 1981 (Jerkeman & Norrström, 2017:133). In 1989, the SEPA adopted AOX to be used instead as the standard measurement in Sweden as it was a simpler method and would therefore be easier to standardize across actors (SEPA, 1989). AOX is not, however, a perfect measurement of dioxins. While chlorine use and AOX emissions are almost perfectly correlated, the prevalence of dioxins drops at a faster rate than AOX with less chlorine use (McKinnon, 1994). According to SEPA estimates (SEPA, 1993, p. 153) emissions of Swedish pulp and paper mills were averaging 8-10 kg of AOX/ton produced in the 1970s, in 1980 this was down to 5 kg AOX/ton and further down to 1.5 kg AOX/ton in 1990.

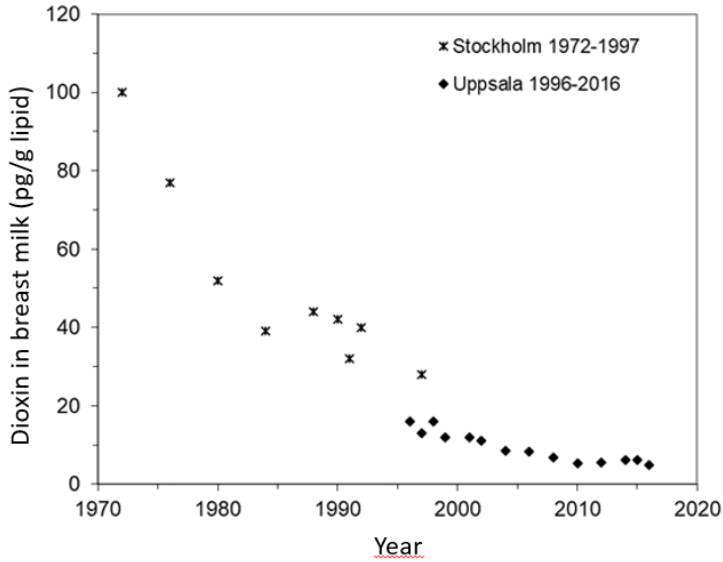


Figure 2: dioxins in the breast milk of mothers over time (Swedish Food Protection Agency, 2022).

2.3 Timeline of Regulation

The Swedish Environmental Protection Agency (SEPA) was established in 1967 in tandem with the national licensing board² (NLB). These were quickly followed by the establishment of the Environmental Protection Act in 1969. According to Lönnroth (2010), both trade unions and industry representatives accepted that pollution control was a necessary step in modernization and that this was to be done in accordance with the best available technology logic. Until its

² The Swedish name for this agency was koncessionsnämnden. There is no official English name, and it is translated differently by different authors.

replacement by the environmental courts in 1999, the NLB was the primary regulatory organ regarding environmental issues. The NLB comprised one magistrate, and three delegates – one with technical expertise, one with industry experience, and one with an environmental protection perspective (for example someone from the SEPA). Regulation of plants was done on a case-by-case basis through negotiation in this pseudo-court considering the specifics of the particular case but also the possibilities for pollution control in the relevant industry in general (Kinneryd, 2010). In 1987 came the first demand for national guidelines from the SEPA to limit emissions of TOCl to 1.5 kg/ton produced by 1992 (SEPA, 1987). This guideline was later adopted by the Swedish parliament to be the starting point for all NLB negotiations of licenses for the PPI while also clarifying that all emissions of chlorinated waste must be eliminated in the future (proposition 1987/88:85). It is important to note that while this is the only instance of anything resembling a national limit on these emissions set by parliament it is a testament to how serious the issue was taken rather than callousness. This is because of how decentralized regulation was in Sweden; licensing was based on the Environmental Protection Act and the best available technology logic. As technology advanced far beyond reducing emissions to 1.5 kg of chlorinated waste per ton produced, the NLB would then put higher demands on mills without parliamentary ratified limits. Thus, with the changing understanding of what the best available technology was the emission limits set by authorities would also become stricter.

3. Literature Review

The literature review is divided into two parts. The first focuses on the broader interdisciplinary literature on industrial transitions, which the subject of this thesis ultimately is an example of. The second part discusses previous research on the Swedish PPI and the transition away from chlorine-bleaching.

3.1 Industrial Transitions

Transition studies is a relatively new field of research, but it is of increasing importance due to the need for socio-technological transitions to meet environmental limits (for more recent overviews see Geels, 2019; Zolfagharian et al., 2019). An in-depth understanding of technological industrial transitions is necessarily an interdisciplinary process. From the technical processes of the technology itself to economic models explaining investment and technological lock-in, further into legal, cultural, and socioeconomic factors. Dosi (1982) seeks to explain the process of technical change and innovation through the prism of technological trajectories within set technological paradigms, examining the differences between incremental change and radical innovation. Arthur (1989) also writes about the path dependency of technological outcomes, emphasizing that adopting a certain technology also leads to improving this technology further down the line. Other technologies are then “locked out” and barring unexpected factors there is a tendency for technological trajectories “to lock itself in to an outcome not necessarily superior to alternatives, not easily altered, and not entirely predictable in advance” (p. 128). Moreover, Berkhout (2002, p. 2) posits that:

“Because of the interrelated and interlocking nature of technological regimes, change is both slower and tends to be more cumulative. For a regime change to be carried through it must be recognised as necessary, feasible and advantageous by a broader range of actors and institutions than would normally be the case for a discrete technological change.”

Rycroft & Kash (2002) goes more in-depth in specifying three factors that affect the path dependency of complex technologies, (1) culture and institutions, (2) organizational learning, and (3) technology design. The concept of a technological lock-in was also discussed in the context of environmental problems by Unruh (2000; 2002) emphasizing the institutionalization

of fossil fuels across different sectors and cultures in society, conceptualizing this as ‘carbon lock-in’. These forces converge creating both economic and social conditions which reinforce the technological path, and which in turn make it exceedingly difficult to instigate a radical shift away from, for example, fossil fuels.

Other literature focuses more on changing technological paths and how this can be instituted. For instance, Mickwitz et al., (2007) emphasize the need for the development and adoption of more environmentally friendly technology in order to move toward sustainability. They examine the potential of policy in accomplishing this finding that: “new requirements and tightening of the existing ones have to be foreseeable and credible in order to promote innovations. It is also essential that the regulations in place are flexible enough to allow try-outs and pilot installations” (Mickwitz et al., 2007, p. 169). Furthermore, Krysiak (2011) analyzes how environmental policy influences the direction of technological innovation. The results show that the type of policy instruments implemented has consequences for what type of technological progress is induced, for example, “taxes and standards facilitate the development of only one technology and thus result in a lock-in into the current least-cost technology” (p. 539). In a similar vein, Kemp and Never (2017) outline concrete guidelines which are suggested to have the potential to aid in green transitions after contextual consideration and adaption.

There have been a multitude of environmental industrial transitions in the past which are fertile ground for transition studies. For example, in an in-depth study of the Dutch chemical industry’s transition to more environmentally friendly practices, Mol (1995) argues that increasing environmental priorities in society led to mounting public pressure on the industry as well as stricter policy interventions, and ultimately to better practices.³ Dijk and Yarime (2010) examine the introduction of hybrid electric vehicles finding significant technological lock-in mechanisms stifling and delaying technological development. In another paper, Yarime (2007) focuses on the effects of environmental regulation and technological change in the chlor-alkali industry in Western Europe and Japan. Findings show that the stringent regulation in Japan resulted in innovative technological changes focused on clean technology, i.e., changing the technological path. However, in Western Europe, comparatively milder regulation meant that

³ This is part of the literature on Ecological Modernization which is discussed at length in the theory chapter of this thesis.

it was cheaper to meet the requirements with end-of-pipe solutions resulting in continued lock-in of the technological path.

Another interesting and relevant case is that of the ozone-layer. Much like the story of dioxins, this can be categorized as an environmental success, albeit maybe a bit more well-known in the general public. There was a substantial international effort to limit the emissions of ozone depleting substances organized under the Montreal Protocol, which is often hailed as a great success of global governance (Albrecht & Parker, 2019). One focus of case studies on this topic has been the transition away from methyl bromide in strawberry agriculture. Findings by Mayfield and Norman (2012), and Wolverton (2014) suggest that alternatives were developed and implemented faster than industry had reported possible, and to less cost. Another study showed that agriculture-protectionist interventions slowed the development and implementation of viable alternatives (Gareau, 2017). What these examples show is that there is a diverse and rich literature on industrial transitions which focuses on different dimensions of transitions, e.g., social, economic, political, technological, etc.

3.2 Previous Research on the Transition Away From Chlorine Use in the Pulp and Paper Industry in Sweden

The history of the regulation of dioxin emissions of the PPI in Sweden begins before the compounds were discovered as a byproduct of processes within the industry. To better understand how the PPI responded when the dioxin alarm broke and to the subsequent regulations an understanding of the earlier, albeit inadvertent in terms of dioxins, approach to environmental concerns is necessary. As a point of departure, the Swedish context is “underpinned” by a corporatist tradition dating back to the 1930s. This means that industrial development and economic growth were seen as means to develop the welfare state (Bergquist & Söderholm, 2015; Söderholm et al., 2017). Reinstaller (2008) also emphasizes the role of institutionalized corporatism in Sweden in organizing a fast response to the dioxin question, made possible by high levels of trust between parties. In essence, Swedish corporatism engendered a collaborative relationship between the state and industry which is expressed in practice by the joint research projects, but also, in more ephemeral terms, in a general understanding between regulators and firms to reach a mutually satisfactory solution to environmental issues.

The first two subsections essentially summarize literature relevant to this text from the body of work of Bergquist and Söderholm on the regulation of chlorinated waste from the PPI in Sweden. The third subsection discusses literature that preceded this body of work. One of the main interests of this literature is the drivers that caused the transition of the Swedish PPI. The later work of Bergquist, and Söderholm, in general, argue that the conclusions of the earlier work exaggerated the significance of some drivers while neglecting others. This thesis certainly owes a great deal to these previous studies while aiming to shed new light on the transitional process as a whole by examining this case in-depth taking a social science and environmental sociology perspective.

3.2.1 Knowledge Creation and Sharing

The PPI in Sweden was world-leading in transitioning to processes with safe emissions of dioxins.⁴ For this reason, there has been a notable amount of academic interest in researching how this speedy transition was possible and what the key factors were that facilitated it. One such factor is the long history of joint R&D – both within the sector and between the sector and government- dating back to the 1940s. These initiatives were formalized into three research initiatives, The Swedish Forestry Research Institute established in 1944, the Institute of Water and Air Protection established in 1966, and the Forest Industry’s Air and Water Pollution Research Foundation established in 1970. The first of these was founded as an outcome of an agreement between the state and industry to increase the competitiveness of the Swedish PPI (Bergquist & Söderholm, 2015), and the latter two conducted research into, among other things, reducing the environmental impact of the PPI (Bergquist & Söderholm, 2010). The Forest Industry’s Air and Water Pollution Research Foundation was a joint industry effort, and the Institute of Water and Air Protection was again funded by both state and industry with the purpose of managing risks related to stricter environmental regulation (Söderholm et al., 2017). However, there was a dual purpose to research into emission reductions as the improved environmental outcomes were pursued through the effectivization of processes, e.g. by reducing the use of expensive chlorine inputs (Söderholm et al., 2017). Thus, these efforts were directed towards clean technology options which the literature shows are the better option for longevity, rather than end-of-pipe solutions. These R&D initiatives “not only reduced costs and risks

⁴ Reinstaller (2005) shows that the Nordic countries were twice as fast as the US and Canada in adopting new technology, and of the Nordic countries with a significant PPI Sweden was significantly faster than Finland in the transition process, according to Rajotte (2003).

related to R&D but also likely speeded up the diffusion process of new technologies and learning about new techniques” (Bergquist & Söderholm, 2010, p. 23). Furthermore, the joint knowledge creation and information-sharing ventures spurred innovation and made pollution abatement a joint sector/government point of interest (Bergquist & Söderholm, 2011).

3.2.2 Flexible Licensing Processes

Another important feature of the Swedish institutional context that facilitated a fast transition was a flexible licensing process. Before national standards of AOX emissions were set, licensing boards issued incrementally stricter emission standards on individual mills based on that specific plant’s potential to address emissions, available technology, the location of the mill, as well as socioeconomic aspects such as jobs. Licensing was given on a mill-by-mill basis, and to meet new standards of emissions licensing boards granted probation periods during which mills could try new technologies or alternate processes to achieve the emission goals (Bergquist & Söderholm, 2015; Söderholm et al., 2017). Söderholm & Bergquist’s (2013) case study of a single Swedish mill gives an in-depth insight into how the relationship between emitter and regulator as well as how this regulatory style worked in practice. To summarize, they found that incrementally increasing demands on emission reductions were met through well-functioning cooperation based on trust between the mill and regulators that allowed for strict but realistic targets based on the mill’s abilities to reach them. It was also clear to the mill that abatement technologies would not only have to meet short-term targets but also have the potential to meet future regulations of emissions.

3.2.3 Public Pressure

The two previous subsections discuss transition factors as a result of the regulator-firm relationship and could hence be categorized as institutionally defined technocratic-driven change. Other literature emphasizes other drivers of change which are more public in nature such as consumption and activism. Reinstaller (2005; 2008) emphasize the role of ‘policy entrepreneurship’ as a driving force in the transition of the PPI. What is meant here is that efforts by activists, e.g., Greenpeace, were crucial in getting public attention to the problem, envisioning solutions to the problem as well as sometimes even showing this in practice. This is best exemplified by the action they took in cooperation with Aspa mill in Sweden when they

produced and distributed a copy of the German newspaper *Der Spiegel* called *Das Plagiat* using paper bleached using the new TCF production process (Waluszewski & Håkansson, 2004).

Reinstaller (2005) compares the competitiveness of TCF versus ECF in the Nordic countries showing that TCF in the mid to end 90s briefly overtook ECF in spite of its drawbacks – arguing that this is indicative of the effectiveness of policy entrepreneurs to create momentum for environmental solutions. This competition was made possible in part by the eco-labeling of the Swedish Nature Conservation Association. They introduced two different categories of eco-labels, low-chlorine, and chlorine-free, which producers embraced and used as a means of green marketing (Bergquist & Söderholm, 2018). Popp et al. (2011) agree that eco-labeling was significant in guiding concerned consumers, however, they argue that because eco-labeling can only be applied to existing technologies the practice cannot initiate innovation. Rather, these authors propose that the spikes in patenting occurring before regulation indicate that the most significant drivers of innovation were public and community pressure. Söderholm, Bergquist & Söderholm (2017) oppose this conclusion, arguing that Popp et al. neglect the long history of cooperation and R&D between firms and the government and that “the transition towards chlorine-free pulp was primarily a story about regulation-induced technological change” (p. 1337).

4. Theoretical Framework

This chapter discusses and contextualizes the theoretical and conceptual framework employed in this thesis. The first two sections cover the history and some of the general core tenets of each of the two theoretical perspectives; the Treadmill of Production (ToP) and Ecological Modernization Theory (EMT, or EM as an abbreviation of Ecological Modernization). The third section engages with the debate between these two schools of thought and highlights some fundamental differences and similarities between them. Finally, the fourth section describes a model for examining environmental outcomes based on middle-range reappropriations of these theories. Both these theories deal with trajectories of environmental degradation caused by industrial society and potential transitions away from environmentally detrimental practices. In a *post hoc* analysis of environmental industrial transitions, these theories grant a researcher the conceptual tools to make an informed analysis of relevant power dynamics while also having a clear theory of change or the lack thereof.

4.1 The Treadmill of Production

The ToP theory was first introduced by Schnaiberg (1980) as a model that described the expansion of productive forces and its consequences in the post-World War II United States. The model explains the increases in the use of technology and chemicals in production leading to greater output the gains of which were then reinvested into more capital-intensive inputs again producing more output – thus describing an ever-accelerating *treadmill of production*. In Schnaiberg's original model this expansionist creed was supported by a tripartite of influential stakeholders in labor, firms, and the state – by labor for the sake of jobs, by firms for the sake of profits, and by the state for legitimacy reasons as well as to ensure tax revenue. The consequences of the treadmill are greater and greater withdrawals from the environment, i.e., resource use, and increasing additions to nature, i.e., pollution. In other words, as production becomes more capital-intensive environmental destruction and resource depletion also intensify. In later developments of the theory, the focus at the national level in general, and the US in particular, is upscaled to a global level. This is due to the increasing globalization in the decades following the original iteration of the model from 1980. Moreover, the role of labor and the state in defending the treadmill is diminished in response to the rising power of transnational corporations and their ability to pit states and workers against each other (Buttel, 2004; Gould et al., 2004; Gould et al., 2008; Schnaiberg et al., 2002).

Whereas the model might appear to be linear in its depiction of an ever-accelerating treadmill Gould et al. (2008, pp. 29-33) instead call it dialectical as “social forces benefitting from its expansion would engage in political contests with forces diminished by such expansion” (p. 31). Societies seek both economic growth and environmental protection, which are often conflicting goals, therefore, Gould, et al. (2008, p. 31) call this relationship the societal-environmental dialectic. The instances where environmental aims have “won” against economic aims are few and ultimately have done very little to challenge the treadmill, according to the authors (pp. 31-37). Thus, while the ToP model and its proponents paint a bleak picture there is theoretical room for environmental improvements. However, given that power is still heavily in favor of the economic as opposed to the environmental side of the dialectic, improvements that challenge the treadmill are rare.

4.2 Ecological Modernization Theory

Much like the ToP the EM perspective has gone through developments of some of its core tenets. Earlier uses of the concept of EM viewed it as an inevitable stage of modernity. Much in the same sense as Rostow’s (1959) stages of economic growth (or similar models of modernization theory), society would organically go through a process of EM as an outcome of economic prosperity. As Spaargaren and Mol (1992) describe it:

“Focusing on technologically induced developments within the industrial system, the theory of ecological modernization exposes an evolutionary and technologically deterministic view of social development that is characteristic of the theories of industrial society. The ecological switchover is analyzed as a logical, necessary, and inevitable next stage in the development of the industrial system – the system correcting itself for the construction fault of neglecting ecology.” (p. 336)

Some early EM theorists also eschewed intervention by the state in market dynamics as this was seen to stifle innovation and technological development; instead, deregulation and privatization were seen as tools that would engender environmental improvements (Mol & Spaargaren, 2002; Spaargaren & Mol, 1992). Later, EM scholars would take a more reflexive stance toward the role of technology in EM (Mol, Spaargaren & Sonnenfeld, 2014), as well as include the state as an important actor in environmental protection (Mol, 1995; Mol & Spaargaren, 2002).

The core tenet of EMT is that in modern capitalist society, the economic sphere has become disembedded with the ecological sphere, and according to EMT, a re-embedding must take place to address existing environmental problems and prevent new ones. This must be done by first emancipating the ecological sphere and ecological rationality from the economic sphere and economic rationality. Through the emergence of ecological rationality to be pitted against economic rationality modernity can begin to adjust to environmental needs. An important point, however, is that according to EMT, ecological rationality will not replace economic rationality. Rather, it will act as a counterweight to the environmental destruction that follows from pure economic rationality as ecological rationality becomes ingrained within institutions and social practices (Mol, 1995, 27-33; Mol, 2002; Mol, Spaargaren & Sonnenfeld, 2014).

4.3 The Treadmill of Production Versus Ecological Modernization Theory

These perspectives as macro-theories are juxtaposed in that they perceive the trajectory of the current state of affairs as markedly different. Whereas the ToP perspective argues that the political economy that developed from the end of World War II is fundamentally unsustainable (Gould et al., 2008; Schnaiberg, 1980), EMT treats capitalism as neither inherently incapable nor necessary for sustainable human-ecological relationships, but rather focuses on industrialism (Mol & Spaargaren, 2002; Spaargaren & Mol, 1992). However, delving deeper into these theories beyond surface-level generalizations of the relationship between the global political economy and the environment, there are ways that these theories can complement each other, resulting in richer analytical tools. Furthermore, there have been compelling arguments that they are not opposed as much as describing human-ecological relationships through different stages of capitalism (Fisher, 2002).

The contextual origins of these perspectives in time and space are important factors to consider when looking at what sets them apart from each other. The introduction of the ToP theory by Schnaiberg (1980) aptly describes the development of the post-war United States political economy and its relationship with environmental degradation. However, whether this is a model that sufficiently describes the development to this day and in other national contexts is up for debate. Some global metrics certainly lend support to treadmill dynamics having the upper hand globally. For example, in 2022 – 25 years after the signing of the Kyoto Protocol, 7 years after the Paris Agreement, and after 27 COPs (Conference of the Parties to the United Nations Framework Convention on Climate Change) – global emissions of CO₂ are still increasing

every year (Friedlingstein et al., 2022). In addition, recent research by Bugden (2022) using patent data finds no support for the increased focus of technological innovations on environmental improvements proposed by EMT. However, the global level is not the only one worth looking at. Several countries have seen absolute decoupling between CO2 emissions by both territorial and consumption-based accounts (Le Quéré et al., 2019). Specifically, in Sweden, there is research moderately indicating that ecological modernization explains environmental improvements enacted in the country before the turn of the century (Vail, 2008). This is not surprising given that EMT was developed and gained prominence through early case studies set in the European context and is therefore more affiliated with it (see, for example, Mol, 1995). In addition, the lack of aggregate evidence in support of strengthening ecological rationality can be argued to relate to the respective theories of change of the two theoretical perspectives. In other words, these theories are very difficult to falsify.

As Mol (2002) argues, EMT is more about environmental radicalism compared to the social radicalism of the ToP. Meaning environmental improvements, according to EMT, is more gradual and incremental whereas a ToP analysis demands first radical changes to the political economy before the treadmill logic (or economic rationality) can be overcome. Furthermore, EMT suggests that as ecological rationality spreads in social practices and institutions there is a potential snowball effect if this reaches a critical point. According to Mol, Sonnenfeld, and Spaargaren (2014), one of the main contributions of EMT is the integration between scholarship and policy and the spread of EM perspectives outside of academia. However, some argue that this is not due to its potential to ameliorate environmental issues, rather this is argued to be because EMT does not directly challenge the status quo, it instead allows for the greening of business as usual and thus legitimizes the status quo from an environmental perspective (Ewing, 2017; Foster 2012). Furthermore, the issue with the logic of incremental reduction to ecological pressure is that planetary boundaries are already over the limit in certain areas and in some cases, for example biodiversity loss, the changes are irreversible (Rockström et al., 2009).

There are fundamental ontological and epistemological similarities between the ToP and EMT in that both are founded in realist and materialist philosophies (Buttel, 2004; Mol & Spaargaren, 2002). Moreover, the neo-Marxist label on the ToP and lumping it together with other eco-Marxist perspectives becomes oversimplifying and misleading in a close analysis of the differences between the two perspectives. This is examined in-depth by Buttel (2004) who points out that there is a notable lack of references to Marx's own works for a neo-Marxist

theory. Ultimately, this examination lead Buttel (2004) to label the ToP as extra-Marxist which means “a style of critical or radical political-economic reasoning that borrows eclectically from Marx’s concepts and insights while eschewing other aspects of Marx’s work or those of contemporary Marxists” (p. 326). For example, the ToP does not adhere to Marxist value theory which, according to Buttel (2004) is “arguably the most important component of orthodox Marxism” (p. 326). Where the ToP draws heavily on Marxism is in its understanding of capital as inherently anti-ecological through its profit-seeking logic, which combined with the growth imperative results in the treadmill. This implies, and is acknowledged by ToP scholars, that public and state intervention in this anti-ecological logic of capital can achieve significant changes to environmental outcomes. However, it is argued that specifically for this reason sufficiently effective policy interventions are rarely implemented. Moreover, the globalized nature of firms makes national policy less potent (Gould et al., 2008, pp. 80-87). This emphasizes the characteristic of capitalism which is fundamentally at odds with the environment, according to the ToP – growth and the growth imperative. Gould et al. (2008) essentially state this explicitly in arguing that “what makes the treadmill model so threatening to state, capital, and movement elites is that it strongly advocates a move toward a steady-state economy” (p. 85). Consequently, what Gould et al. (2008, pp. 114-115) call for to combat the treadmill and stop environmental degradation is not explicitly an end to capitalism, but rather the democratic control of (1) development priorities, (2) socioeconomic and environmental trade-offs, (3) the distribution of costs and benefits of development, and (4) research priorities. Depending on the strength and characteristics of these solutions, however, the result would potentially mean a change to capital “in ways that would make it unrecognizable to bankers, money managers, venture capitalists, and CEOs looking at themselves in the mirror today” (O’Connor, 1998, p. 235). This ‘social radicalism’ potentially gives credence to criticism from EM scholars that the ToP is utopian in its theory of change (Mol & Spaargaren, 2002).

The discussion on differences and similarities between the ToP and EMT serves three purposes for this thesis. First, it motivates the model for examining environmental outcomes presented in the next section and makes it more viable. Secondly, it is necessary to address the third research question in a more deliberate and thoughtful manner. Thirdly, it makes it visible where there are parallels between the debate of the ToP and EMT, and the more publicly relevant debate between degrowth and green growth. In short, similarly to the ToP, degrowth also focuses on growth (unsurprisingly perhaps, given the name of the concept) and its fundamentally anti-ecological outcomes as explicitly a characteristic of capitalism, while not

calling outright for an end to capitalism but, essentially, increased democratic control of economic activity (Hickel, 2020). Moreover, similar discussions of utopianism, political feasibility, legitimacy, pragmatism, and effectiveness are utilized in both discussions (Sandberg et al., 2019). For these reasons, the debate between the ToP and EMT is translatable into the debate between degrowth and green growth and through this the debate is made more relevant today, even beyond academia.

4.4 A Joint Model for Examining Environmental Outcomes

In describing how environmental outcomes are determined the ToP emphasizes a dialectical relationship between economic criteria and ecological criteria, similarly, in EMT these factors are called economic rationality and ecological rationality. The point is that both perspectives describe this process the same, notwithstanding the differences in wording. The reason for this might be what was mentioned above – that both are focused on industrial society and its trajectory through the lens of realism and materialism. The fundamental differences in this dialectical model are, however, made clear in the power ascribed to these respective criteria based on the theoretical assumptions of the respective theories. In other words, the ToP perceives the power potential of economic criteria as higher than EMT, and EMT perceives the power potential of ecological criteria as higher than the ToP, these ultimately result in the substantially divergent differences in outlook. In adapting these theories at the meso-level the similar dialectical models make it straightforward to combine them into one model. The outcomes are then explained by the conceptualizations of either theory thus building on the strengths of either theory's explanatory power. In other words, a particular environmental outcome, for example, dioxin emissions of the Swedish PPI, will hypothetically fall either in favor of economic criteria (treadmill logic explained by the ToP) or in favor of ecological criteria (explained by EMT).

Shwom (2011) developed a set of indicators that describe the conditions under which either of these theories would apply arguing that “a middle-range theorization of these broad theories seeks to scope the conditions under which the dynamics predicted would emerge, illustrating how they may be complementary views of environmental politics” (p. 710). The author found that both theories were applicable and had explanatory power during different times regarding the issue of energy-efficient appliances. The indicators developed by Shwom (2011) are:

1. levels of public consciousness of the issue and strength of the environmental movement. Constituting high levels of public consciousness as well as the capability for public action;
2. past regulations – which increase the potential of firms to adapt to regulatory costs and internalize externalities;
3. threat of future regulation in response, at least partially, to public pressure; and
4. disunity of the business class due to fragmentation of interests. This criterion is also conditioned on the makeup of the sector – monopolistic and oligarchic, as well as industries with strong trade associations naturally being considered more unified.

According to the model, the conditions described by EMT are likely to emerge when these factors are present/strong; and, when these factors are missing/weak ToP conditions are likely to emerge (see Table 1). Thus, in this model the ToP becomes an explanation of why improvements will not happen, whereas EMT becomes an explanation of why they will. In this thesis, Shwom’s (2011) model as described above is applied to the issue of dioxin emissions from the PPI in Sweden.

	public consciousness	past regulation	future regulation	business unity
ToP	low	no	no	high
EMT	high	yes	yes	low

Table 1: specifying the criteria for power relations of either perspective to apply.

5. Methods and Data

This chapter describes the methods, data collection, and coding undertaken to answer the research questions. The previous literature and background chapters offer a good entry point into understanding the history of emission reductions of dioxins and chlorinated waste. However, a more in-depth understanding of the dynamics that facilitated this reduction is required to answer the research questions. To get at this more in-depth understanding two methods were used. Firstly, a qualitative content analysis of print newspaper media content. Secondly, semi-structured interviews with key individuals that were working with the dioxin problem specifically related to the PPI in Sweden at the relevant time (the mid-1980s to early 1990s).

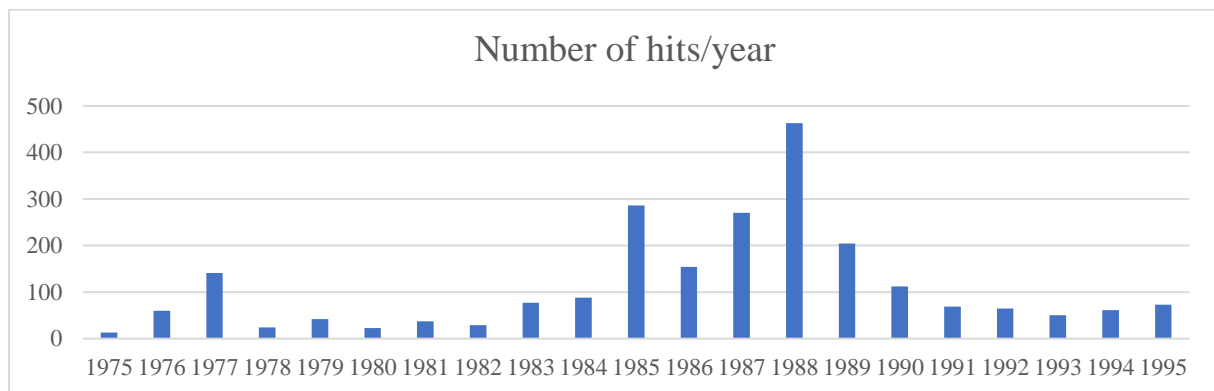
5.1 Qualitative Content Analysis

Basic content analysis typically uses quantitative statistical methods, for example, counting the number of times specific words are used in a corpus of relevant texts (Drisko & Maschi, 2015, pp. 21-56). In comparison, qualitative content analysis adds an element of interpretation to the method in the effort to understand not only the explicit meaning but also the latent meaning (Drisko & Maschi, 2015, pp. 85-88). However, as Sandelowski (2000) put it: “qualitative content analysis is the least interpretive of the qualitative analysis approaches in that there is no mandate to re-present the data in any other terms but their own” (p. 338). Thus, the interpretative aspect of qualitative content analysis must be grounded in, and narratively constructed by the data.

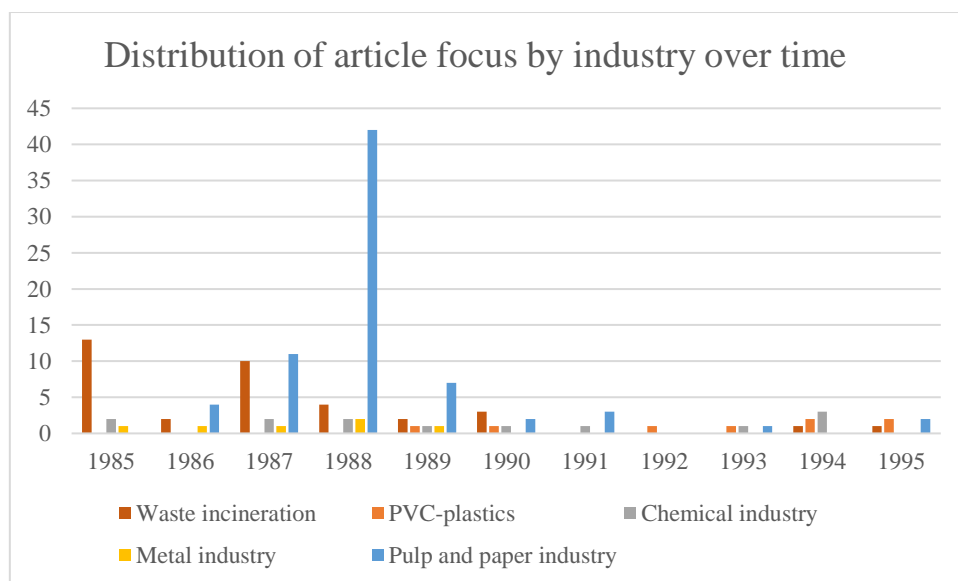
5.1.1 Data Selection

Searching for dioxin* on The Royal Library’s digital archives of Swedish newspapers in the time period 1975-1995 resulted in 2341 hits from the five selected publications: Dagens Nyheter, Dagens Industri, Aftonbladet, Svenska Dagbladet, and Expressen (see Graph 1 below for yearly distribution of hits). These publications were chosen because they were the nationally distributed newspapers at the time. It should also be noted that Dagens Industri is affiliated with Dagens Nyheter and were distributed together. The search term dioxin* means any usage of that specific word or composite word including dioxin would generate a hit. Articles and ads were then selected for coding based on length, relevance, and publication – ads were included

as they are a medium of communication for industry actors. Texts that were too short or lacked relevance (i.e., a single mention in a text about general environmental issues), were not included, and only content from these five leading national newspapers was selected. In addition, whilst the period of time is 1975-1995 only articles between 1985-1995 were coded. This is because dioxins were first generally acknowledged to be an issue in Swedish waste incinerators in 1985. However, it is still interesting and significant to give a sense of the scale of dioxin reporting before this period. This selection process resulted in a corpus of 135 articles. However, these also include articles covering other sources of dioxins, e.g., waste incineration, metal smelting, and PVC plastics (see Graph 2 for distribution). Limiting the analysis only to the content directly relating to the PPI left 72 articles and ads of interest in the sample.



Graph 1: yearly distribution of hits of the search term dioxin*.



Graph 2: article focus by industry over time.

5.2 Interviews

Semi-structured interviews with five key individuals were carried out, three of whom had prior executive positions directly in the forest industry or at the industry trade association (informant 1, informant 2, and informant 3); informant 4 has a history in a high position at a major activist organization; and informant 5 has a history within the NLB. The interviewees were selected using a combination of expert and snowball sampling (see Etikan & Bala, 2017). Relevant organizations were contacted with a request to extend contact to persons who were professionally active during the relevant time frame. The interviewees were informed of the purpose and usage of the interview, and that they would be anonymized in the presentation of the interview data. Following this, the interviewees gave written consent via e-mail. Careful consideration was given to prevent the possibility of linking any of the interviewees to a specific firm or the trade association through any statements cited in this text. An interview guide was devised before the interviews with necessary revisions being undertaken based on the history of the respondent (see Appendix A).

5.3 Coding

A general abductive approach to coding and analysis was adopted for this thesis (see Tavory & Timmermans, 2014). This is best summarized as a mix between an inductive and a deductive approach which according to Tavory and Timmermans (2014) “breaks the stalemate by developing a pragmatist theory of meaning and inference in qualitative research” (p. 121). In practice, what this means for this thesis is that codes were not derived only from data, nor from theory, but through an iterative process where theory and previous literature were consulted or otherwise a part of the coding process of the newspaper content and the interviews. In practice, the process started with a reading of previous research on the topic and a general familiarity with the theoretical perspectives presented in relevant chapters of this text. The second step was data collection and immersion, which started with the selection and open coding of the newspaper content and conducting, transcribing, and open coding of the interviews. Throughout this process, notes and analytical memos were written, kickstarting this process while being responsive to surprises in the data, as recommended by Tavory and Timmermans (2014, pp. 125-126). The coding procedure started with identifying core thematic categories and subcategories, creating a hierarchy of themes that were continuously refined and reduced (see Drisko & Maschi 2015, pp. 103-106), in later stages to more precisely address the research

questions informed by the literature. As this procedure is a mix of inductively and deductively developed codes, the researcher should be transparent with how the codes were developed and utilized (Drisko & Maschi, 2015, p. 107). Therefore, a detailed code book can be found in Appendix B describing this process. In the final round of coding the same code book was used for both the articles and the interviews.

5.4 Limitations

One apparent weakness of using newspaper content in a *post hoc* analysis of an environmental success is that this data might be more representative of the media narrative of the problem instead of the problem itself, resulting in potential validity issues as this data is used in both these ways in this thesis. However, for this thesis, this is less of a limitation since the media narrative is useful for understanding the social dynamics of the environmental problem. Media is here considered an intermediary for measuring public consciousness, and in some respects it can even do a better job than, for example, surveys. Particularly in examining the prevalence of various factors of influence, e.g., expert warnings, consumer advice, etc., and practical impacts of conscious behavior, such as consumption. More importantly, the use of expert interviews to triangulate the newspaper data diminishes this problem even further. Potentially, this could be triangulated further by another form of data, for example, archival records of licensing procedures. However, this was not feasible as the archival records of the NLB are too extensive to go over in the time frame of this thesis, potentially making it exceedingly time consuming to even find the relevant documents.

Another potential issue with the newspaper content is the choice to analyze only national newspapers. To some extent, the problem of dioxins is local due to the emissions of wastewater into local environments. Moreover, threats to mills via regulation has an important local dimension. Thus, local reporting can offer other interesting perspectives less prominent in national newspapers. However, the decision to look at the national news outlets is still justifiable due to the national breadth of the research aims.

When it comes to coding one measure of ensuring reliability and validity is to compare the coding of different coders (Drisko & Maschi, 2015, pp. 107-109). Unfortunately, since this research was conducted by one researcher alone this is not possible. However, this is always the case in interpretative data sets and does not disqualify all studies conducted by a lone

researcher. Thus, while triangulating between researchers would be ideal this is not always possible. Furthermore, as has been mentioned above, another mode of triangulation is employed by using two or more methods of data collection.

Lastly, there is a weakness related to language and translations. All the data used in this thesis is in Swedish, meaning excerpts and quotes in the analysis are translated by myself. This opens up for the potential of misrepresentations, especially where there is colorful language meant to evoke a certain emotion. For example, I struggled with the decision to translate a certain headline from the Swedish “gift” into either toxin or poison. Toxin would be a more accurate word to describe dioxins, and “gift” can correctly be translated into “toxin”. However, poison is arguably the more general translation of “gift”, especially given that if the author of the text intended to invoke “toxin” they could have used the word “miljögift” in the headline instead. In the end, I chose to go with “poison” as I believed this better represented what the author wanted to invoke and convey.

6. Analysis

The analysis is divided into three parts according to three major themes that correspond to the research aims as well as the theoretical framework. The first part looks at intervention by political actors, and agencies including efforts made by governing entities to limit dioxin emissions from the PPI, such as but not limited to regulation. Following that is a section on public consciousness which also cover consumer pressure, market incentives, and demand from citizen-consumers for safe products. This section also relates to the question of power among people being on the receiving end of negative environmental externalities to address this. Lastly, industry response/pushback details instances or trends of PPI responses to regulation, criticism, and demands. This section also examines the PPI's unity and/or disunity in relation to the problem of dioxins and chlorinated waste, and how this varies in different situations and/or at different times.

It should be mentioned again that all the newspaper content as well as the interviews were translated from its original Swedish by the author of this thesis. While these then do not qualify as quotations *per se* the quotation marks were, for the sake of clarity, still used.

6.1 Political/Agency Intervention

The 1980s in Sweden saw an increased interest in environmental protection in the public leading up to the 1988 election when the Green Party was first elected to parliament. The PPI was also affected by this trend, and one expression of this is the increasingly tightening permits given by the NLB. Ultimately, this culminated in the adoption into law of the SEPA's recommendations of 1.5 kg of chlorinated waste per ton of produced pulp mills should be allowed to emit. This trajectory was covered previously in this text in the background and literature review chapters. However, it is worth noting that this sentiment of the chickens coming home to roost or the reality of the unsustainability of the current practices was described also by interviewees. For instance, one interviewee from the industry described it as "very obvious" that these emissions were detrimental to the environment just from observations downstream from a mill before dioxins had been discovered in the wastewater.

For this analysis, this data as well as corresponding interview data will be divided into two subsections, the first regarding regulation specifically, and the second about more general agency or government interventions.

6.1.1 Regulation

It is important to note that the Swedish regulatory system of giving licenses of emission rights to individual mills instead of setting national limits through its structure isolates the mills, giving no clearly defined common “enemy” in the form of regulation to lobby against. In addition, this has the effect of leveling the playing field in terms of power – it is easier for activists and government agencies to have leverage over one mill than the entire industry. The unity or disunity of the PPI will be discussed at length later in this thesis. However, it is important to mention here in this section where it pertains specifically to regulation. This isolation is highlighted by informant 2 as the mill they were associated with accepted a strict license from the NLB: “our colleges from other mills started one hell of a commotion questioning how we could agree to this”. The reaction stems from the fact that this sets a precedent that can later be referenced in future negotiations, even though mill-specific conditions are taken into consideration. These decentralized licensing processes, specifically the probation periods, are also described by informants both from industry and with a background in the NLB as being crucial in developing the technology and skills needed to reduce emissions. Informant 2 describes it thusly: “In that time government representatives were more pragmatic compared to today and you were allowed to try things, so to speak, in the factory that I don’t think you would be allowed to do today”. This sentiment is reinforced by informant 5 who when talking about these probation periods says: “This possibility exists still today, but it is not utilized in the same manner, and I think it was very successful with these probation periods because it meant that demands were put on the industry to develop the technology”.

These licensing procedures were the object of discussion in six of the articles from the selected sample. Three of them covered the process regarding Värö mill (Dagens Nyheter, 1987, p.8; Ekman, 1986, p. 6; Sandberg, 1987, p. 8), and three reported on the negotiations regarding Aspa mill (Engman, 1988, p. 22; Karlsson, 1987, p. 8; Strandberg, 1988a, p. 9). In both cases, there is a significant gap between demands on emission reductions put forth by the SEPA, or ultimately by the NLB, and the mill in question – for Värö the SEPA demands 1.5 kg of

chlorinated waste per ton of produced pulp, whereas the mill's representatives agree to reduce it to 3.5-4 kg. At Aspa mill, the probationary period system was utilized, as it was decided by the NLB that the mill would explore the possibilities of reaching 0.5-1 kg of chlorinated waste per ton of pulp produced, from the starting point of 4 kg, by employing new methods and technologies. In both the case of Värö and Aspa, previous licensing decisions were reported as benchmarks both the NLB and the SEPA considered when making their decisions or demands. Thus, earlier licensing procedures act as precedents in later procedures and should therefore be categorized as past regulation in the Swedish decentralized context. In addition, the way the Swedish environmental code of 1969 worked in practice allowed not only for individual licensing processes for each actor. It also focused not on specific compounds, but on umbrella parameters, which did not require new legislation to be added as a criterion in the licensing process, rather it fell under the existing environmental code (informant 1; informant 5). As for the threat of future regulation, the government was clear that the goal was to eliminate these emissions altogether (proposition 1987/88:85), a proposition with a broader environmental focus which one newspaper summed up as "Stricter rules regarding dioxin emissions" (Dagens Nyheter, 1988, p. 14) illustrating the prevalence of the issue. Soon after, the proposition set a goal of 80 % reduced emissions of chlorinated waste from the PPI before 1992.

The efforts of the SEPA were not always effective in limiting emissions in the immediate future, as informant 2 describes an early licensing process:

"This mill was the first to accept a license of 2 kg of TOCl per ton of pulp. But then the SEPA made a mistake because they thought it was too high and appealed the license, arguing that we should be obliged to only emit 1.8 kg. But this meant that it would take another year before any limit at all was in effect which turned out worse for the environment than if we would have had the 2 kg limit."

On the other hand, this set a precedent that could then later be referred to in future licensing processes. There were also other aspects that limited the effectiveness of regulation on the broader issue. Informant 4 said this about the licensing processes:

"At the end of the eighties and beginning of nineties, the SEPA wanted to pose higher demands in the licensing processes but since most pulp mills already existed and had their licenses forever, they were not too affected by this tool."

Furthermore, the role of regulation shifted early on from being directly regulatory to falling behind, meaning mills quickly reduced emissions far below what was permitted by the licenses as market dynamics became more and more relevant. However, this did not mean that regulation became irrelevant as a potential tool for instigating change, according to informant 4, who argued that:

“The social democrats’ environmental program came out which was called ‘our green dream is red’, or something like that, and which was a driver in all of this. Not to mention Birgitta Dahl personally played a huge role in the political part of this. She was environmental minister 86-94 and during this time she managed to influence the industry a great deal – the very present threat of regulation through legislation if the industry did not invest was very real.”

Furthermore, informant 4 suggests that: “Clear legislation was not needed in this area, rather it was solved through market forces which had everything to do with the fact that we [citizens] had some modicum of power and could force the industry to adapt”. This sentiment that the market fast became the dominant or at least a highly significant means of regulation of emissions is also reiterated by the other informants. For example, as informant 3 put it: “What happened was that, in Sweden, this issue evolved from being a problem for the authorities to being taken over by the market at the end of the eighties”. To sum up, the evidence suggests that regulation in the form of licensing processes played an important role early in the development of this story. What was also important was the style of regulation which allowed for flexible adaption to the limits on emissions set. Later, as the story developed and became a more prominent issue in the public, consumer pressure and other market mechanisms took over as the more important driver for change. However, this does not diminish the importance of regulation in the initial stages of the solution to the problem with dioxins and chlorinated waste. In addition, the, at the time, very strict guidelines set by the government to limit emissions to 1.5 kg by 1992 sent clear signals to the PPI about how important this issue was in the eyes of government representatives. This corresponds again, however obviously less straightforward compared to licensing, with the threat of future regulations indicator of the theoretical framework, as this potentially reveals an inclination from politicians and agencies towards more regulation.

6.1.2 Agency Interventions

During the licensing procedure for Värö mill where SEPA was an active party both in establishing the pollution conditions in the waters outside of the mill, but also in arguing for what is by then in 1986 very strict limitations on emissions of 1.5 kg of chlorinated waste per ton produced (Ekman, 1986, p. 6; Dagens Nyheter, 1987, p. 8). The SEPA also criticized the mill in the media for minimizing the issue in stating that “large parts of Kattegatt could be affected by Värö mill during longer periods of higher barometric pressure in the summer, or when it is frozen during the winter” (Sandberg, 1987, p. 8). Furthermore, “there are no recipients that can safely be exposed to toxins such as dioxins, compounds that are very toxic and very persistent and stays so long in the environment that they cannot be diluted to a safe level” (Sandberg, 1987, p. 8). The informants describe the SEPA as an important actor, both as an opposing party in the licensing processes, but also as an actor deeply involved with addressing the issue beyond this process. For example, informant 1 describes how they had a representative from the SEPA with whom they could discuss research developments. And informant 2 describes a discussion they had with a SEPA representative as such: “At the time when the use of chlorine chemicals was the most controversial, I had a discussion with a SEPA representative who recommended we remove the chlorine entirely and use hydrogen peroxide instead, and that was what we did”. Thus, the SEPA and the industry were on the one hand opposing parties, but at the same time, there were exchanges that implies more of a joint effort towards a compromise that would address the issue. It is noteworthy that throughout the handling of this environmental issue, the findings indicate a significant base level of trust between regulators and government agencies on one hand, and the industry on the other hand. In addition, the agency, or its representatives, took on an informative role in educating the public about the dangers of dioxins and chlorinated waste in the emissions from pulp and paper mills taking an active role in the public debate, as exemplified by the samples above.

Another government agency that greatly impacted the discourse is the Swedish Chemicals Agency (SCA). Late in 1987, the agency issued a statement suggesting that diapers made using chlorine-bleached pulp should be banned, adding that they were looking into whether other products using pulp and/or paper should also be banned (Falkirk, 1987, p. 6). While it was also mentioned as a cause for concern, the main reason for this suggestion was not the potential dangers of dioxins in household products but rather the emissions into the environment from production. The media, however, gave a lot of attention to the potential dangers of dioxins in

common products such as diapers and tampons – not only because of the statement by the SCA, other experts had issued similar, albeit tentative, warnings that the media latched on to. At the same time, the consumer agency tried to calm parents worried about dioxins in the diapers emphasizing that there are no dangers with the small amounts of dioxins in toilet paper and diapers (Strandberg, 1987, p. 12). The warnings from the SCA were repeated in *Aftonbladet* three months later – with no mention of the rebuttal by the consumer agency (Hallgren, 1988, pp. 20-21). Emphasizing that the SCA was looking to ban “all bleaching of paper in every household product” (p. 20) to avoid what was referred to later in that text as “The Death toxin dioxin” (p. 20). This is not the only example of sensationalist media practices which will be discussed further in the next section.

There were also other political entities active in some sense in the dioxin issue, mainly in the discussion on the use of paper in government bodies. For starters, the municipal association (an association representing all municipalities in Sweden) changed its paper supplier to environmentally friendly paper in response to the dioxin debate (Hallgren, 1988, pp. 20-21; informant 4). Similarly, there was a motion that the Swedish parliament should follow suit and use only unbleached paper in circulation in parliament (Hallgren, 1988, pp. 20-21). Lastly, the Swedish Election Authority printed all ballots on unbleached paper for the 1988 election (Jacobsson, 1988, p. 8). While this is not the same as the direct pressure by the SEPA and its demands for reduced emissions, nor is it the same as the more indirect pressure exerted by the SCA through suggesting direct bans on products, these acts still send clear signals both to the PPI and to citizens that this problem is acknowledged by the authorities and political actors. In addition, large buyers such as the municipal association can create demand for products that require and motivate technological development if the products do not fit the demands. As informant 4 points out when talking about the municipal association: “They have quite a bit of power, particularly when it comes to public procurement, all of a sudden there is a market”. Another notable intervention by a government agency was undertaken by the municipal environmental department of Stockholm which distributed a folder to Stockholm inhabitants urging for a boycott of bleached paper. This provoked a strong response from the forest industries which responded by taking out full-page ads to debunk the, what was argued, misinformation of the folders (Melander, 1988, p. 34; *Skogsindustrierna*, 1988, p. 19). Altogether it was apparent that further restrictions and regulations were looming in the future, and the various interventions from different political or government actors adds weight to this threat. Beyond speaking to the regulatory indicators of the theoretical model employed in this

thesis, the stringency of agencies and political entities might also be related to the capability of the public to push these to action. However, whereas this would be difficult to identify with certainty it is highly likely that this would have been a factor – which is also tentatively hinted at by the data. As it turned out the PPI performed far better than the restrictions regarding emissions of chlorinated waste placed on the mills.

6.2 Public Consciousness, Consumption, and the Power of the Citizen-Consumer

There are two separate but interrelated dimensions to understanding how awareness of the dioxin problem developed, both related to the public consciousness and capability to influence the issue indicator of the theory. On the one hand, there is the environmental dimension, which is more scientific and weighed in its understanding of chlorinated waste in general and dioxins in particular. On the other hand, there is the personal danger dimension characterized by the apparent danger represented in bleached pulp and paper products. This becomes confusing fast because there was a clear and present personal danger of chlorine-bleaching, but this was through emissions and the intake of fish exposed to these emissions. It is important to distinguish between these two understandings of the issue because here there is a clear constructivist element to how public consciousness about dioxins developed, and ultimately how this issue was addressed in Sweden. This dichotomy is implied or sometimes directly referenced by all but one of the informants, often in relation to the licensing procedures or marketing advantages of one method of bleaching over another. For instance, as informant 5 put it: “Back then there was a great public engagement with environmental questions, including the emissions of the forest industries. The hot topic, I believe, was the coffee filters”. When talking about the driving force of consumer demand to address the issue of dioxins, and what motivated this particular type of driver, informant 4 said:

“This is not always successful, however. Some also questioned if using, for example, toilet paper that was bleached using chlorine really can lead to human intake of dioxins and the truth of the matter is that well, probably not, or at least to a very limited extent. This whole thing was more about dioxin emissions in bodies of water and how it affected the fish and ecosystems there.”

Furthermore, when asked about dioxins and the licensing of chlorinated waste emissions informant 3 explained that: “It never really became a huge question at the negotiations about

particularly dioxins, rather the focus was continually on the total – dioxins, it was more of a media thing, so to speak”. This is important because these perspectives then act as motivators as to why consumers, both in Sweden and in export markets, demand chlorine-free pulp and paper products – which in turn relate to the capability of the public to address the environmental issue in question.

6.2.1 Awareness of the Dioxin Problem

This section shows the build-up of consciousness around the problem with dioxins and chlorinated waste, and how this problem was portrayed in the media. This is important because the construction of the issue will ultimately influence the public’s motivation to address it. Thus, the indicator for public consciousness extends further than mere awareness. Articles that emphasized the environmental consequences of the emissions of dioxins from the PPI often do so by describing the effect on animal life. For example, the elevated dioxin levels in west coast crabs were narratively directly related to emissions from Värö mill (Ekman, 1986, p. 6; Nyström, 1986, p. 6; Sandberg 1986, p. 6). Another angle is the detrimental effect on fish and fishing. For example, an article by Dagens Nyheter (1987, p. 8) has the headline “Chlorine emissions lead to the death of fish”, the article also relates this to the elevated levels of dioxins in crabs and names Värö mill as the culprit. The effect on fish and the general worsening state of Swedish lakes are crucial aspects in several other articles of the sampled content (Andersson, 1987, p. 7; Ekman, 1987, p. 7; Karlsson, 1987, p. 8). These articles often frame activist organizations like Greenpeace or other local activists as the main antagonists of the emitting industries. Compared to the articles of the sample which emphasize the other dimension of awareness of the dangers of household products (see below) these articles use less alarmist headlines and text and are more to the point of reporting the state of the situation.

Rather early in the debate experts both from the SCA, as described in section 6.1.2, and otherwise issued warnings about dioxins found in household products such as diapers, tampons, coffee filters, toilet paper, etc. In the case of the statement by the SCA, for example, these warnings were tentative and emphasized that products were unnecessarily bleached with a detrimental impact on the environment; the dioxins in the actual product were a secondary reason, as per a letter sent from the SCA to environmental minister Birgitta Dahl (Falkirk, 1987, p. 6). The media were quick to latch on to the idea that one’s household products were contaminated with what was often described in some manner as ‘one of the most toxic

compounds ever created', and several articles were published on this topic and selected for this analysis. For example, an article written by Hansson (1988) about dioxins in coffee filters quotes the environmental expert Björn Gilberg:

“Dioxins are such a new problem that we have not yet realized the extent of it. We are probably killing ourselves by ingesting the large quantities of dioxins that the pulp industry is emitting. By eating fish we are introducing the toxin to our systems” (p. 23).

This excerpt is interesting also because it highlights the parallel dimensions of understanding the dangers of dioxins. As was mentioned, the article was entirely about the finding of dioxins in coffee filters. Gilberg then acknowledges that “dioxins are so dangerous that one should strive to eliminate any intake completely”. However, at the end of the article he is quoted as emphasizing the intake of fish as the main issue. There are other instances in the sampled articles with a similar pattern – the article is angled towards issuing an alarm of a consumer product, followed by the featuring of an expert that acknowledges that any intake is unnecessary but shifts the emphasis towards the intake of food. For example, an article by Boltegård (1988, p. 8) has the headline: “POISON IN ICE CREAM AND TOOTHPASTE [capitalization in original]” and reported on the finding of dioxin in a food thickener made using pulp. In the article dioxin researcher, Christoffer Rappe is quoted as: “It is an unnecessary source of dioxins and other production methods should be developed”, later in the article Rappe states that: “The level of dioxins in fish from the Baltic Sea are many times higher”, bringing the emphasis again back to the emissions.

The debate about tampons featured experts with slightly differing opinions. For instance, following the finding of dioxins in tampons a piece by Creutzer (1988, p. 6) features chief physician Lennart Hardell who issues a stern warning that there is a possible connection between the dioxins in tampons and cervical cancer, therefore Hardell recommends women to altogether stop using tampons that are bleached with chlorine. Also in this article, Christoffer Rappe downplays the dangers of the product as: “There is nothing that indicates that the dioxins in the tampons enter the system of the user” and emphasizes the emissions: “We need to remember that what exposes us mostly to dioxins are emissions from pulp mills”. Another article on the topic by Erseus (1988, p. 9) was headlined with a quote from chief physician Hardell: “STOP USING TAMPONS [capitalization in original]”, as the headline subtly implies,

the article alerts people to the dangers of using tampons relying on Hardell's suggested link between cervical cancer and the dioxins in tampons. Rappe is featured, in this article as well, as a moderate counterpart to the alarmist message, emphasizing that while it is slightly worrying that dioxins are found in household products, the bigger issue is the dioxins polluting the environment. All the sampled articles featured thus far in this paragraph have been geared toward raising the alarm through the use of provocative headlines and fear-evoking language. Moreover, every sampled article discussed also featured experts who moderately rebutted the alarmism in an effort to redirect it toward the more scientifically grounded but related issue of emissions. Only one article (Bojs, 1988, p. 6) in the sample on this topic had as a primary focus the problem of emissions while moderately downplaying the warning of household products, as opposed to the focus of the others which were to issue warnings.

This did not mean that the emissions into the environmental dimension of the production processes were ignored and wholly supplanted by a worry about the dioxins in household products. It was, however, a slight misrepresentation that experts attempted to correct in the media – the problem was not the dioxins in the products made from bleached pulp and paper, but the dioxins in the foodstuffs and in the environment in general which came from, among other sources, the PPI's emissions. However, at this stage concern with the dangers of these products was already a cemented part of the discourse and public knowledge about them. Producers of sanitary products like Mölnlycke and Holmen Hygiene were quick to adapt and opt out of using any chlorine-bleached pulp in their products, as reported by Ollevik (1988, p. 6). While this is not conclusive evidence, this example suggests that the sensationalist media practices of the dangers of dioxins in household products did have a significant effect on consumers which garnered a response from producers. Furthermore, it should be noted that while the discovery of dioxins in household products was new, dioxins had been discussed extensively in the media earlier – both as dioxins were discovered to be a byproduct of waste incineration, but also in relation to incidents like Seveso. Thus, there was potentially already a deeper-rooted fear of dioxins which amplified the effects of the reporting that these compounds had been found in household products. It is important to note, however, that in both understandings the problem of dioxins was brought close to the reader – either in a more direct way through household products or in a slightly more roundabout way through the intake of contaminated food and the destruction of the local environment. Neither of the narratives supported an understanding that dioxins were a minor issue, rather, both framed dioxins as a major problem requiring immediate action. Lastly, it is also noteworthy that the evolution of

the problem-framing in the media, from emissions to the dangers of products, correlates chronologically with the diminished role of regulation and the increased significance of market dynamics in achieving reductions to emissions discussed in section 6.1.1.

6.2.2 Consumption and the Power of the Citizen-Consumer

This section corresponds to the capability of the public to influence the problem of dioxin emissions. To a lesser extent, this section also relates to the economic incentives of firms to self-regulate due to the competitive advantages of ‘going green’, connecting it to the “disunity of the business class due to fragmentation of interests” as described in the theoretical model. As consumer demand for products made without chlorine-bleaching increased this traveled upwards to producers and ultimately to the PPI who made the pulp used in the products. For producers, it became an area of competition for who could be more environmentally friendly. As was mentioned in the literature review section of this text, eco-labeling became an important factor in facilitating this competition. The importance of eco-labeling was also emphasized by three of the informants – two former industry people, as well as the informant with a background in an environmental organization. Both industry people expressed that the ‘greening’ of the bleaching process evolved into a marketing method with informant 3 emphasizing that their firm advocated that a certain eco-labeling actor should have even stricter requirements. Informant 4 described a more contentious process where the PPI at first resisted eco-labeling but that this became an untenable position as more producers of goods and retail sellers elected to partake.

Newspaper articles coded with this theme is implicitly or explicitly guiding citizen-consumers in a certain direction, or in a more general way cover the effects of consumption on industry. The first of these, implicit guiding, inescapably overlaps to a great extent with the reporting of the dangers of household products discussed in section 6.2.1 above. For the sake of avoiding repetitiveness these will not be discussed again here other than to acknowledge this aspect of this kind of reporting – informing the newspaper’s readers that their everyday products are toxic has at least an undertone of recommending one should not use these products. Some articles featured explicit consumer recommendations. For example, Aftonbladet (1988a, p. 11) informs their readers that unbleached coffee filters are soon in stores that are “guaranteed dioxin-free”. Another two-page piece in Aftonbladet (1988b, pp. 16-17) is structured as a practical consumer guide, listing what brands or products are low-chlorine or chlorine-free – a service that would

later be undertaken by eco-labeling. There were other efforts of this kind by activist organizations who published books and pamphlets about what brands and products were low-chlorine or chlorine-free, and which were heavily circulated (informant 4). Eco-labeling became an important factor according to several informants. As informant 2 put it when asked about the significance of eco-labeling:

“The importance of it came and went. For a while, it was extremely important to meet these requirements. In the case of firms that had products that were close to the consumer, such as toilet paper and diapers, they simply had to meet the requirements.”

Informant 4 describes the launch of the first relevant eco-label in 1989 thusly: “We talked about this with ICA and KF [two leading nationwide supermarket chains] and it was decided that we would proceed with on-shelf eco-labeling, meaning we could implement it overnight, which had a rather substantial effect”. The other informants also discussed the market dynamic and its general significance in ultimately reducing emissions which, in part, was made possible by eco-labeling. While eco-labeling was implemented rather early in the dioxin story some producers had already shifted production to exclude chlorine-bleached pulp. For instance, in the case of diapers, producers were very quick to react to growing demands from consumers. In an article published in February of 1988 one major producer of hygienic products announces that they are shifting away from using chlorine-bleached pulp in any of their products. Incidentally, the representative of the producer acknowledges the two different dimensions in the perception of the problem mentioned in the introductory paragraph to section 6.2 of this text when they are quoted as bluntly saying: “We are convinced that this is a constructed debate, but rather than to engage with it we will refrain from using chlorine-bleached pulp” (Ollevik, 1988, p. 6). Diapers are an often-recurring topic in the articles in the sample. For example, an article that references the demands from the SCA to ban chlorine-bleached diapers reports on the competitive edge of environmentally friendly products: “The debate about chlorine-bleached diapers has made the producers completely stop using any chlorine-bleached chemical pulp in the diapers, and this is avidly used in commercials” (Sjökvis, 1988, p. 1). Another article describes the introduction of a pamphlet issued by a major grocery store chain about which pulp and paper products are chlorine-free. In the article, a representative of the firm talking about demand is quoted as: “All of the Swedish-made diapers in our stores today are already chlorine-free. There is a tremendous will from producers to acquiesce to environmental demands” (Wrange, 1988, p. 6).

Moreover, Hedström (1988, p. 10) writes about the “parents worried about toxins in diapers that are pushing the forest industries to reduce chlorinated waste” as a consequence of reports that “the toxin dioxin has been found in diapers made with chlorine-bleached pulp”. In this piece, the competitive edge is a major theme as an executive of the last manufacturer of diapers in Sweden that still uses chlorine-bleached pulp in their products speaks out: “They [competitors] directly targeted our diaper in ads pointing out that we still use chlorine-bleaching”. As a result of the stiff competition, the executive clarifies that they too will stop using chlorine-bleached pulp. Informant 4 describes a similar sentiment when retelling a meeting with the executive of a diaper manufacturer musing that: “they folded completely” when pushed on environmentally friendly production.

It did not take much time for Swedish producers to meet the demands of consumers and already in 1989, the general tone of articles had shifted from building awareness and issuing warnings to describing a more or less successful process. An article by (Reberg, 1989, p. 8) emphasizes how the demand for chlorine-free products led to grocery store chains competing amongst each other about which is the most environmentally friendly. Remarking on the speed with which producers have reacted Sandberg (1989, p. 7) writes in an article that: “Industry has reacted to the environmental demands of the public to the degree that what was relevant in the autumn - 88 is no longer relevant in June of -89”. Lastly, in a front-page article, Lindström (1989, p. 1) seemingly declares victory with the headline “The Consumers forced the industry – All paper is now environmentally friendly”. In the text of the article, the author then clarifies that this is according to the criteria of the Swedish Society for Nature Conservation Association. While the Swedish domestic market was well on the way to pushing out chlorinated pulp and paper products most of the pulp produced in Sweden was still exported. However, consumers in important export markets such as the UK and Germany also started demanding chlorine-free products shortly after the Swedish consumers. As informant 3 described it:

“We still defended chlorine-bleaching in 1988. But at this point, Greenpeace got involved, and the environmental movement took over which affected the market, and the market dynamics, particularly in Germany. Greenpeace was extremely strong in Germany and was very active there. So this led to demands to get rid of chlorine-bleaching altogether, in Germany.”

Informant 4 also discussed the export markets and the demand in these for chlorine-free pulp:

“It was, among others, a female organization in Great Britain who were demanding chlorine-free pads among other things. There were also consumer organizations in Germany that called for boycotts of Swedish pulp and paper products, toilet paper for example because these contained chlorine and could therefore contain dioxins.”

Informant 4 later continued by stating that: “Sweden was a rather small market, we exported most of the pulp and the products, meaning that the pressure from Germany and Great Britain was necessary for this to become real for the industry”.

The increased demands also from export markets for ‘safe’ pulp and paper intensified the competition between firms to meet these demands. Not meeting these environmental requirements closed these markets to producers, as described by informant 2:

“The advantage was that you could sell to Swedish, German, Dutch, etc., clients. If you could not meet the Svanen [an eco-label] requirements you would have to deliver to China or Japan, you had to transport it further and charge less for the product.”

The evidence in this section suggests that the power exerted by consumers had a significant impact in ultimately reducing the emissions of chlorinated waste in general, and dioxins in particular. As informant 4 put it: “Consumer power and government power joined forces on this and to some extent, you could say that they [the forest industries] gave us a walkover win, there was no need for legislation in the end, consumer power solved the problem.” The following section goes more in-depth about the economic incentives of the PPI to transition to chlorine-free production processes.

6.3 Industry Response

This theme covers responses from PPI actors, either through comments, interviews, or ads. There is an interesting trajectory where firms are more defensive and deflecting early, but as time progresses and pressure builds (and technology is progressed) this evolves into a counter-offensive. The connections to the theoretical model in this section are mostly related to the fourth indicator describing the unity and/or disunity of the business class. Due to the special

position the forest industries have had for a long time in Swedish society, its consolidated ownership as well as the strong trade association it is reasonable to assume a unified business class as per the theoretical model. It is in analyzing this part of the data that the most surprising dynamics were identified specifically regarded the unification and quite early acceptance of the problem representation of dioxins and chlorinated waste by the forest industries.

This section is divided into two subsections, the first of which examines how the problem of dioxins and chlorinated waste was received, discussed, and framed by the forest industry. The second covers and discusses instances of unity and disunity in approaching the problem. While the first subsection also relates to this dynamic it is discussed more in a more focused manner in the second subsection.

6.3.1 Is There a Problem According to the Forest Industry?

Looking at other environmental issues, e.g., CO₂ emissions, the fossil fuel industry has used denialism or downplaying of the problem as strategies to forestall or limit regulation (Dunlap & McCright, 2015, pp. 310-311). Similarly, and more relevant to the subject of this thesis, industry actors in the US followed a similar path in the handling of the developing dioxin problem in that context (Beder, 1997, pp. 141-160). In the case of dioxins and the Swedish PPI, there are few instances of these practices, but not none. In an article published by Dagens Industri (1986, p. 5) it was reported that research conducted by the Swedish Forestry Research Institute found that no dioxins could be found in either the exhaust to the air or in the wastewater. To label this as an industry response is potentially controversial as this organization is a research institute and not, for example, a public relations firm. However, ignoring the clear and obvious bias of a research institute tied to and funded by this industry would be a bit naive. At the same time, one does not need to assume deliberate fixing, or something similar, to view research by industry-funded institutes with a healthy dose of skepticism (for a recent example of problematic forestry research in Sweden see Andersson & Westholm, 2019, pp. 111-137). In another article, (1987, p. 12) reports on a letter sent to the Swedish government in protest of the SCA's demand to ban chlorine-bleached diapers in which the forest industries allegedly claim that "it is erroneous to claim that emissions of chlorinated waste have detrimental environmental effects". Another form of denialism is mitigating the problem, which was expressed by representatives of a paper mill claiming that there was no environmental damage from the mill's wastewater due to it being diluted in such a large body of water (Dagens

Nyheter, 1987, p. 8; Sandberg, 1987, p. 8). Thus, while there are a few examples of denialism or downplaying of the problem, there does not appear to have been a concerted and/or joint effort to engage in these types of strategies based on the available data. This might be due to limitations of the types of data collected which might be corrected by using archival records of licensing procedures. These could show whether firms attempted to deny or downplay the problem or if they more or less accepted the framing of the issue. However, this finding is quite surprising given that the model suggests that a sector with this makeup would offer a more unified resistance.

The three informants with a background within the PPI essentially expressed that while there were some disagreements about the extent of initial regulation the problem with chlorinated waste was recognized and acknowledged by the industry and therefore there was no significant resistance. For instance, informant 1 expressed that: “Within the industry, we understood that the kind of emissions we had caused for many years with the technology we used back then was not good”, and later in the interview when asked whether the limits to emissions were reasonable the informant put it thusly:

“It is always the case that what is technologically possible, economically reasonable, and environmentally desirable should be weighed. But in this case, if we look at dioxins, it was such an important issue that the forest industries invested heavily to correct and make it environmentally desirable.”

Similarly, when asked if they perceived increased pressure from agencies once it was discovered that there were dioxins in the emissions informant 2 replied:

“No, this was not my experience of the situation. At least not from the side of agencies such as the NLB or the SEPA. This was because we acted so fast to address the issue. This was discovered in -86, you could say, and we did experiments and could conclude that it was probably the emissions from Värö that caused the higher levels found in crabs off-coast, it didn't come from anywhere else, it was clear that they were from Värö. And two-three years later we had transitioned to new processes and then we left elemental chlorine completely when mills either took the ECF-route or the TCF-route.”

On this issue, the informants' perspectives diverge. When asked whether there was resistance from the PPI to the initial regulations informant 4 strongly affirmed that there was significant initial resistance from the PPI to the extent of the regulation of TOCl. Due to the very short period of time between when the dioxin problem was discovered and the know-how to effectively cut emissions was obtained, and the decentralized regulation of Sweden, both of these perspectives can be argued to be supported by the newspaper content data. However, it is clear that at the offset of the problem with dioxins and the PPI, there was significant contention and resistance to the limits sought by the SEPA and environmental activists alike. One such example, found in the sample of newspaper content, of a highly contentious NLB permit process that took place in 1987 concerned the previously mentioned Värö mill. The SEPA demanded a reduction of emissions of chlorinated waste down to 1.5 kg per ton of produced pulp whereas Värö mill suggested that they lower their emissions to 3.5-4 kg (Sandberg, 1987). In later licensing procedures, the counterparts were significantly closer to each other in their respective suggestions, for example, one instance described by an informant the mill in question agreed to 2 kg whereas the SEPA demanded 1.5 kg.

One noteworthy response from the PPI recurring in the newspaper content is to argue that the dangers of dioxins and chlorinated waste are exaggerated, but at the same time acknowledge that they take this issue very seriously and accept what is asked of them (Hedström, 1988, p. 10; Karlsson, 1988, p. 8; Wergens, 1987, p. 2). However, this is not necessarily paradoxical as merely adapting to the two dimensions of public consciousness of the issue described in section 6.2. As informant 2 expressed it: "That's how it often was during these years, things were done because they did not want to challenge, you followed the path of least resistance".

In 1987 the then president of the forest industries trade association Bo Wergens (1987, p. 2) published a debate article in *Dagens Industri* that is partly an inventory of environmental improvements done by the PPI, and partly a call to arms of the PPI to address the issue of dioxins and chlorinated waste. This is an indicator of how the PPI perceived the problem as real and serious from that point on, at least. However, it is far from conclusive evidence that this is how they acted in practice and in licensing negotiations. Later, Strandberg (1988b, p. 9) reported in June of 1988 that the forest industries had earlier expressed that the SEPA's and the parliament's demand to reach 1.5 kg of TOCl/ton was completely unrealistic and that they could limit emissions to 2 kg of TOCl/ton. However, this would not be possible before the mid-1990s and it would cost twice as much as the SEPA had estimated. As of this reporting the forest

industries instead expressed that they could reach 1.5 kg of TOCl/ton by 1992 but that meant stretching the technology to the limits. Of course, we now know that they would reach this average in 1990 and that the emissions would continue to drop.

In late 1988 and early 1989, the forest industries launched a public relations campaign publishing five different full-page ads each appearing in every national-spanning daily newspaper (Skogsindustrierna 1988-1989). These ads paint a picture of the forest industries as advocates for the environment with each of them describing actions taken by the PPI to address dioxins i.e., investments, and research. In addition, the forest industries were expressing and emphasizing the world-leading position of the Swedish PPI to reduce dioxin emissions due to these commitments. The ad campaign is in the same spirit as the debate article published by Bo Wergens (1987, p. 2) brought up at the beginning of the previous paragraph – describing past, present, and future dedication to environmental values. In other words, this indicates a substantial continuity and coherence in the stance of the forest industries stretching across at least two years. The interesting detail, however, is that this unified stance is not necessarily defensive or deflecting, the disagreements with regulators and activists only regard the speed with which the emissions need to be addressed. This will be discussed more in detail in the next section.

6.3.2 Unity and Disunity

There are instances of both unity and disunity of the forest industries in addressing the problem of chlorinated waste and dioxins. In terms of regulation, the Swedish system's decentralized licensing procedures organically fomented disunity by not offering any centralized regulation to target the forest industries. This is exemplified by informant 2 when they described the criticism their mill received from representatives of other mills when the former accepted what was considered to be too low emissions limits. This set a dangerous precedent for the forest industries, with the potential to cause a chain of higher demands in licensing procedures. There are however instances where the forest industries through the trade association acted in unison in the national arena such as in criticizing the ambitions in proposition 1987/88:85. Moreover, there was a debate in the government to implement a chlorine tax, which would then incur significant costs for the PPI. However, this tax was never implemented due to what Lerner (1990, p. 14) and Bjerström (1991, p. 10) both describe as intense lobbying. In both pieces, the forest industries' spokespeople point to past investments and promises of future investments

made across the industry geared toward addressing the issue, arguing that this should be enough. By 1991, when Bjerström wrote her piece, it is clear that there will be no tax on the use of chlorine, and she describes “great irritation” at this from the SEPA. This highlights that there was still by that time significant contention on between the industry and the SEPA.

Whereas there were instances of disunity the forest industries are more characterized by unity in response to the problem of dioxins and chlorinated waste. However, not necessarily only because of the joint efforts to defeat the proposed chlorine tax and in arguing against national legislation. At the offset of the dioxin issue, the forest industries were already organized in longstanding joint research avenues, much of which concerned growing environmental demands. Informant 1 emphasizes the importance of these joint research institutions as well as the significance of this history for the relevant issue resulting in the creation of a task force specialized in working on chlorinated waste, summarizing it thusly:

“This was a hot topic for the media, but it was also a hot topic within the industry. The fact that we had this industry united environmental research meant that we could approach this in a much wider sense than if each firm were to do this by themselves – we could pool our resources.”

These types of joint efforts are also indicated by the newspaper content. In some cases deflecting, for example, when the forest industries’ joint spokespeople minimized the hazards of dioxins and chlorinated waste (Karlsson, 1988, p. 8; Strandberg, 1987, p. 12). In another instance, in a debate article written by two representatives from the forest industries research institute these express frustration with the focus on the forest industries in the dioxin issue, emphasizing that there are other industries that are greater emitters of dioxins. Moreover, the authors criticized the calls from the SCA to ban diapers that contain pulp bleached using chlorine arguing that the criticism is misinformed (Hernell & Axegård, 1988, p. 3). There are also more progressive contexts where the unified efforts of the forest industries are expressed, such as when the forest industry trade association finances a trial bleaching method at a mill facing harsh demands by the NLB based on its location (Ullenius, 1988, p. 7). Ostensibly resulting in a breakthrough reported on by Wäingelin (1988, p. 1) one month later.

As technology and know-how of bleaching processes developed, the unified research efforts in some ways tapered off in a competition of who could produce the most environmentally friendly

pulp. This competition was defined and framed by the two different routes toward this goal – ECF and TCF and is described by all three informants from the PPI. As informant 2 put it:

“One interesting thing is that this became business. Because the ones that could produce TCF-pulp, meaning totally without chlorine. All of a sudden, these could get 25 dollars more per ton pulp compared to the ones that produced ECF.”

Informant 1 describes one firm’s commercialization of TCF as “a very serious marketing effort” where they tried to “find their own specialization”. This even provoked calls from certain firms on eco-labeling actors to tighten requirements as these were argued were too forgiving, according to informant 3. Moreover, informant 3 remarked that being an early adopter of TCF became a “huge advantage” when export markets began demanding it. While competition can be categorized as business as usual, this type of competition is relevant for this thesis as the basis of the competition essentially leads to addressing the environmental issue at hand, whether this comes from a place of misinformed dangers of dioxins or not.

To sum up, there are aspects both of disunity and unity of the corporate class. Disunity is represented mostly by the Swedish regulatory style isolating belligerents, and later in somewhat harsh competition between firms over who is more environmentally friendly, both between producers of pulp, and between producers of household products. While this competition is a normal state of affairs on a market it is categorized here as disunity because it represents a disunity of the industry toward the environmental issue, which seemed to have resulted in even fewer emissions as it became advantageous to be environmentally friendly. However, unity is a more accurate description, to some extent against regulation in the form of a chlorine tax and against the ratification of proposition 1987/88:85. But even more so than unity in lobbying against regulation there was unity against the issue itself. This was through the joint research ventures, as well as the unified effort against the portrayal of the forest industries as environmental “villains”.

7. Conclusions, End Discussion, and Suggestions for Future Research

7.1 Conclusions and End Discussion

The research aims of this thesis were (1) to examine the case to understand how and why the PPI in Sweden transitioned away from chlorine use in bleaching processes; (2) to discuss which if any, lessons can be drawn from this case to current or future environmental issues; and (3) to add to the constructive debate between ToP and EMT, and in extension degrowth and green growth perspectives. The guiding research questions were:

- What are the economic, regulatory, and political factors that led to reduced emissions of dioxins from the pulp and paper industry in Sweden?
 - How did these factors influence emissions reductions?
- What, if any, are the implications of this case for the debate between growth-critical and green growth perspectives?

The analysis shows that regulation, economic incentives, and broader political pressure all converged to instigate the transitions. The initial stages of the transition were driven by regulatory efforts, which were early put in the background of economic incentives when consumers began demanding chlorine-free products. This demand was instigated and driven in part by rising fears of dioxins and in part by environmental concern, and made possible by consumer awareness organized by newspapers, and environmental activist organizations through eco-labeling. When export markets also began demanding products free from chlorine-bleached pulp and paper the incentives for firms to resist transitioning diminished even more, if not disappearing completely. The theoretical model suggests four indicators that identify whether the conditions of the case would likely lead to EMT or ToP power relations to emerge. Looking at the case of dioxins and the Swedish PPI using these criteria places these conditions firmly in the position of EMT in the public consciousness, and future regulation criteria. In the past regulation condition this case, arguably, also falls in favor of EMT. However, this requires some clarification since dioxins were discovered as a byproduct of production and then almost immediately regulated. The industry as a whole, the PPI included, had since the 1970s been facing increasing demands in licensing negotiations of reducing the environmental impact of production processes. Moreover, chlorinated waste was beginning to be regulated, albeit tentatively, before dioxins were discovered. Thus, while past regulation of dioxins was not

possible it was clear that past regulatory practices would imply regulations of dioxin emissions. Furthermore, in the regulatory style of Sweden, the precedent set by earlier licensing procedures essentially functioned as past regulations for the sake of this model. The fourth condition, business unity, is the indicator that revealed the most surprising conditions. While there is a long history of business unity in the form of, for example, joint R&D, and a more-or-less unified stance on the dioxins issue there was also fierce competition as firms took different technological paths that created disunity in how the firms perceived the problem of dioxins. This is best exemplified by the firm that lobbied those responsible for eco-labeling to make the conditions for chlorine-free products stricter. Ultimately, however, based on the oligarchic organization of the sector as well as the strong trade association the theoretical model suggests there should have been stronger opposition from the forest industry toward the strict regulation. One reason why this was missing could be the strong relationship between the state and industry, in particular through the joint research institutes.

One very interesting component of this case is the hard-to-kill notion that household products made from chlorine-bleached pulp or paper were a significant source of dioxins. There was of course a real and serious health issue *related* to the presence of dioxins in products, but not directly because of the dioxin levels in the products. Rather, the issue was from high levels of dioxins in food intake which was contaminated by emissions from a bleaching process that also resulted in contaminated products. Addressing the emissions also took care of the dioxins in products, and vice versa in this case. Thus, a person might have purchased a diaper labeled low-chlorine motivated by their aspiration to not expose their infant to toxins through the use of diapers. But in reality, they were limiting the exposure through reduced emissions resulting in reduced intake of dioxins via food by the mother, and ultimately reducing the dioxins in the breastmilk – saving both mother and child from exposure. In other words, it is clear that consumers were worried about dioxins in household products, and while this fear was unwarranted it did motivate consumers to buy ‘low-chlorine’ or unbleached products – which helped push pulp and papers firms to clean up the bleaching process. Thus, the sought-after outcome of consumers (limiting dioxin exposure) was achieved, but in a more roundabout way than directly through safer consumer products. It is hard to speculate how this transition would have developed without this added motivator. However, based on the media interest shown in Graph 2 above as well as the hyperbolic and sensationalistic reporting on the issue it is reasonable to assume that it was significant. Especially considering some estimates of total dioxin emissions at the time putting the metal industry just as high as the PPI without a remotely

similar media interest. To put it in modern terms, it seems as if what could be called ‘fake news’ worked in favor of the environment in this case.

Whereas this thesis identifies conditions for EM to better explain the reductions in emissions this should not be understood as strengthening the case for EMT and green growth writ large, as this is not supported by this thesis, nor was it its aim. However, I argue that it certainly shows how conceptualizations and perspectives from these are crucial to gain an in-depth understanding of how environmental successes happen – even given the criticism of these perspectives. It should be emphasized that the conceptualizations from the ToP are also crucial in the model; much like flipping a coin, the outcome is illustrated by which side is up but both sides are needed to make sense of the other at meso-level theorizations. The theory of how change happens for these two theoretical perspectives is, more or less, identical – economic criteria are pitted against ecological criteria leading to a synthesis that, as both theories agree, has historically almost exclusively favored economic criteria. At this level, the difference between these two is practically one of optimism versus pessimism. EMT is optimistic in arguing that ecological criteria are gaining more and more ground in existing institutions, whereas the ToP suggests that treadmill actors and economic criteria are too powerful. According to the ToP, what is needed is a surge in democratic control of resource extraction and pollution. What this means in detail is somewhat ambiguous, certainly, there are stronger and weaker forms of how this would look. I would argue, however, that this case can be viewed in this manner as the pollution of dioxins and the emissions of chlorinated waste were essentially eliminated by bringing the issue under democratic control.

This thesis highlights the multitude and strength of factors that can go into bringing an issue under democratic control and through this process successfully addressing an environmental issue. Importantly, while this is not to say that democratic control will always lead to environmental success, the case shows that there is a pathway to achieving this. What this case exemplifies is a case where an environmental externality was successfully and with a beneficial outcome brought under public and democratic control through regulation and consumer pressure. However, for this to be possible according to the theoretical model the public requires to possess the power to influence the issue. For environmental issues where the detrimental effects are felt mostly in the global South and where the benefits are enjoyed by the global North there is a substantial power discrepancy. It is evident that power was the underlying reason why this case was resolved the way it was. Whereas EM certainly has explanatory

strength in global North meso-level contexts and thus lends credence to green growth solutions, it does not follow that this dynamic can be repeated at a macro-level given this substantial power discrepancy. If the power of the population suffering under an environmental externality is crucial in correcting this, then it seems feasible to expect that some environmental problems will not be “important” enough before effects are felt sufficiently in the global north – when it will be too late for at least some of these problems to be sufficiently addressed.

One question that has lingered with me since the start of this project is: was this simply an easy problem to solve? This is a hard question to answer. Technologically, as it turns out, it was just around the corner. However, this was far from apparent during the crucial initial years when this specific environmental problem gained prominence. It is more accurate to say that it was a problem that was made to be easy through the efforts of regulators and activist-guided citizen-consumers. Interestingly, informants from the three separate sources all expressed that they did not think this problem would be solved, or at least not in the same forceful manner, had it emerged as a problem today; this is theorized by the informants to be because the licensing processes are not as pragmatic and the relationship between regulator and industry is more conflict-driven today. Furthermore, there are a plethora of labeling today, eco or otherwise, because of this, and because some labels are merely greenwashing which ends up hurting the trustworthiness of serious labels, it is much harder to be an informed consumer today.

7.2 Suggestions for Future Research

Researching criteria for when environmental problems were successfully addressed and when they were not is a worthwhile undertaking simply because of the implications it might have in solving current and future environmental problems. Future research could build on this body of work and develop a broader social-scientific understanding of environmental problems from the meso-level up. The conceptual model used in this thesis first developed by Shwom (2011) could be used to analyze other sectors or contexts which has seen dramatic reductions in dioxin emissions. Furthermore, other cases of environmental successes could also be analyzed such as ozone depletion and the transition away from methyl bromide, or the transition away from leaded gasoline. However, future research projects should also consider using either a longitudinal design or comparative case study design to further test and develop the specific indicators. Of special interest might be sectors that have significantly lowered emissions of greenhouse gas, or cities which have significantly improved air quality – both of these offer

fertile grounds for developing the understanding of socioeconomic factors in addressing environmental issues as these would exemplify pockets of success with greenhouse gases. The model could also be improved by integrating terminology and concepts from the broader literature on environmental transitions, such as technological lock-in. Studying anthropogenic environmental change is necessarily an interdisciplinary undertaking. Therefore, research should represent this by utilizing a breadth of literature and conceptualizations outside of the home field of the researcher whenever necessary.

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APPENDIX A

Intervjuguide för intervju 1-3

Konversationsbyggande:

- Fråga om karriärbiografi
- När började hen, och vid vilken position, fråga om bakgrund (utbildning, etc.)
- Hur utvecklades hens karriär

Beroende på vilket år hen började:

- Var dioxiner redan en fråga på agendan då du började eller utvecklades detta över tiden? Hur?
- Hur skulle du säga att arbetet med att reducera kloravfall ändrades efter dioxinlarmet ljud? Blev det snabbt en prioriterad fråga?

Hur skulle du beskriva dialogen mellan industrin och koncessionsnämnden, och andra myndigheter vid tiden? Hur mycket pressade myndigheter industrin och försökte industrin motstå detta tryck?

- Om du tänker tillbaka, enligt din erfarenhet, fick industrin gehör för eventuell oro när det kommer till regleringar?

När nya riktlinjer kom från Naturvårdsverket och koncessionsnämnden satte nya begränsningar på utsläpp, tyckte du att dessa var rimliga och nåbara i början?

- Ändrades din åsikt om dessa senare? Vad fick dig att ändra åsikt?

Till min vetskap fanns det två vägar att gå för att begränsa dioxinutsläpp från blekningsprocessen, (1) elementärt klorfritt papper, eller (2) totalt klorfritt papper. I och med att dessa metoder utvecklades kommer du ihåg dina tankar kring dem?

- Kommer du ihåg vad som påverkade dina preferenser om vilken väg som var "bäst"?

Kommer du ihåg om detta vägval ledde till konkurrens mellan olika företag? Hur mycket kommunicerade företag sinsemellan om detta?

- Påverkades denna konkurrens av Naturskyddsföreningens miljömärkning?

- Hur var det med andra marknader än den inhemska? Fanns det någon konkurrens som härleddes från miljöegenskaper av produkter?

Nu i efterhand, skulle du säga att regleringen som tillämpades var rimlig? Eller skulle de varit annorlunda på något sätt? Skulle något annat medel använts för att ta itu med dioxinfrågan?

Hur dyrt var det för industrin att rätta sig till dessa regleringar?

Har du något att tillägga utöver det vi redan pratat om?

Stort tack igen för ditt deltagande!

Interview guide for interviews 1-3

Build rapport:

- Ask about career biography
- When did they start, and what position, ask about background (education, etc.)
- How did their career develop

Depending on the year they started:

- Were dioxins already a big issue in the industry/at the mill when you started, or did it develop over time? How?
- How would you say the work on reducing chlorinated waste changed after the dioxin alarm sounded? Did it become a priority issue at the mill/in the industry quickly?

How would you describe the dialogue between the industry and the NLB and other government agencies at the time? How much pressure were regulators applying to the industry? Did the industry push back?

- Thinking back, in your experience, was the industry listened to as far as their concerns about regulation?

As new guidelines by the SEPA were declared and the NLB put new limitations on chlorinated waste did you think these were reasonable and attainable initially?

- Did your opinion on these change over time? What prompted it to change?

To my knowledge, there were essentially two routes to limit dioxin emissions (1) elemental chlorine-free bleaching, and (2) totally chlorine-free bleaching. As these two methods were developing do you remember your thoughts about either?

- Do you remember what influenced your preferences about what route to go?

Do you remember if this crossroads of methods spurred competition between firms? Did firms discuss this with each other?

- Did the labeling by the Swedish Society for Nature Conservation influence this competition?

- What about other markets than Sweden? Was competition based on environmental principles also influencing export markets?

In hindsight, would you say the regulations that were eventually applied were reasonable? Should they have been different somehow? Should some other means of addressing dioxins have been used?

How expensive was it for the industry to adjust to these regulations?

Do you have anything to add that we did not talk about already?

Thank you again for participating!

Intervjuguide för intervju 4

Konversationsbyggande:

- Fråga om karriärbiografi
- När började hen, och vid vilken position, fråga om bakgrund (utbildning, etc.)
- Hur utvecklades hens karriär

Beroende på vilket år hen började:

- Var dioxiner redan en fråga på agendan då du började eller utvecklades detta över tiden?
Hur?

Kan du ge en överblick på din erfarenhet om hur ni [i organisationen] jobbade med dioxiner?

Hur skulle du beskriva att den allmänna diskussionen gick kring dioxiner? Om/hur kopplades dessa till skogsindustrin?

När nya riktlinjer kom från Naturvårdsverket och koncessionsnämnden satte nya begränsningar på utsläpp, tyckte du att dessa var rimliga?

- Hur reagerade skogsindustrin på dessa enligt din uppfattning?
- Ändrades din åsikt om dessa senare? Vad fick dig att ändra åsikt?

Vilken roll tog ni [organisationen] i dioxinfrågan? Var ni inblandade i koncessionsnämndens licenseringsprocess på något vis? Samarbetade eller kommunicerade ni med någon annan myndighet eller politisk aktör?

Hur fungerade miljömärkningen?

- Enligt din uppfattning, ledde denna, eller liknande aktioner, till en konkurrens baserad på miljökriterier?
- Försökte man påverka hur denna skulle fungera från andra parter exempelvis producenter av massa eller producenter av hushållsartiklar?

Nu i efterhand, skulle du säga att regleringen som tillämpades var rimlig? Eller skulle den varit annorlunda på något sätt? Skulle något annat medel använts för att ta itu med dioxinfrågan?

Har du något att tillägga utöver det vi redan pratat om?

Stort tack igen för ditt deltagande!

Interview guide for interview 4

Build rapport:

- Ask about career biography
- When did they start, and what position, ask about background (education, etc.)
- How did their career develop

Depending on the year they started:

- Were dioxins already a big issue in the industry/at the mill when you started, or did it develop over time? How?

Can you give an overview of your experience on how you [in the organization] worked on the dioxin problem?

How would you describe the public debate regarding dioxins? Were they linked to the forest industries? How?

As new guidelines by the SEPA were declared and the NLB put new limitations on chlorinated waste did you think these were reasonable and attainable initially?

- How did the forest industries react to these, in your experience?
- Did your opinion on these change over time? What prompted it to change?

What role did you [the organization] take in the dioxin issue? Were you involved in NLB the licensing processes in any way? Did you cooperate or communicate with any other government agency or political actor?

How did the eco-labeling work?

- In your experience, did this, or similar activities lead to competition based on environmental criteria?
- Was there any attempt to influence how the eco-labeling worked from other parties such as producers of mass or producers of household goods?

In hindsight, would you say the regulations that were eventually applied were reasonable? Should they have been different somehow? Should some other means of addressing dioxins have been used?

Do you have anything to add that we did not talk about already?

Thank you again for participating!

Intervjuguide för intervju 5

Konversationsbyggande:

- Fråga om karriärbiografi
- När började hen, och vid vilken position, fråga om bakgrund (utbildning, etc.)
- Hur utvecklades hens karriär

Beroende på vilket år hen började:

- Var dioxiner redan en fråga på agendan då du började eller utvecklades detta över tiden?
Hur?

Beskriv gärna processen som leder fram till ett beslut om utsläppsrätt.

Hur skulle du beskriva dialogen mellan industrin och myndigheter, exempelvis Naturvårdsverket vid tiden? Hur mycket pressade myndigheter på industrin och försökte industrin motstå detta tryck?

- Om du tänker tillbaka, enligt din erfarenhet, kände du att industrin var mottagliga för de hårdare reglerna?

Minns du något om hur diskussionen gick i allmänheten omkring dioxiner? Kände man i koncessionsnämnden ett tryck eller en önskan kanske från allmänheten att vara tuff i bestämmelserna?

Till min vetskap fanns det två vägar att gå för att begränsa dioxinutsläpp från blekningsprocessen, (1) elementärt klorfritt papper, eller (2) totalt klorfritt papper. I och med att dessa metoder utvecklades kommer du ihåg dina tankar kring dem?

- Hur anammades dessa i koncessionsnämndens arbete?

Nu i efterhand, skulle du säga att regleringen som tillämpades var rimlig? Eller skulle de varit annorlunda på något sätt? Skulle något annat medel använts för att ta itu med dioxinfrågan?

Enligt din erfarenhet, fungerade regleringen som verktyg för att dra ner utsläppen och driva på teknologisk utveckling? Hur upplevde du licenseringen kontra konsumentpåtryckningar som drivande faktorer i denna övergång?

Har du något att tillägga utöver det vi redan pratat om?

Stort tack igen för ditt deltagande!

Interview guide for interview 5

Build rapport:

- Ask about career biography
- When did they start, and what position, ask about background (education, etc.)
- How did their career develop

Depending on the year they started:

- Were dioxins already a big issue in the industry/at the mill when you started, or did it develop over time? How?

Please describe the licensing process that determines the limits of emissions.

How would you describe the dialogue between the industry and government agencies, for example, the SEPA, at the time How much pressure were regulators applying to the industry? Did the industry push back?

- Thinking back, in your experience, was the industry receptive to stricter regulation?

Do you remember anything about the public discussion surrounding dioxins? Did you feel, in the NLB, increased pressure or a desire from the public to be stricter in the licensing procedures?

To my knowledge, there were essentially two routes to limit dioxin emissions (1) elemental chlorine-free bleaching, and (2) totally chlorine-free bleaching. As these two methods were developing do you remember your thoughts about either?

- How was this knowledge incorporated into the work of the NLB?

In hindsight, would you say the regulations that were eventually applied were reasonable? Should they have been different somehow? Should some other means of addressing dioxins have been used?

In your experience, did the regulation work as a tool to decrease emissions and drive technological development? How do you perceive the licensing contra consumer pressure as driving factors in this transition?

Do you have anything to add that we did not talk about already?

Thank you again for participating!

APPENDIX B

Public consciousness and power	Consumption	Originated from the data; however, with the awareness that some previous research emphasized consumer pressure. In dialogue with the theory, the theme was reinterpreted and applied in the last round of coding as representing an exertion of power through consumption.
	Activism	Originated from the data. This theme represents descriptions of activist activity from either organizations or individuals.
	Expert advice	After the initial coding of the data, this theme was constructed by combining related themes. The theme concerns input from experts such as warnings or efforts to calm worry about the supposed dangers of products.
	Closeness	This theme was constructed through a combination of themes of ‘urgency’, and ‘vicinity’ representing a closeness of the issue to the individual. It regards consciousness of the issue as it motivates action to address it.
Political/agency intervention	General pressure	Various interventions not directly related to regulation, i.e., statements, actions, etc., by government agencies, are represented by this theme.
	Past regulation	This theme was created for the final round of coding in, congruence with the theoretical framework, by dividing ‘regulation’.
	Future regulation	This theme was created for the final round of coding in, congruence with the theoretical framework, by dividing ‘regulation’.

Industry response	Forestalling/diversion	<p>This code was used in instances where industry representatives expressed themselves in ways meant to minimize the problem or delay action. It was added in the final round of coding by combining the codes ‘emphasis on environmental improvements’, and ‘economic issues with reducing emissions’.</p>
	Acceptance	<p>This theme represents instances where industry representatives in some manner accept the problem as significant. Interestingly, in some instances, representatives combined ‘forestalling/diversion’ statements while also expressing acceptance of what must be done.</p>
	Unity/disunity	<p>After consulting the theoretical model this theme was added to the coding process for the last round of coding – often overlapping with ‘forestalling/diversion’, and ‘acceptance’ as these were simultaneously representing a unified or disunified industry.</p>