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Abstract

The evolving paths of natural resource-based industries, such as the forest industries, are volatile to new technologies and changing markets. The volatilities of a Norwegian forest industrial regime are studied in this paper. Private forest owners and two firms have been the key actors in the regime. Since the 1960s and until the early 2000s, these actors and the relations between them defined a national regime of forest industrial evolution.

Financialization among forest owners combined with a strategy of debt financed global expansion within newsprint production at the turn of the century initiated the decline of the regime. Managers did not understand the growth of electronic media, and the consequences this would have on the previously successful business model of global capacity management. Lack of innovation and investments combined with cross border rescaling contributed to national deindustrialization of the forest industries. Norwegian pulpwood has become a precondition for continued Swedish forest industrial expansion. The materiality of logs being the basis for two interdependent industrial paths is highlighted as part of the reason behind this rescaling.

Key words: forest industry, industrial regime, scale, Norway

1. Introduction

The closure of a newsprint mill and two chemical pulp mills in Eastern Norway in 2011 and 2013 sent shock waves through the forest industry. The closures were part of a broader adaption to market decline for paper producers, with particularly severe consequences for the Norwegian forest industry. In two years, a fourth of domestic demand for logs disappeared, leading to severe imbalances in the forestry sector (Thuresson 2014). As a result, about 2 500 mill workers was laid off. The once global industrial champion Norske Skog filed for bankruptcy in 2017, leading to concerns about the remaining forest industry in Norway.

The crisis reported on here is but one example of a forest industrial region in the Global North facing challenges. Sweden, with a history as a global leader in the pulp and paper industry (Porter 1990), has been impacted with the closure of seven newsprint machines since 2007.¹ Major products such as newsprint and writing grade paper are under severe substitution pressure due to increased use of information technology in communication (Nilsson 2015). However, capital is invested in product development and capacity increases in other segments and Sweden is still ranked as a global leader (Peterson 2011; Karltorp and Sanden 2012). A study of the restructuring of British Columbia's (BC) forest industries argues that the recession of the 1980s was a turning point, combining a long-term decline in the market for main commodities and increasing levels of volatility (Edenhoffer and Hayter 2013, 150).

This paper investigates the evolution of the forest industrial regime in Norway. Some key events to the formation of the regime, starting in the 1960s are presented. The 1980s and 1990s were characterized by construction, while the 2000s has been dominated by

¹ <http://www.paperadvance.com/blogs>. Read 8. December 2017.

deconstruction of the regime as old alliances and companies dissolved. The paper identifies modes of coordination among forestry owners and industrial companies as defining the regime from the 1960s until the early 2000s. The evolution of the companies Norske Skog and Moelven and the long term relations between these firms and the forest owners are a focal point of interest. The two companies became the leading industrial companies in the newsprint and sawn timber segments of the forest industries. Firm-level attempts at knowledge-based renewal are taking place, however insufficient to replace the former national industrial dynamics. The evolution of the Norwegian forest industry will be contextualized with references to parallel developments within the Swedish and BC forest industry.

The notion of regime was originally based on critical notions of spatio-temporal “fixes” within a globally dominant capitalist mode of production and circulation (Friedman 2009). Later the growth and decline of regimes have been studied as an integral part of transitions of socio-technical system and the Multi-Level-Approach (Schot and Geels 2007). More recently industrial regimes have been given a central role within a multi-dimensional framework for studying the destabilization of existing regimes (Kungl and Geels 2018). A triple embeddedness framework represents a promising approach to analyse co-evolution of firms in industries and their environment, there are however some shortcomings. The role of space and materiality is important, not at least in studies of natural resource based industries. It is proposed that space and materiality are added as dimensions to the triple embeddedness framework.

It will be argued that conceptualizations of regimes are suited to investigate adaptability among actors within material and institutional constraints. Material constraints are discussed

within a framework of scarcity, physical properties of natural resources and value chains (Edenhoffer and Hayter 2013; Clapp 1998). Based on the analysis of the evolution and disruption of a Norwegian forest industrial regime, it will be argued that the physical properties of wood represent material constraints that partly explain the decline of the industry. The forest industries with their peculiar material dependencies should be an ideal case to discuss the materiality of path dependency. It takes in the range of 60–100 years for Norwegian spruce, *Picea Abies*, to mature into a raw material for industrial processing, while pulp and paper mills have a lifetime of 30–50 years. Since the early 2000s, the newsprint industry has been a case of path destruction, mainly due to the growth of electronic media (Nilsson 2015). The rise of electronic media and the related destruction of the newsprint industry is an incident in the production of historically and geographically uneven development. The destruction is thus also a reminder of how the fortunes of the resource peripheries are dependent on the core urban agglomerations (Edenhoffer and Hayter 2013; Kortelainen and Rannikko 2014). Based on this, the paper discusses the following questions:

1. How did the Norwegian forest industrial regime emerge and what were the key elements of the regime?
2. What are the factors behind the destruction of the regime?

Karltorp and Sanden (2012) discussed what might destabilize the regime of pulp and paper production in Sweden. This study investigates what have actually destructed the Norwegian forest industrial regime. Some comments on a possible renewal of the forest industry are provided. The next section presents the methodology, and then a theoretical framework including contributions on natural resource-based industries and the role of actors within

regimes is presented. An overview of the historical evolution of the forest industrial regime is presented together with the major actors in the regime; forest owners and industrial firms.

2. Methodology

This is a theoretically informed case study (George and Bennett 2005; Sayer 2000), where the case in question is the evolution of a Norwegian forest industrial regime. Two types of actors are highlighted: forest owners and their associations and firms represented by managers and board members, including the relations between these two groups. The paper draws upon a range of empirical and historical materials, including statistical data on import and export of pulpwood. The case is set in context by presenting research on the forest industries in Sweden and the province British Columbia in Canada. The two regions are intended to represent a “comparative contrast”, as being part of the northern boreal forests (Lehtinen et al. 2004), although both regions do have a considerable larger forest industry. The ambition is to contribute to a research topic of limited academic interest, natural resource-based industries in peripheral regions (Edenhoffer and Hayter 2013; Kortelainen and Rannikko 2014).

The authors have a long-term research interest in the forest industry; one of the authors studied the environmental strategies of the Norwegian paper industry in the 1980s and 1990s (Sæther 1999). Interviews with managers and stakeholders conducted 15–20 years ago in a study of the globalization of Norske Skog (Sæther 2004), have been reinterpreted in this study. Authors took part in roundtable discussions concerning the future of the sawn timber industry in 2016. About 20 interviews with managers and other informants were conducted in 2013 and 2016. This is in some respects a longitudinal study, however since the forest industry has a history at least back to the 1880s, it is possible for researchers to collect own data on what are only the most recent developments.

3. Analysing forest industrial regimes

Notions of regime were discussed in the 1990s as a balancing of power between public bodies and private interests in urban development. It was argued, “When one governing coalition in particular becomes dominant or hegemonic in a locality it constitutes a ‘regime’” (Gibbs and Jonas 2000, 306). Groups of actors organize collectively on the basis of an agreed agenda, and within structural constraints and available resources seek to deliver on the agenda (Gibbs and Jonas 2000). In a study of northern forest industries at the turn of the millennia, a notion of regime was used to analyse the systems of governance and cooperation, including norms and conventions, that sustain activity within the forest industries (Lehtinen et al. 2004). Later research within the Multi-Level Perspective (MLP) has become influential and has defined regime as, “The whole complex of scientific knowledge, engineering practices, production process technologies, product characteristics, skills and procedures, and institutions and infrastructures that make up the totality of a technology” (Kemp et al. 1998, 182). Originally MLP and transition studies were based on work within studies of the history of emerging technologies. Empirically this understanding of regimes has been supported by research on the role of regimes in transitions, such as the energy systems in the UK and Germany (Geels et al. 2016). The focus has been on the new technologies, such as wind energy developments in Denmark (Karnøe and Garud 2012).

More recently, attention has been directed towards destabilization of incumbent industries. A study by Karltorp and Sanden (2012) investigated regime destabilization in the Swedish pulp and paper industry. Representatives from the pulp and paper industry identified three landscape level pressures inducing change: increased attention to energy and environmental

issues, the rise of ICT and economic growth in South America and Asia (Karlton and Sandén 2012). Other research relates regime destabilization to overall changes in the Swedish economy and the increasingly important role of the “knowledge society”. The role of innovation within firms, industries and localities is highlighted by Peterson (2011) and Coenen et al. (2015). It is argued that at least a partial transformation of the forest industry has been taking place since the late 1990s and the large “Chandlerian” firm has been transformed into a decentralized knowledge-driven growth model promoted by a spirit of mutual understanding, according to Peterson (2011, 190).

The research on the destabilization of the Swedish pulp and paper industry has inspired further research on the destabilization of incumbent industries, such as the utilities in the German energy transition (Kunzl and Geels 2018). The Triple Embeddedness Framework provides an understanding of the co-evolution of firms-in-industries and their environment (Kunzl and Geels 2018, 80) drawing on a wide range of theories from evolutionary economics, strategy literature, neo-institutional theory and other sources. A distinction is made between the economic, which includes competitiveness and financial performance and institutional environment including policy makers and the wider public (Kunzl and Geels 2018, 81). Firm level responses to outside pressures are shaped by industry regimes containing industry specific institutions contributing to path dependence and lock in. The Triple Embeddedness Framework thus connects with older established descriptions of regimes and path dependency. As such, the framework is rich and well suited to guide studies of how established industries are destabilised by external pressures. However, the dimensions of space and materiality are not discussed in the Triple Embeddedness framework. Space and materiality are of particular interest in the current study and will be included in the analysis.

The importance of material constraints in studies of natural resource-based industries requires attention to nature and materiality, "... because [natural resource industries] confront nature directly, they utilize materials and confront processes over which capital has only limited control" (Boyd et al. 2001, 558). The Resource Industry Life Cycle Model (RILCM) discusses material conditions in resource-based industries, such as the lack of economically viable timber resources. The RILCM as presented by Edenhoffer and Hayter (2013) and building on Clapp (1998), describes the path a natural resource-based industry passes through, with exploration, discovery and initial production and followed by a lengthy period of upswing and booms. It is argued that: "... the interests of core markets in obtaining cheap large volume supplies of resources dovetail with motivations of peripheries in exploiting resource endowments for economic development and making them available at low cost" (Edenhoffer and Hayter 2013, 141). Mills, transportation systems and whole communities (Kortelainen and Rannikko 2014) are established to accomplish this, something which results in path dependency (Brunninge and Melander 2016). Large scale operations are closely linked to vertical and horizontal integration of sawmills and pulp and paper mills. A key point of the RILCM is an internal dynamic of self-destruction when growth levels out in the plateau stage. Building on Clapp (1998), industrial exploitation of renewable resources can progressively degrade the quantity, quality and accessibility of the resources, leading to increased costs. According to Edenhoffer and Hayter (2013) this can result in collapses, which have been widespread around the globe within forestry. Lack of quality resources combined with increased competition from other resource-rich regions signals the end of a region's competitive advantage at the plateau stage of the cycle. The plateau stage will be followed by decline, often in combination with attempts at path renewal. The Resource Life Cycle Model is proposed as one way of integrating materialities in studies of the destabilization of natural resource based industries.

4. Establishing a Norwegian forest industrial regime

It was British industrialists with their knowledge and investments in a chemical pulp mill at the Sarpsborg waterfall close to the Oslo fjord who brought the modern pulp industry to Norway in the 1880s (Bergh and Lange 1989). The forest industries became a leading industry, contributing half of national export income by 1920 with a strong position internationally (Moen 1997). The new pulp technology increased demand for pulpwood dramatically. Pulpwood was produced out of the upper part of the tree, while sawmills utilized the lower part of higher quality. This meant the whole log could be exploited commercially. Responding to the commercial potentials, the forest owners expanded planting and harvesting capacity and invested in transportation improvements along the main rivers (Halberg 1999). The power relations between the small forest owners and the large mills were asymmetrical. Since the early 20th century, forest owners organized into associations which eventually were able to represent their members in negotiations with the mills (Johnstad 1998; Halberg 1999). These negotiations gradually developed into centralized annual negotiations and upon entering a contract to deliver timber, individual forest owners gained access to lines of short-term credit provided by industry (Merok 2016). The forest owner's reliance upon industry credit gave industrialists the ability to secure deliveries, and some industrialists owned significant forestry resources (Sogner 2001)

Increased demand for forestry resources, combined with the hydroelectric use of waterfalls, gave political grounds to regulate ownership over natural resources. The Parliament in the newly independent nation in 1917 decided only national residents could own waterfalls and

forestlands (Lange 1977). Nationalization of forest ownership conserved an egalitarian structure of forest ownership, with 125 000 farmers owning 80 per cent of forestland, while 96 per cent of the farmers owned less than 500 hectares of forests (Statistics Norway 2017). Major forest industrial firms, including the pulp mill in Sarpsborg, were transferred to Norwegian owners in the first decades of the 20th century (Bergh and Lange 1989). This contributed to establishing forward and backward linkages; supporting national economic development (Gunton 2003).

The Fordist boom of the forest industries benefitted the Nordic countries. In Sweden pulp mills integrated forwards with paper mills and integrated mills became a mechanism for coordinating and optimizing the economic value of the logs (Järvinen et al. 2012). Parallel to this, firms like Stora and SCA established leading positions and became *de facto* holding companies controlling not only pulp and paper mills, but sawmills and large tracts of forest land (Peterson 2004). This strengthened the competitive position of Swedish firms, while Norwegian firms were slow and to some degree unwilling to invest in new technology and restructuring during the 1960s (Moen 1997).

The Norwegian government operated a quota system for allocating logs to the mills until the 1960s. Forest ownership has since been regulated according to the Forestry Act, securing the long-term viability of forest resources, including the requirement that annual cut was less than annual growth. Opposition from industry and policy mistakes thwarted efforts by the government to consolidate the pulp and paper industry in the 1950s and '60s. The withdrawal of an active government policy towards the forest industry implied that forest owners and industry were the only actors that mattered. The evolution of this specific Norwegian forest industrial regime, as a regional specific constellation of institutional and material forms,

emerged in the 1960s. This is particularly clear given the central role one industrial firm, Norske Skog, would have from the late 1960s.

5. Norske Skog – the rise and fall of a champion

The establishment of Norske Skog by private forest owners in 1962 marked a new phase in the relations between forest owners and industry. Forest owners invested their savings in the 1960s to secure demand for pulpwood at stable prices and to learn about the forest products markets (Ulseth 1992). The scale and profitability from Norske Skog's greenfield newsprint mill in mid-Norway gave forest owners the powers to block alternative strategies for consolidating the industry. Through a series of cross-ownership deals, firms entered a strategic alliance with Norske Skog, finally formalized with a merger of Norske Skog and three paper mills in 1989 (Pollen 2007; Ulseth 1992). Norske Skog invested in a chemical pulp mill, sawmills and board mills, emerging in the 1980s as a horizontally and vertically integrated holding company coordinating 80 per cent of the Norwegian forest industries (Pollen 2007). Some 20 years after the formation of holding companies in Sweden, a similar maturing of the forest industrial structure took place in Norway.

The forest owner's regional associations controlled 40 per cent of the shares in Norske Skog during the 1980s and were the architects behind the aggressive growth strategy. The forest owners, through their ownership had a *de facto* control of the Norwegian forest industrial regime. Even though Norske Skog was profitable and some years very profitable, forest owners did not seek financial returns through dividends in the 1970s and 80s. Profits were reinvested in acquisitions and upgrading of the mills. In particular, forest owners in Eastern

Norway would remain vigilant in expanding paper and pulp production, seeking to maintain balances in timber markets in their regions (Halberg 1999).

Swedish forest firms operate according to the same principle today, integrating ownership of forests, sawmills, pulp and paper production (Karlton and Sandén 2012). Norske Skog however left this strategy in the 1990s, when decisions with long-term consequences were made. The profitability of newsprint production was satisfactory, but location criteria were changing. During the 1990s, recycled paper became an increasingly important raw material for newsprint production, new de-inking technology meant paper of lower quality could be recycled as newsprint. This changed the localization patterns from the Nordic countries towards Central Europe and the UK. These much more populous regions had access to large amounts of recycled paper and Nordic producers had to consider investments in Central Europe to defend their market share. Norwegian forest owners and Norske Skog needed to make a decision. Should they remain a national company with all their production capacity in Norway, or should they invest abroad? Forest owners initially invested in Norske Skog to secure their deliveries of pulpwood; investing in mills in Central Europe was not part of such a strategy; investments should be allocated to ageing Norwegian mills. Labour representatives supported this argument and a number of forest owners, especially in Eastern Norway, were reluctant to invest abroad. However, attitudes and strategic thinking started to change among forest owners, not least among their leadership. Attitudes towards dividends changed and in the late 1980s Norske Skog started to pay dividends. Forest owners' associations then received large sums of capital annually, which were distributed to members as a bonus for their deliveries of logs. If Norske Skog declined FDI, it was maintained, market shares would be lost, leading to reduced profits and dividends. In 1997 the National Forest Owners Federation argued that FDI was necessary to keep control of Norske Skog mills in Norway

(Johnstad 1998, 236). Leading forest owners supported FDI, and at the same time promised investments in Norwegian mills. Eventually this argument got support among the lower ranks among forest owners, and their representatives on the board of Norske Skog supported FDI. This implies that forest owners were undergoing a process of financialization in the 1990s, and emerged as actors within the global paper industry, seeking to maximize their financial return on their ownership in Norske Skog through receiving annual dividends.

The CEO of Norske Skog was a key person behind the financialization among forest owners. He established good relations with a sufficient number of leading forest owners who agreed upon his strategy of FDI. The agreement between the CEO and forest owners' representatives was firm and defined the Norwegian forest industrial regime for some years. In an interview with a business newspaper in 2003, the CEO argued that increasing shareholder value of Norske Skog was his main concern. He realized the firm was unable to expand all their business areas and at the same time remain among the best producers. The CEO picked newsprint as the business area with the best chances of expanding and through the 1990s, Norske Skog followed a core business strategy with the goal of being among the global leaders. Capacities within craft pulp, sawmills and forest land were divested, and available capital allocated to FDI in newsprint. Expansion within the core business area was a strategy to remain an independent firm, according to the CEO it was "better to eat than to be eaten".

Norske Skog's first FDI was a greenfield newsprint mill in Eastern France in 1991. While newsprint consumption grew only slowly in Europe and North America in the 1990s, growth was stronger in Asia and Australasia. The advent of the Asian crisis in 1997 meant firms with debt in US dollars and income in local currencies were facing financial trouble. Norske Skog was able to benefit from this, and together with the Canadian newsprint producer Abitibi

Consolidated, established a joint venture headquartered in Singapore. Together they acquired newsprint mills in South Korea and Malaysia (Sæther 2004). Neoliberalism in the New Zealand forestry sector included divesting from newsprint production by the major forest industrial firm Fletcher Challenge (Hayter and Barnes 2012). Norske Skog paid 2.6 billion US dollars to acquire Fletcher Challenge and financed the acquisition mainly by debt. Fletcher Challenge controlled several mills in BC, which had a problematic history with worker unrest and poor operational performance (Hayter 2000). According to our sources, Norske Skog hesitated to acquire these mills, but Fletcher Challenge insisted on the BC mills being part of the deal.

In what appeared at the time as a highly successful global expansion within newsprint, Norske Skog expanded earnings from 150 million US dollars in 1992 to 4 billion in 2001, while improving EBITA margins. At the dawn of the new millennium, Norske Skog ranked second among global newsprint producers with 26 mills on five continents. Norske Skog was for a while among the Nordic firms repositioning themselves from being national champions into taking roles in global value chains (Moen 2011).

Only a few years later however, Norske Skog was in deep structural problems facing a fall in global newsprint demand and mounting debt. Management had to cut costs and divest mills on five continents acquired only a few years earlier, due to poor operational performance and financial obligations. According to a former CFO, Norske Skog was the first Norwegian firm hit by “digital disruption” and management did not realize that their business model had expired. Instead of renewing the business model while they still had the financial possibilities to do so in 2008, management tried to repair their previously successful model. According to the former CFO, a regional model with mills integrated in local value chains should have

replaced the old model of global capacity management.² Lending capital to finance the old model eventually led to bankruptcy. Creditors in the City of London and on Wall Street have controlled the firm since 2011, until Norske Skog filed for bankruptcy in December 2017.

6. Moelven and cross-border integration

The divestiture of Norwegian forest industrial assets did provide room for a new, highly unlikely champion; out of the ashes of a bankruptcy, the wooden house builder Moelven emerged as an industrial champion in Eastern Norway. Moelven was a small-scale producer of wooden barracks and agricultural equipment in the post-war era and went public in 1981 with an ambition of expanding into housing construction. Motivated by a buoyant housing market and with access to new financial instruments, the company invested in the construction market. Integrating downstream, the “Moelven house” became a household brand. The successful expansion into a supplier of factory-produced housing included financial risks through its holdings of land and housing projects. With the downturn of the Norwegian housing market in the late 1980s, Moelven incurred severe losses. In order to salvage the company, a series of refinancing operations were performed, making a bank the dominant owner in the company. While Norske Skog enjoyed praise in the business press for its global expansion, Moelven was facing bankruptcy, being forced to sell off its core business divisions in order to receive financial rescue.³

The salvage of Moelven eventually resulted in a central role in the national forest industrial regime. Management concentrated on the wood industry, a former peripheral part of operations. From its initial ownership of one sawmill in 1979, the company gradually

² Andreas Enger, *Dagens næringsliv* newspaper, 15 January 2018.

³ Moelven annual report 1995 p. 47.

expanded its capacity upstream and in the late 1990s, acquired sawmills in mid-western Sweden. The emergence of Moelven as a major buyer of timber led to moves by forest owners' associations to secure strategic control. Through market operations, three regional forest owner associations secured control over a blocking third of equity in the late 1990s. Negotiations between Finnish and Norwegian forestry associations, collectively controlling 97.5 per cent of shares, led to a strategic alliance, and Moelven was delisted from the Oslo Stock Exchange. The Finnish Forestry Owners Association's ownership however had limited industrial consequences, and after facing financial difficulties, the Finns sold their shares to a consortium of Norwegian owners in 2007. At present, the regional forest owners' associations control 60 per cent of shares in Moelven.

With a controlling position in Moelven, the forest owners' associations had established a "post-Norske Skog" instrument to realize strategic ambitions, first of all to secure demand for logs from sawmills. The observation is that although Moelven has some success within the mechanical wood industry, the firm has not developed business initiatives to sustain profitability across the forest industry. Operating a strict divisional separation of financial responsibility, Moelven has lacked centralized control over key operational areas. Examples suggest this organizational form has limited the ability to promote new industrial initiatives. Investments in one area, for instance Glue Laminated Timber has suffered because Moelven's own sawmills demand market prices for timber. Forest owners have prioritized financial return over investments. As a result, 70 per cent of profits during the period 2000 to 2015 have been distributed as dividends, limiting internal sources of investment capital. A study of innovation data indicates a lack of product innovation and lack of educated personnel to work with innovations in the mechanical wood industry (Alnes and Sæther 2016). Exogenous factors also account for the company's relative divestment in Eastern Norway. As a

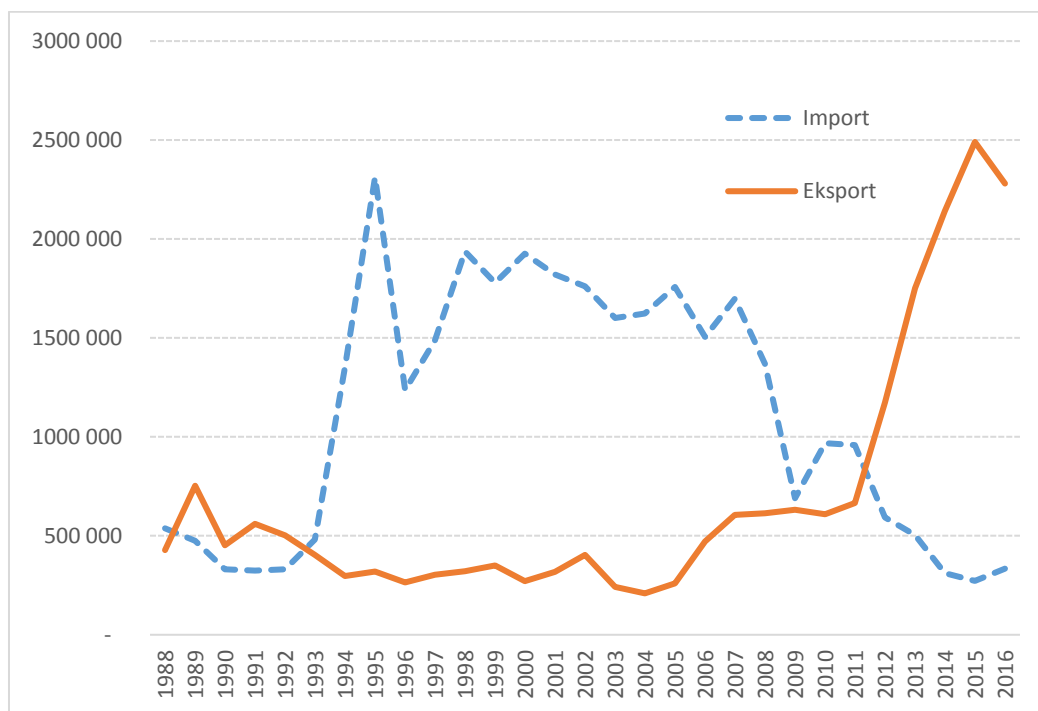
multinational company, Moelven has detailed insight into operational costs and profitability across areas of operation, and higher profitability in Swedish operations has stimulated investing in Sweden.

The absence of production lines for pulpwood and sawdust results in higher transportation costs and increased costs for sawmills, threatening long-term viability of the forest industry, including Moelven itself. Despite being controlled by forest owners' associations, Moelven has not invested in pulp production to compensate for the fall in demand for pulpwood in Norway. Neither has any other firm invested in such capacity. The Borregaard pulp mill in Sarpsborg has innovated in processing of chemicals and has become a global niche supplier based on pulp from the old (sulphate) pulp mill. This has however not led to any capacity increases in pulp consumption. As a result of the lack of new investments in pulp production, about 50 per cent of available pulpwood is exported. Thus, the remaining's of the forest industrial regime in Norway can be characterized by an absence of strategic capacity to coordinate the forest industry during the last 10 years.

7. Regime decline, rescaling and materiality

As Figure 2 documents, Norway was a net importer of pulpwood until 2011, but has become a net exporter since.

Figure 2. Norwegian import and export of pulpwood. Source: Statistics Norway and Stuve et al. 2016.

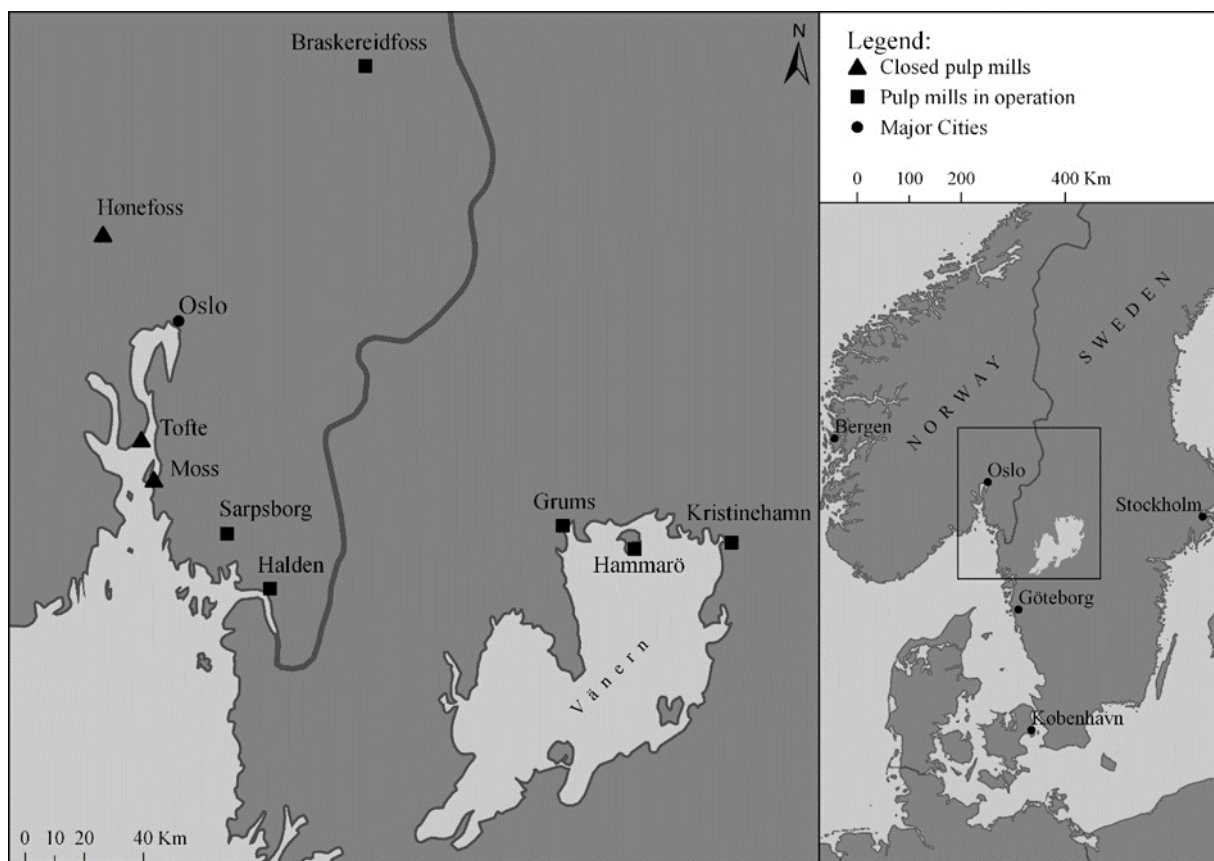


The changing trade balance in pulpwood is a strong indicator of the decline of the Norwegian pulp and paper industry. Because of reduced domestic demand for pulpwood, prices dropped 30 per cent in 2013, followed by downward pressure on prices of logs destined for sawmills as well. Closure of pulp mills in Norway disturbed the balance in demand between pulpwood and timber. Since about 50% of all round wood, including chips and sawdust from the sawmills, becomes pulpwood, there is no longer a complete value chain for the processing of round wood in Norway. Instead, pulpwood is increasingly being exported, and more than half the export is destined to mills located at the Lake Vänaren in mid western Sweden. With

increased supply of pulpwood, mills at Lake Vänern now invest in new capacities. Parallel to increased export, import of finished wooden products have increased (Røtnes 2017).

Increased export of raw logs combined with increased imports of finished wood products indicates there is an ongoing de-industrialization of the Norwegian forest based industries.

Figure 1. Pulp mills in Eastern Norway and Western Sweden 2018



The history of the Norwegian forest industrial regime is a history of bold moves, strategic thinking and strategic mistakes. It is a telling example of a specific spatio-temporal fix that seemed to work well for forest owners and the firm Norske Skog which they established and nurtured until the early 2000s. Small scale forest owners organized themselves in associations and for some time were able to secure stable prices for their logs and capture value downstream from processing. Being motivated by the returns from the initial investment in a newsprint mill in the 1960s, their ambitions increased. Through their ownership in Norske

Skog, forest owners defined a national forest industrial regime for some years. To become a global leader within newsprint, forest owners went through a process of financialization and became an actor within the global capitalist class. The forest owners however only got a short period as part of this class. The event signalling the end of the Norwegian forest industrial regime was Norske Skog financing the takeover of New Zealand based Fletcher Challenge by debt. Since Norske Skog shares peaked in 2001 until the recent bankruptcy, forest owners lost 500 million US dollars of shareholder value. With hindsight, FDI in newsprint upon the advent of printed media being substituted with electronic media, turned out to be a complete failure. Norske Skog found itself locked into a path that within a few years changed from being positive to negative. Capital that was invested to secure shareholder value suddenly changed character and became locked in mills no longer able to produce such shareholder value. The case of Norske Skog underlines the fact that resource-based industries are indeed vulnerable to new technology (Edenhoffer and Hayter 2013).

A consequence of the decline of the Norwegian pulp and paper industry is a rescaling of operations due to an increased dependence on and integration with the forest industry in western Sweden, in particular the pulp mills at the Lake Vänaren (Figure 1). The case of Moelven, operating a Swedish-Norwegian cross-border functionally integrated value chain is a good case in point. This implies it is no longer possible to identify a specific Norwegian forest industrial regime. Central parts of this regime disappeared with the meltdown of Norske Skog, while Moelven have re-emerged as an integral part of the Swedish forest industry. Norwegian actors have a limited influence on the value chain of pulpwoods; instead, Swedish firms are powerful purchasers of pulpwood. Swedish firms' dependence on this pulpwood makes it more difficult to establish a new pulp mills in Norway, since such a mill would have to compete with Swedish firms about wood. After 10 years of absence of actors with the

capacity and power to coordinate value creation based on Norwegian pulpwood, it is no longer possible to identify a national forest industrial regime.

Based on the discussion of the rise and fall of a national forest industrial regime, some points can be made. The decline of Norske Skog was not caused by scarcity of forest resources. Annual cut has been well below, and since the 1960s has amounted to 30–40 per cent of annual growth (Thuresson 2014). The volume of logs in Norwegian forests has never been higher than at present (Statistics Norway 2017). While the RILCM proposes scarcity of quality forests lead to forest industrial decline (Edenhoffer and Hayter 2013; Clapp 1998), resource scarcity has not contributed to the decline of the Norwegian forest industry. The closure of mills during the dismantling of Norske Skog has been paralleled by a lack of investing in new capacities in pulpwood processing. This disturbed the balance between demand for pulpwood and wood destined for sawmills, with a surplus of pulpwood which eventually had to be exported as indicated in Figure 2. Due to the material, and in this instance physical differences between pulpwood and timber, it is not possible to substitute these two distinct qualities in an economically and technically efficient way. The technologies used in housing construction do not allow for the use of pulpwood, with its small diameter and low strength. To use timber in pulp mills is technically, but not economically feasible. Logs are sorted into a lower grade (pulpwood) and a higher grade (for sawmills) at the site they are harvested (Sandberg et al. 2014). This sorting has to be optimized and both grades should be processed as close to the point of harvest as possible (Stuve et al. 2016). The two qualities define two partly separated and partly interlinked industrial paths, one for pulp and paper and one for sawn goods. This interdependence is strengthened due to the fact that sawmills produce large amounts of chips and sawdust which have to be used to produce pulp. There is thus a path interdependence as proposed by Martin and Sunley (2006), because of a

material interdependence between pulp production and sawmills. Given these material interdependencies between the two qualities of wood and the disturbed balance of demand between them, it was no longer possible to optimize logistics along the forest industrial paths established in Norway. Export remains the only option.

The value chains have *de facto* been rescaled into an integrated Swedish–Norwegian cross border value chain. This has become the operational scale of the remaining forest industry, according to the distinction proposed by Marston (2000). Such a rescaling has however occurred at a cost, since the distances from Norwegian forests to pulp mills in Sweden are beyond the optimal. Reduced transportation costs was an integrated part of Fordist forest industrial operations since the 1960s in Sweden and BC (Moen 1997; Hayter 2000). The construction of Norske Skog as a national champion in the 1980s led to optimization of the industrial path at the national level. The decline of the firm and the forest industrial regime has led to destruction of the path, while a rescaling across the Swedish border has led to survival of parts of the old path. Increased transportation costs and reduced forest owners' earnings is a consequence of the fact that it was no longer possible to coordinate a complete value chain at the national level. One estimate argued that Norwegian forest owners lost in the range of 50 million dollars 2013 -2017 due to low pulpwood prices and increases in transportation costs. A rescaling has also occurred regarding the location of the actors who financially control key actors in the forest industry. Until about 2008, forest owners had some control of the board of Norske Skog. As Norske Skog gradually became unable to service its debts, financial control was transferred from the forest owners and other shareholders to actors in control of credit lines, located in the City of London and on Wall Street. As a compensation, forest owners now control Moelven, however this firm has less influence in the market for logs, than what Norske Skog had between 1980 and 2008.

8. Conclusion

The ongoing structural change of the Norwegian forest industry have some similarities compared to Sweden and BC with mill closures and worker layoffs. The path-destruction of the news print industry however had the most negative impact on the Norwegian forest industrial regime, since the dominant firm, Norske Skog, specialized in newsprint. The possibility of a knowledge based path-renewal of the forest industries are discussed, but there are few successful examples in practice so far. Long-term investment in research and innovation at a pulp mill in Ôrnskoldsvik is reported (Coenen et al. 2015). In Norway the Borregaard pulp mill successfully has followed a similar strategy and produces a range of chemicals based on sulphite pulp from spruce. However, in neither Sweden nor Norway has such a knowledge-intensive path of renewal occurred at the level of the forest industries. Instead, Swedish researchers concluded that incumbent firms are reluctant to invest in new large-scale technologies (Karltorp and Sanden 2012). As this paper documents this describes the current situation in Norway as well. There are thus only a few signs of a broader forest industrial path renewal. Given the lack of ability to coordinate the still available material and cognitive resources in the forest industry, Norway seems to be particularly far behind realizing the potentials of a forest-based bioeconomy. Transition from a large-scale commodity-based industrial path towards a more knowledge-intensive path seems to be little more than a possibility at the moment. Instead the history and geography of uneven development is reproduced with destruction of workplaces and value creation in the Noregian part of the northern resource peripheries.

The rescaling of the Norwegian forest industry has so far been documented on an intermediate cross-border level. However according to a recent report,⁴ there are signs of a new round of

⁴ Bondebladet, February 2018.

rescaling on a Nordic-Baltic level. The recent opening of a large pulp mill in Finland has led to increased demand for pulpwood across the Nordic-Baltic region. This raises the possibility of an ongoing production of new forest industrial spaces interlinked with yet another rescaling of industrial activity.

Theoretically, the case of the decline of the Norwegian forest industrial regime underlines the role of materiality and scale. These dimensions of industry destabilization are somewhat overlooked in the multidimensional framework for studying such destabilizations. Any explanation of the destabilization of the Norwegian forest industrial regime is however incomplete without an integration of these dimensions. There is a path interdependence between rescaling and the material and the institutional dimension of the decline of the industrial regime in this case. Future research will have to decide whether this interdependence is common in other natural resource based industries as well.

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