



The role of environmental regulation in the future competitiveness of the pulp and paper industry: the case of the sulfur emissions directive in Northern Europe



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ABSTRACT

Introduction of the sulfur emissions reduction directive for maritime transport has become a heavily debated policy issue in Northern Europe from the perspective of the future competitiveness of transport-dependent industries. The scientific value of this study is in its contribution to the scarce literature on the future of pulp and paper industry competitiveness from the tightening environmental regulation perspective, highlighting the complementary role of law-abiding and voluntary regulations. Using a Delphi-foresight method, the study evaluates the effectiveness of environmental regulation by identifying its positive and negative aspects for the future success of the pulp and paper industry, and uses the reduction of sulfur emissions as an example. From a business perspective, the panelists saw tightening regulation as both a threat and an opportunity, and stressed the role of the policy implementation in achieving actual environmental improvement. The strict regulatory measures were generally perceived as environmentally advantageous and more effective in the long term, but a rather divided view was seen in the ability of the sulfur emissions directive to effectively govern environmental sustainability. In discussion, the role of more voluntary alternatives to implementing command-and-control type policy measures is emphasized in complementing government legislation, to gain market benefits from greening the entire pulp and paper supply chain. To conclude, the development of sustainable transportation strategies has the potential to contribute toward long-term competitiveness in the pulp and paper industry, especially if new strategic innovation-oriented cross-sector partnerships develop in the production and use of transportation biofuels.

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1. Introduction

Environmental regulation has had a large role in the case of the European pulp and paper industry (PPI) in determining the terms and conditions for current practices and future opportunities (Wagner, 2005). In the case of an export-dependent sector such as PPI, the regulatory framework for environmental impacts has a significant role in determining the terms and conditions for industry competitiveness (Li and Toppinen et al., 2011). The relationship between environmental policies, environmental performance, and competitiveness may vary depending on the regulation source, its form, and the environmental asset it is seeking to protect (Iraldo

et al., 2011). On the one hand, this increases business uncertainty in the future, and hampers incentive creation for adopting more sustainable business practices.

The global export value of forest industry products (pulp, paper, and wood products) amounted to 246 billion USD in 2013 (FAO, 2015). With strongly increasing consumption growth in China, moderately increasing growth in Latin America and Africa, and existing production capacity for pulp and paper in Europe and North America, the transportation of intermediate and final products between these regions has been intensifying in relative and absolute terms, and currently accounts for approximately one third of total production (e.g. Hetemäki et al., 2013). Some countries, such as Finland and Sweden, have specialized in the manufacturing of paper and paperboard products due to their rich forest resources, and are globally among the largest exporting countries; and due to the recent capacity reductions in North

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America, the demand for softwood pulp from European coniferous forests is increasing in global markets (Hujala et al., 2011). Transportation to global markets from Northern Europe typically calls for the shipping of products over long distances, due to product bulkiness.

Shipping is currently an important contributor to global anthropogenic emissions, accounting for 15% and 4–9% shares of nitrogen oxide (NO_x) and sulfur oxide (SO_x) emissions, respectively, according to Tzannatos (2010). SO_x and NO_x emissions from international maritime shipping in the EU amounted to approximately 30% of the land-based emissions in 2000 (European Commission, 2009). Reducing emissions from maritime transport has been a target of recent regulatory action. According to a MARPOL Annex VI agreement signed in 2008 between member countries of the International Maritime Organization (IMO), SO_x levels in maritime transport will be reduced globally by 2025.

In addition, sulfur emission control areas (SECAs) were formed in some specific regions vulnerable to currently high emission loads, such as the Baltic Sea area, the North Sea, and the English Channel, to push SO_x emissions down from 1.5% m/m to 1% m/m starting on July 1, 2010 (European Commission, 2009). A more stringent EU regulation (in comparison to MARPOL Annex VI) came into effect in 2012, so that the allowable SO_x emission levels in marine transport fuels in SECAs have been further reduced from their current level of 1% m/m to 0.1% m/m starting on January 1, 2015. Altogether, these measures are estimated to reduce SO_x emissions in the SECA region by 92% between the years 2009–2015, while the level of greenhouse gas emissions during this period is expected to moderately increase (Kalli et al., 2013). The Helsinki Commission (HELCOM) was established to monitor the compliance with the IMO regulation around the Baltic Sea, and to promote intergovernmental cooperation to protect it from all sources of pollution without a legal enforcement capacity. Between 2012 and 2013, the emissions of all other observed pollutants (incl. SO_x) except CO₂ decreased, and SO_x emissions from IMO-registered, large vessels reduced by 0.7% due to the tightening regulation, while contradictory activities from non-IMO registered traffic (presumably from small boats) increased SO_x emissions by 4.6% (Jalkanen and Johansson, 2014). A summary of different forms of regulation and their intervention in the maritime sector is provided by Hyvättinen and Hilden (2004).

Agreeing on which actions should be taken to alleviate or cope with the environmental and societal changes that are looming above the European forest industry and under tightening global competition has proven politically difficult (e.g. Kleinschmit et al., 2014). There is a lack of research focusing on the effectiveness of environmental regulation in conjunction with pulp and paper industry competitiveness, and in particular regarding ongoing implementation of the EU sulfur emissions directive. Previous case studies have been conducted on the environmental impacts, using life-cycle assessment (LCA) of alternative compliance possibilities via fuel switching (e.g. Brynolf et al., 2014); on transport speed reduction (Doudnikoff and Lacoste, 2014); and on comparing private abatement costs, via the adoption of sulfur scrubber technology, to social environmental benefits from emission control (e.g. Jiang et al., 2014). According to Gritsenko and Yliskylä-Peuralahti (2013), emission reductions in shipping have not been treated as an “energy policy issue” in research. They concluded that tightening environmental regulation challenges the traditional forms of maritime governance, and further suggest combining mandatory and voluntary forms of regulation to improve its effectiveness (see also Yliskylä-Peuralahti and Gritsenko, 2014). In addition, they pointed out that the Baltic maritime industry is not homogeneous in its reactions to SO_x regulation: some ship owners are adopting voluntary measures to implement new regulations,

possibly reaping reputation gains and a first-mover advantage by doing so.

Finally, in developing policies for pollution control, it is essential not only to consider the direct effects of decreased emissions on environmental quality, but also the equally important dynamic effects that affect the creation of new technology and the diffusion of innovations, as suggested by Hyvättinen and Hilden (2004). This emphasizes the need for analyzing innovations as typical side-effects of environmental policies in anticipation of policy implementation (Fronzel et al., 2007; Horbach, 2008; Horbach et al., 2012).

To build a coherent understanding of the role of environmental regulation for the future competitiveness of the pulp and paper industry, the aim of the study is to analyze the industry development from the perspective of environmental regulation effectiveness, with specific emphasis on the current sustainability debate concerning maritime transportation in Northern Europe. As the methods for assessing the relationship between environmental policies and industry competitiveness may also generate different estimates of the regulatory effect on competitiveness (e.g. Iraldo et al., 2011), a comparison of highly varied implementation cost estimates and partly intangible future benefits would not sufficiently capture essential strategic and forward-looking aspects in the complex decision-making context. Instead, the use of the established Delphi-foresight method, where expert opinions and views are the source of information (Blind et al., 2001), is appropriate for gaining a better understanding of the relative importance of sustainable transportation and other forces that influence the future development of the PPI. From a managerial perspective, the main aim is to map the preconditions for future business development with emergent strategies that are likely to facilitate transition toward a bioeconomy (see e.g. McCormick and Kautto, 2013 or Kleinschmit et al., 2014) and sustainable value creation in the focus industry.

2. Background and environmental policy context

Environmental regulation should be *effective* in the sense that it significantly improves, if not resolves, the problem it was introduced to address, and *efficient* in the sense that it minimizes the direct costs carried by those who regulate, and the indirect costs that may be imposed on the public (OECD, 2006). A review by Ribeiro and Kruglianskas (2014) defines regulatory effectiveness as the capability to produce an intended effect, generally set as “environmental quality improvement”. Overlapping or conflicting goals of different regulation forms are likely to cause negative implications for competitiveness and the environment (Peuckert, 2014). Regulatory effectiveness and efficiency are best ensured if regulated entities are able to perceive the increased production costs caused by environmental protection actions turning into a net benefit.

Different regulatory instruments aimed at the environment can be divided into legally binding obligations (direct regulation), the use of economic instruments (taxes, subsidies), and the use of soft instruments (“soft law” or market-based governance), or the instrument can also be a mixture of these hard- and soft-law elements (Abbott and Snidal, 2000). Typical problems of legally binding “one size fits all” regulation are low cost-efficiency and a lack of operator incentives to move beyond compliance, which has led to an increasing interest in more flexible or proactive regulation that provides opportunities for interactive and broader stakeholder engagement in environmental policy-making (Howlett, 2004; Ribeiro and Kruglianskas, 2014). The more flexible private regulatory standards can, according to Vogel (2008, p. 275), “function to avoid additional state regulations, to complement or better enforce

state regulations, [act] as a precursor to more stringent state regulations, or as a substitute for state regulations.”

Activities under the umbrella of corporate (social) responsibility (CSR) represent *voluntary self-regulation*, which is part of the corporate sustainability strategy (e.g. Auld et al., 2008; Husted and Allen, 2010). Institutional theory of CSR underlines formal and informal rules, norms, and shared understanding as crucial structures regulating behavior among industry actors, regulators, and other stakeholders (Brammer et al., 2012). According to Campbell (2007, p. 962), “corporations are more likely to act in socially responsible way the more they encounter strong state regulation, collective industry self-regulation, NGOs and other independent organizations that monitor them.” Brouhle et al. (2009) argue that the threat of direct regulation can be an important driver for improving a firm's environmental performance, and it may also encourage diffusion of voluntary activities for improving environmental performance. Thus, and also in line with Lyon and Maxwell (2008), CSR and strong government regulation may be rather complements than substitutes for each other. The use of soft instruments of regulation may not be sufficiently rigorous, and a dynamic interplay between private commitments and legislation carries the risk of becoming “a messy compromise” that dissatisfies everyone (Best, 2008). Vogel (2008) states that the non-legally binding regulations (industry self-regulation) have been documented as clearly less effective than most government regulations.

Investment in socially responsible activities may have both internal and external benefits, by helping a firm develop its resource and capability base (Hart, 1995; Sharma and Vredenburg, 1998; Branco and Rodriguez, 2006). According to the well-known “Porter hypothesis,” environmental regulation can actually improve competitiveness and offset compliance costs by driving resource efficiency and new innovations (Porter and van der Linde, 1995). Furthermore, Bailey et al. (2002) point out that due to asymmetric information, firms are better aware of their business processes than regulators, and can also seize technological innovation opportunities. Haq et al. (2001) state that while environmental standards and regulations may impose burdens on industries, they may also result in the emergence of new, environmentally sounder technologies that alleviate the increased costs for those who “seize their opportunities”. Based on the findings by Mickwitz et al. (2008), anticipation and flexibility are the most crucial aspects of regulation with respect to their effects on innovation.

According to the European Commission (2009), EU-level benefits from reducing the negative effects of sulfur emissions on public health and the deterioration of marine and coastal environments are estimated to outweigh the costs until 2020. Simultaneously, both European-level and national industry associations have raised concerns about postponing the introduction of more stringent SO_x emission regulations, which “disadvantages industry competitiveness in global markets and in international trade” (Confederation of European Paper Industries, 2013; Swedish Forest Industry Federation, 2012). For example, Nietola (2013) estimated that a 20–45% increase in the shipping costs of the paper industry exports from Finland will add 200 million euros of costs when it comes into force in 2015. Several studies focusing only on implementation costs have also argued that a foreseeable viability loss will occur in the shipping-dependent industrial sectors of the North European SECA regions (e.g. Kalli et al., 2009), while in other contexts positive net benefits have also been found (e.g. Wang and Corbett, 2007).

Placing policy-mix discussion into our case context, as pointed out in Yliskylä-Peuralahti and Gritsenko (2014), international maritime governance can be made more effective by mixing mandatory and voluntary (public and private) forms of regulation. As a solution to meet the more stringent SO_x emission levels,

shipping companies operating in the SECA sea areas may invest in scrubbing machinery (i.e. exhaust gas cleaning systems) in their shipping vessels, which decreases emissions to the required level (European Commission, 2009). The shipping companies may alternatively seek to invest in the use of marine gas oil (MGO) or sulfur-free fuels such as liquefied natural gas (LNG) and bio-methanol, instead of heavy transportation oil (Brynolf et al., 2014). The biorefinery concept introduced in the PPI could potentially contribute to the development and commercialization of next-generation marine transport fuels, which could act as catalysts for the diversification of the traditional pulp and paper business toward being a renewable energy industry (Pätäri et al., 2011).

The topic of the SO_x emissions directive has overall proven to be very controversial and has raised heated debate among associated industries and members of the environmental lobby, particularly in Northern Europe. Debate around implementing more stringent environmental regulation on maritime transportation in SECA represents an issue that has caught the PPI unprepared, resulting in active lobbying to postpone its enforcement, based on the expected threat to its competitiveness (e.g. Swedish Forest Industry Federation, 2012). The managerial mind-set of the pulp and paper industry may also be representative of a more reactive stance toward regulation and embedded opportunities for environmental innovation (see Toppinen et al., 2015). However, previous literature also indicates that a gap often exists between the inflated *ex ante* cost estimates presented during the negotiation phase of new environmental regulation and the results of lower *ex post* evaluations, as companies typically work hard to lower the costs of compliance once legislation comes into force (Bailey et al., 2002).

3. Data and methods

According to Hurmekoski and Hetemäki (2013, p. 17), “there are potential advantages in complementing the current modeling approach dominant in the forest sector with other methods from the field of foresight,” which also warrants the use of the Delphi method. The Delphi method is a future studies technique used for the qualitative exploration of complex issues (Wakefield and Watson, 2014). The method was developed in the 1950s and typically entails two or more survey rounds, with two being the minimum (Blind et al., 2001). In contrast to a survey, the panel of experts in a Delphi study is quite small, and the topic under scrutiny is rather complex and lacking historical, economic, or technical data (Rowe and Wright, 1999). Delphi panelists are thus asked to participate in the research process, and the research topic typically sharpens from round to round (Kent and Saffer, 2014). Iteration, controlled feedback, anonymity, and a group statistical response have been reported as the key features of a Delphi (Rowe and Wright, 1999).

The benefits of the Delphi method are that time and place constraints can be avoided (Landeta, 2006). It also provides experts with the opportunity to freely and anonymously express their comments and knowledge on a topic (Kennedy, 2004). The method has faced criticism (see e.g. Gupta and Clarke, 1996), not due to the method itself, but rather mainly due to the way the Delphi has been executed, which is to be expected as no universally accepted definitions exist for the Delphi or for the process of conducting a Delphi (Wakefield and Watson, 2014).

The objective of the Delphi has been summarized by Wakefield and Watson (2014, p. 579): “The purpose of the Delphi is to facilitate a discussion that elicits a broad range of responses among selected experts in a given domain or around a particular topic.” Previously, many Delphi studies strived for consensus among the experts, but as the previous citation also shows, it is now more typical for a

Delphi study to aim at bringing forth all the relevant issues and possible options related to the topic. Our Delphi study can also be classified as a dissensus-based Delphi design (see e.g., Steinert, 2009). The research process is presented in Fig. 1.

With the help of the Delphi study, our aim was to elicit expert opinions on the relative importance of sustainable transportation and other forces that influence the future development of the PPI towards 2030. The Delphi study consisted of three rounds of online surveys carried out within four months (from March to June 2014). The key objective of the first round was to analyze the current situation of the PPI in Europe, and to identify key drivers and potential new business opportunities shaping the industry in the future. The questionnaire included both closed and open-ended questions, where the panelists could relatively freely comment and give arguments for their opinions. The previous rounds served as a basis for the following rounds, in which the focus was on the themes and issues that either provoked a lot of opinions and discussion in the previous round or needed further clarification. The second and third Delphi rounds consisted of more tailored questions and statements with answer alternatives. The questions and statements related to the environmental regulation and sustainability of maritime transportation, from each of the three Delphi rounds, are reported in this manuscript.

In-depth knowledge of the European PPIs was required when selecting the expert panel. Our aim was to form a panel of approximately 30 experts from Europe, with an intended weight placed on the Nordic countries hosting the main body of the modern and export-dependent pulp and paper industry. The experts can be categorized roughly into three equal sized groups: industry experts [1], representatives of academia [2], and representatives of industry associations and other experts [3]. The panelists represented a total of six European countries (Finland, Sweden, Germany, France, the Netherlands, and Belgium), and more than 70% of the respondents had more than 10 years of experience in the forest sector. The first Delphi round was answered by 19 experts, and 17 and 15 respondents were included in the second and third rounds, respectively. When analyzing the data set, special attention was paid to potential differences in the

answers and averages between respondent groups, and where striking differences do occur, they are reported. Representative quotes from open-ended questions are also used to improve our analysis reliability. Findings are otherwise presented for the entire expert panel uniformly. The anonymity of the panelists was secured and feedback was given to them after each round.

4. Results

In the first round, two open-ended questions were used to gather different perspectives on the foreseen effects that tightening maritime transport regulations would have on the environmental and economic sustainability of the PPI. The first one was “How does tightening environmental regulation on maritime transport impact environmental sustainability?” Table 1 lists excerpts provided by panelists, which show that industry experts (indicated as group [1] from now on) and academia (indicated as [2]) have varying views on the effects, ranging from low to high/moderate impact level, although differences can also be seen within these groups, and on whether the impact was seen as negative or positive. Associations and other experts (i.e. group [3]) saw tightening regulation more often as merely a negative phenomenon than the other groups, inevitably increasing costs and placing industry in an unequal position compared to the world’s other producer regions. The research community in particular saw improved environmental sustainability as a potential positive feature for promoting PPI sustainability. Differences between expected (short-run) adjustment costs and possible business benefits over a longer time perspective, gained from building front-runner capabilities in environmental sustainability, were also clearly recognized among panelists.

4.1. Design of environmental regulation and its effectiveness

The second open-ended question “How does regulatory pressure on reducing environmental impact on the air and water affect the business of European PPIs?” was used to bring further insight on the importance of regulatory design. For example, one expert from an industrial association group clarified “... . Regulatory pressure as a direct driver is not necessarily as effective as it could be, but larger issues, i.e. indirect regulatory drivers, are placing great pressure on PPI in the form of climate change, water scarcity, and maintaining biodiversity, and voluntary schemes are currently more advantageous than regulatory ones due to slow processes. Market-based voluntary schemes and other non-legally binding instruments are thus often more effective at least in the short-term period” [3]. However, as one expert from the research community pointed out: “It depends. How it affects costs and the competitive conditions depends much on the regulation design. It also depends on whether it is about energy/climate policy or the regulation of conventional pollution. Water pollution is not a cost problem anymore. Energy is the critical issue.” [2] As this topic seems to be an area needing further clarification from our panelists, the next section focuses on the issue of designing an effective policy in more depth.

In the second round, experts were given an opportunity to comment on the role of governments in shaping the future of the European PPI, and were then asked to give their opinions on the most effective and efficient ways of creating policies. According to the responses, the role of government was perceived as strong and government actions as potential catalysts for a bio-based economy increasing the demand for PPI products. However, it was suspected that the capacity of governments to promote a bio-based economy is not currently being utilized to its full potential. As one representative pointed out “The role is big, as governments in principle have the capability and the tools to foster much more

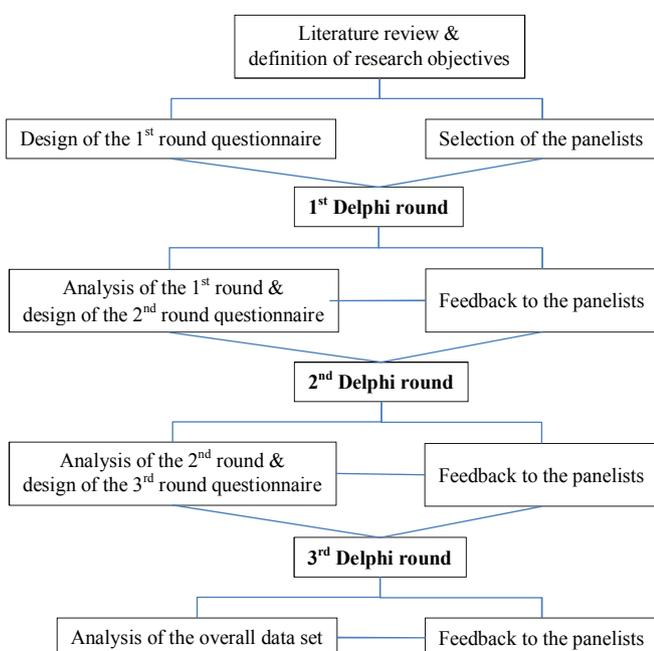


Fig. 1. Delphi process in this study.

Table 1
Differences in respondent perceptions for the question: “How does tightening environmental regulation on maritime transport impact environmental sustainability?”

Category:	Industry experts [1]	Research community [2]	Representatives of industry associations and other experts [3]
High positive or negative impact	It adds costs. This is certainly something to strive for and also certainly fine if the world implements these measures and is also willing to bear the extra costs.	The EU sulfur directive with respect to maritime transport will have a great impact on costs and competitiveness in the short term.	It leads to a risk of sulfur leakage when countries outside the SECA region can use maritime fuel with a sulfur content 35 times higher than the Nordic industry.
Low positive or negative impact	It will, in the short term, cause investments costs, but also place pressure on developing internal operations, which in the long run may be positive for the sector. Hard to see the benefit.	Sustainability in transport should be a top priority for the forest sector! It should and could have fossil-free logistics, based on bio-based sources: in forestry, land transport, and sea transport. The short-term negative impact can be compensated by new solutions in maritime transport.	All rules not based on a European or global basis could have a major impact on profitability and a limited environmental benefit. Regulation will improve the sustainability but only in small steps.

bio-based economic activity in Europe. Until now, tools of that kind have not been in very active use, though.” [2].

Industrial experts similarly perceived the role of governments in defining the future competitiveness of the European PPI to have more potential: “Their role is very important. Forest-based-industries’ voice is not strong enough within the EU and/or is scattered. EU officials do not perceive the commercial value of using wood sustainably; forest is seen as an environmental matter only. The EU should be supportive of its own industries, not the opposite. All energy- and environment-related decisions should be farsighted and targeted to improve the operating environment of European industry. This does not mean that regulation should be lax.” [1].

Government was further pointed out to have a rather generic role unless more clear emphasis is placed on the policy targets for renewable energy. One industry expert interpreted the role of government in the future of the PPI as follows: “Other than, in general terms, providing a favorable business climate and competitive education, the role of government is rather small. Possibly with one exception: the governmental support for wood-based energy should not distort the competition for woody biomass” [1]. Another representative from the same group suggested “Demanding targets for renewable energy and wood constructions would promote the European PPI in the long-term” [1]. The ambiguity of energy policy targets also raised concerns on regulation effectiveness, as one panelist elaborated: “Focusing on a circular economy and renewable energy will help the PPI. However, the ‘devil is in the details’; hence, especially in the case of renewable energy policies, the way these policies are implemented may be positive or negative for the PPI (e.g. might result in increasing resource prices for the PPI, or may negatively affect the profitability of clean CHP)” [2].

The importance of policy predictability and stability were stressed, especially by representatives of the industry association and the other expert group. One representative from the industry associations and the other expert group summarized the policies that best support the industry in the long-term as “Stable, long-term, and predictable policies. Governments must create the enabling conditions for industry to invest in Europe.” [3]. Additionally, there was a wish for the regulation load to be equal among different

European countries and competitors outside of Europe, as also pointed out earlier in Table 1. A typical demand arising from the group of industry association and other experts demanded the designing of “A long-term and holistic politic(s). Commonly agreed and implemented EU-wide policies would guarantee a level playing field for all operators despite the country.” [3]. Facilitating new product innovations, and supporting the environment for energy and transportation were seen as important determinants in the tight global competition, and it was hoped that their role in policy-making would be acknowledged. One representative summarized the anticipated future policy-making as follows: “A strong focus on innovations. A level playing field compared to the rest of the world, especially in terms of energy costs and transportation.” [3].

4.2. Environmental policy and competitiveness

During the second round, panelists were asked to choose whether they agree, disagree, or are neutral regarding seven statements on the impact of environmental policies on industry competitiveness. Based on Table 2, the use of economic instruments was perceived very critically in terms of industry competitiveness, and the need for continuous improvement in decreasing the environmental impacts of production and transportation was unanimously recognized. Responses to the two related claims of whether “environmental sustainability needs to provide (direct) market benefits” and whether “(only) intrinsic motivation for sustainability can provide a competitive advantage” resulted in highly controversial replies, requiring further inquiry.

Furthermore, our respondents did not fully agree that environmental policy effectiveness could be enhanced with a shift from command-and-control to market-based regulation. Nearly half (47%) of the respondents disagreed with the claim, but a substantial proportion (35%) agreed with the claim (Table 2). The combination of command-and-control and market-based mechanisms was supported. One expert representing the research community pointed out: “Some of the global challenges - especially climate change and resource scarcity - are developing in an alarming direction. This might lead to a situation where market-driven regulation does not

Table 2
Implementation of environmental policies and how it relates to competitiveness in the PPI (round 2, N = 17).

	Agree	Disagree	Neutral
The price and tax policy of energy are very critical for forest industry competitiveness.	88%	12%	0%
The shift from command-and-control to market-driven environmental regulation enhances regulation effectiveness.	35%	47%	18%
(The USA and China “declared a war against climate change”). Environmental regulation in Asia/other parts of the world will increase, which will improve the competitiveness of the European pulp and paper industries in the long-term.	76%	24%	0%
The PPI will have to improve and reduce its environmental impact, as regulatory pressure will increase.	88%	0%	12%
PPI companies that really take advantage of intrinsic sustainability aspects of the forest industry are faring better than others.	94%	0%	6%
The implementation of voluntary environmental policies depends on market benefits.	88%	6%	6%
The importance of recycled materials as raw material will increase in PPI production.	47%	47%	6%

Table 3

Effectiveness of different regulatory mechanisms and its relation to competitiveness in the PPI (round 3, N = 15).

	Agree	Disagree	Neutral
The conflicting objectives of different regulatory mechanisms are the main cause of the “failure” in environmental performance in the PPI.	7%	60%	33%
The most effective regulatory measures are a combination of legally binding and market-based mechanisms.	73%	7%	20%
Informative policy mechanisms (such as building customer awareness on sustainability) are not implemented efficiently in the European PPI.	47%	27%	27%
Increased self-regulation (norms set by different economic agents within the PPI) is the most effective way to improve environmental performance.	13%	53%	33%

deliver decreases in resource use and emissions fast enough and a partial return to command-and-control takes place” [2], which was supported by a similar view from another research community respondent: “Both voluntary and legal obligations have their roles in a complementary manner” [2].

In general, the increased interest in sustainability and growing environmental awareness among consumers and producers around the world is likely to benefit countries and areas that have high standards for their environmental operations and management. 76% of the panelists agreed that the increased demand for environmental regulation in Asia and other parts of the world will provide competitive advantages for the European PPI. The increased demand on the customer side would encourage companies to go “beyond compliance” in adopting environmental regulation. The majority of respondents (88%) voiced the view that the implementation of voluntary standards depends on their market benefits. Confidence in increasing the importance of recycled materials divided respondents into two groups: 47% perceived that an increase in recycled material usage as production input is likely to happen, whereas the same proportion of respondents lacked confidence in this occurring.

No support was given during the third round (Table 3) for the idea that conflicting objectives of different regulatory mechanisms could be a reason for environmental performance failure in the PPI. Indeed, the experts already perceived the European PPI as sustainable. Only one respondent from the entire sample agreed with the claim.

The third claim regarding efficient implementation of informative policy mechanisms clearly divided opinions. Less than half (47%) of respondents voiced the view that information-based policy mechanisms are implemented inefficiently. There was also a divided view on industry self-regulation being the most effective way of implementing policies. Approximately one half of respondents (53%) disagreed with the claim, while 27% of respondents supported it.

4.3. Strategic importance of sustainable transportation in the PPI

A few more refined claims on the environmental regulation of maritime transport were presented (Table 4). The impact of regulatory pressure on developing environmentally friendly transportation solutions was perceived to lead to increased net benefits in the long-term. However, there was a rather divided view

on the ability of sulfur dioxide emissions in maritime transport to effectively govern environmental sustainability.

Furthermore, during the third round, panelists were asked to comment on a statement received in the open part of the previous round concerning the regulation leading toward sustainable transportation: “Improving sustainability in logistics should be a top priority for the forest sector and one of the best ways to show that this sector really is sustainable and ahead of other sectors. It is also strange that the forest sector companies have not strived harder to implement bio-fuels in all their transport.” This question elicited highly divided opinions, as the following two quotes illustrate: “I disagree with this statement. While changes in transport may affect global market distribution, I doubt that this should be considered a top priority” [2] and “It is also a matter of cleverly using limited biomass resources. It is more resource-efficient and gives a higher added value to produce products that are recycled as many times as possible and finally used for energy purposes (CHP). On the other hand, a more positive attitude from the PPI in terms of biofuels would position the industry better in the climate and sustainability debate” [3].

Some experts supported the idea: “The forest industries have an interest in improving logistics to improve their competitiveness and concurrently their sustainability” [3] and “I wrote those sentences, and I still think it is a key issue, if the sector wants to show it really is sustainable” [2]. Furthermore, it was also believed that the importance of sustainable transportation will increase in the future: “This issue will grow in importance, and for the PPI to be credible in its claim of being at the forefront of the emerging bioeconomy, it has to be dealt with” [2] and “It sounds like a very good idea. I am not sure how much liquid transportation fuels, especially in sea transportation, can be replaced with biofuels. Perhaps by 2030 it will be significant.” [1].

The priority of improving maritime transport sustainability divided opinions among the different representative groups. The majority of the industrial association representatives disagreed with the claim that sustainability in maritime transport should be a top priority in the forestry sector. Half of the industry expert representatives agreed and half disagreed with the claim, whereas research community representatives were divided equally between agree, disagree, and neutral. This lack of coherence in the group may also be related to the background of these experts, representing quite different scientific orientations and levels of expertise regarding the technological and economic viability of biofuel use in maritime transportation.

Table 4

Implications of environmental regulation of maritime transport for the PPI (N = 15, round 2).

	Agree	Disagree	Neutral
Regulatory pressure on developing environmentally friendly transport solutions will be positive for the forest sector in the long run.	79%	14%	7%
The directive for sulfur dioxide emissions in maritime transport will not be very effective from the environment's point of view.	33%	33%	33%
Improving sustainability in maritime transport should be a top priority for the forest sector.	27%	47%	27%

5. Discussion and implications of results

Better understanding of the role, impacts, and effectiveness of different forms of regulation is important, as long- and short-term political decision-making concerning the environment and natural resources is becoming a more complex task, involving the engagement of multiple sectors and highly influential stakeholder groups. To our current knowledge, this is the first attempt to conduct a Delphi study among forest industry experts, in order to map the influence of environmental regulation and sustainability on the drivers of future competitiveness in the European pulp and paper sector.

The question concerning the role of government in shaping the future of the European PPI divided opinions among the panelists in this study. Some panelists foresee this role as important, but some did not believe in its capability to function as a catalyst for the competitiveness of the PPI – especially if no new tools or supporting political targets are implemented for, for example, renewable material and energy use. One statement that clearly divided the industry representatives from the rest concerned the role of recycled fiber. Unlike industry representatives on the panel, the members from the research community and industry associations believed that the importance of recycled materials as raw material will increase in PPI production. In the open comments, one panelist pointed out the limits of recycled material usage (recycled paper can only be used a limited number of times, and only to manufacture certain paper grades). In addition, there is a huge amount of recycled paper that is currently being exported to Asia. These features may partly explain the divide in expert opinion. It may further be possible that other panelists besides the industry representatives have considered “recycled material” as a broader concept, also incorporating recycled raw materials other than recycled paper, but this is not explicitly revealed in the answers. The more general impression gained based on answers and comments is that the panelists believe that the PPI can, or has to, become more efficient in its use of raw materials and energy. Some panelists also expected some alternative raw material to be in use in the future, such as non-wood fiber.

Agreement could be seen among the panelists that the more voluntary alternatives to implementing command-and-control type policy measures could have an important role in complementing government legislation affecting the forestry and pulp and paper sectors. These findings are in line with [Yliskylä-Peuralahti and Gritsenko \(2014\)](#), who note that international maritime governance can be made more effective by mixing mandatory and voluntary (public and private) forms of regulation. The complementary role of different regulation forms has also been argued to improve the real-world applicability and economic efficiency of environmental policy-making (e.g. [Abbott and Snidal, 2000](#), [Iraldo et al., 2011](#)). Despite the global trend of shifting from command-and-control measures toward voluntary market-based regulation, strict regulatory measures were generally perceived as environmentally advantageous and more effective by the PPI experts in this study, especially in the long-term. Panelists supported the idea of implementing a combination of regulatory and voluntary market-based mechanisms that more equally divide the costs of implementation between international competitors.

The pulp and paper industry is an example of a natural resource-dependent sector, which intensively uses raw materials, water, and energy. There is growing vulnerability in European pulp and paper related to tightening regulation regarding transportation-induced SO_x emissions, but also new opportunities via sustainability-driven innovations, benefits from acting responsibly, and strategic cross-sectoral partnerships in transportation biofuel production and use. These tightening regulations are considered both a threat

and an opportunity by our panelists. Regulation is first seen as an imminent threat, as it is expected to increase short-term costs, influence competitiveness negatively, and place European industry in an unequal position compared to others. Some of the panelists doubted the possibilities of receiving a return on their investments, or the customers' willingness to pay extra for the products because of decreased sulfur emissions. However, some panelists viewed the pressure to develop transport solutions in general (or maritime transport solutions specifically) as a positive aspect. For example, as many as 79% of the panelists in the second round agreed with the statement that “*Regulatory pressure to develop environmentally friendly transport solutions will, in the long run, be positive for the forest sector.*” Some of the panelists also expected the negative effect of cost disadvantage to be mainly a short-term influence. Several panelists in the first round expected the long-term influence of the sulfur emissions directive to be positive on the industry's environmental sustainability, while some answers still reflected doubt toward the directive's capability to influence the environment on a more global level, due to less stringent regulation in other parts of the world. An explicit statement concerning this was made in the second round, and it turned out that the panelists' opinions divided quite evenly between positive, negative, and neutral expectations in this respect.

The contradictory expert views concerning the way the pulp and paper industry incorporates responsibility within the environmental area, beyond its focus on the sustainable procurement of raw materials and sustainable forest management, was also recognized by [Ranängen and Zobel \(2014\)](#) as a lack of research. Additionally, [Gritsenko and Yli-Peuralahti \(2013\)](#) point out that a lack of clarity exists in planning how to transfer to zero-waste, zero-emission shipping in terms of SO_x adaptation strategies, which may also have political, and not only economic consequences. Expected adjustment costs are likely to be short term in nature, while possible business benefits can occur over a longer time perspective, from being able to create environmental front-runner capabilities, conforming to the notions of [Porter and van der Linde \(1995\)](#). Furthermore, imposing more stringent environmental regulation does not necessarily mean increased costs at the level anticipated ([Haq et al., 2001](#)).

In terms of statements concerning environmental policies and competitiveness, most of the panelists agreed that “*PPI companies that really take advantage of the intrinsic sustainability aspects of the forest industry are faring better than others.*” This reflects the strong belief among both the industrial community and other industry experts that sustainability can be a central element in the competitiveness of PPI companies. From society's point of view, this could be promising, because one interpretation is that the pulp and paper industry has a market-based incentive to invest in developing sustainable practices. However, several comments made in answer to other questions indicate that the experts perceive the European PPI as already sustainable by international comparison. We interpreted these comments, however, to more likely reflect improved emission control at the mills, rather than being able to assess the more comprehensive effects in the entire supply chain (see also [Koskela, 2011](#)). In this light, the previous opinion could be interpreted so that the (current) form of sustainability has market potential that materializes (or has already materialized) with the right kind of sustainability communication. This latter impression gains some backing from the third round answers, where 47% of the panelists agreed with the statement “*Informative policy mechanisms (such as building customer awareness on sustainability) are not implemented efficiently in the European PPI.*” This was especially supported by the representatives from the research community and the industrial expert group. Educating consumers on the benefits of preferring renewable products such

Table 5
Summary of the main future trends in the European PPI and their impact on PPI competitiveness toward 2030.

	Relative magnitude of the impact on the PPI in Europe		
	High	Moderate	Low
The rise of environmental regulation in other parts of the world	X		
The rising role of market-driven regulation in the PPI		X	
Innovations and PPI industry leadership in sustainability		X	
Development in sustainable transportation			X

as pulp and paper products can be realized as improved competitiveness of the PPI.

Table 5 summarizes the four main sustainability issues arising from the results of this study that have importance for the future competitiveness of the PPI. First of all, it seems evident that the more stringent regulations to be implemented in the other parts of the world, to fight against the effects of climate change, will have the greatest potential to increase the relative competitiveness of the European PPI. Potential benefits from industry self-regulation are perceived to be only moderate, which reflects the general view of the existing traditional industry mind-set and a lack of diversification (e.g. Hetemäki and Hänninen, 2013). From an innovation perspective, more stringent environmental regulation may lead to the use of forest-based raw materials in the production of renewable biofuels, diversifying current forest-based product portfolios. For example, according to Cullinane and Bergqvist (2014), the future imposition of more stringent sulfur emission levels will put energy use and other efficiency measures high on the agenda of shipping companies, resulting in the wider use of strategic measures such as speed differentiation to absorb additional costs, as well as creating incentives for sustainability-driven innovations (Hyvättinen and Hilden, 2004). Based on Table 5, the development of sustainable transportation strategies is likely to contribute toward long-term competitiveness in the PPI only to a smaller degree, unless new strategic innovation-oriented cross-sectoral partnerships develop in transportation bio-fuel production and use.

This study explored the perceptions of European pulp and paper experts concerning the future competitiveness of the industry and the SO_x emissions directive before tightened regulation came into force. As in any other study, some limitations exist. First, all the experts on the Delphi panel were somehow involved with the forest industry, and thus all the panelists viewed the studied topic from rather similar vantage points. However, the panelists represented six different European countries, which enriched the discussion and brought out a more comprehensive view of the topic than just a view from one country. Second, the number of experts was rather small, but given the specific research topic and the general characteristic of a Delphi study, where experts are selected based on their expertise on the subject matter, the number of experts seems warranted. In addition, nearly all the panelists participated in all three iterative rounds. All in all, the Delphi method proved useful in this context, as it enabled the panelists to comment relatively freely and present their views on the topic without group pressure. This method also made it possible to bring the geographically dispersed experts together, by avoiding time and place constraints, and to gather expert opinions on a topical issue that lacks historical data.

6. Conclusions

The contribution of this study is to make visible the kinds of perceptions and expectations related to the sulfur emission directive among PPI experts. These views importantly reflect not only the prevailing attitudes toward environmental regulation, but also

the perceptions regarding the competitiveness and competitive logic of the PPI. This study departs from other studies on the sulfur directive by specifically focusing on the strategic and forward-looking elements in a complex decision-making context in the PPI, and providing a way to capture the future impacts of environmental regulation beyond traditional environmental impact assessment and cost evaluation.

In the big picture, competition for natural resources and political targets for maximizing resource efficiency are becoming increasingly important factors influencing the future of the European PPI. The results suggest that while the Delphi experts in this study see the more voluntary alternatives and command-and-control policy as complementary to each other, the strict regulatory measures are generally perceived as environmentally advantageous and more effective in the long term. From the business perspective, the panelists saw tightening regulation as both a threat and an opportunity. This result accentuates the importance of recognizing the opportunity to gain market benefits from greening the entire supply chain, for example by building customer awareness and raising the global standards for environmental sustainability in all industries.

As the Delphi method has proved successful in such studies, it would be interesting to study how the forest-based sector, as a natural resource-dependent industry, perceives more broadly its future business and the business environment. Along with this, it would also be interesting to similarly study the insights of the transport sector, and the influences and consequences expected to occur due to the sulfur emission directive, as well as to follow up the adjustment period after 2015. The pulp and paper industry is often seen as a mature, large-scale industry, where innovations are incremental and more process-than product- or business model-oriented. Future studies could therefore concentrate in more concrete ways on how the industry itself perceives its adaptation to the future, now that drastic business environment changes seem to be looming. Another interesting topic for future research would be to focus on the limits of recycled material usage, as this question elicited such a wide range of opinions on our panel. Furthermore, broader and more in-depth treatment of the subject matter could constitute an interesting setting, which has not been studied from the foresight perspective. For example, future research could cover international trade in recycled paper, waste minimization policies (such as the emerging EU directive and the ambitious targets of 90% recycled paper content), and life-cycle aspects when comparing the environmental impacts of products made from virgin fiber and recycled paper.

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