

Environmental concerns in political bioeconomy discourses

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SUMMARY

The term bioeconomy has been generated as a new discourse in the environmental policy arena. This paper raises three questions: (i) are environmental concerns integrated in the political discourses of bioeconomy and, if so, to what extent?, (ii) in which way is the environment framed in the political discourses of bioeconomy?, and (iii) are environmental concerns considered in the political discourses on forest-based bioeconomy? The theoretical framework of this paper builds on the cognitive approach of policy integration and on frame analysis. The empirical research design is a comparative qualitative analysis of five different political bioeconomy discourses in the EU and four different EU member states – Germany, Finland, France and the Netherlands – in general and in the forestry sector specifically. Results show a weak and mainly rhetorical integration of environmental concerns in political bioeconomy discourses. Three major environmental frames are identified: (i) The dominant frame of ‘Environment benefitting from economic growth’, (ii) the ‘Environment as a challenge’ and (iii) the less visible ‘Environment as a standard’ frame. In general, these frames address the environment mainly as a challenge or something that needs to be safeguarded with the help of the bioeconomy. With the exception of Finland, amongst the countries studied, forests play only a minor role in bioeconomy discourses while environmental concerns in this strand of discussion are mainly focused on sustainability arguments in general.

Keywords: bioeconomy; environmental policy integration; sustainable development; forest sector

La place des enjeux environnementaux dans les discours sur la bioéconomie

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Dans le domaine des politiques environnementales le terme de bioéconomie est associé à une nouvelle forme de discours. Ce papier soulève trois questions en lien avec ce phénomène: (i) Les enjeux environnementaux sont-ils intégrés aux discours politiques sur la bioéconomie, et si oui, dans quelle mesure? (ii) De quelle façon la problématique environnementale est-elle posée dans ces discours politiques sur la bioéconomie?, et (iii) les enjeux environnementaux sont-ils pris en compte dans les discours politiques sur la bioéconomie forestière? Le cadre théorique de ce papier repose sur une approche cognitive de l’intégration politique et sur l’analyse des formes de cadrage. Le travail empirique s’appuie sur une étude qualitative et comparative des différents discours politiques sur la bioéconomie, de manière générale et en particuliers dans le secteur forestier, au niveau de l’UE et dans quatre pays membres (Allemagne, Finlande, France et Pays-Bas). Les résultats montrent que l’intégration des enjeux environnementaux dans ces discours est faible et essentiellement rhétoriques. Trois principales formes de cadrage ont été identifiées: (i) le cadrage dominant qui présente «la croissance économique au bénéfice de l’environnement», (ii) celui qui présente «l’environnement comme un défi à relever», et (iii) le moins visible où «l’environnement est un standard». De manière générale, ces formes de cadrage traitent de l’environnement essentiellement comme un enjeu ou comme quelque chose qui doit être préservé grâce à la bioéconomie. A l’exception de la Finlande, dans les pays étudiés les forêts occupent une place marginale dans les discours sur la bioéconomie et les enjeux environnementaux associés sont principalement renvoyés à la question de la durabilité.

Preocupaciones ambientales en el discurso político sobre bioeconomía

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El término bioeconomía ha aparecido como un nuevo discurso en el ámbito de la política ambiental. Este artículo plantea tres preguntas: (i) ¿están integradas las preocupaciones ambientales en el discurso político sobre bioeconomía y, en caso afirmativo, en qué medida? (ii) ¿cómo se enmarcan los aspectos medioambientales en el discurso político sobre bioeconomía?, y (iii) ¿se tienen en cuenta las preocupaciones medioambientales en el discurso político sobre bioeconomía forestal? El marco teórico de este trabajo está basado en el enfoque cognitivo de

la integración de políticas y en el análisis de marcos teóricos. El diseño de la investigación empírica es un análisis cualitativo comparativo de cinco discursos políticos diferentes sobre bioeconomía en la UE y de cuatro estados miembros de la UE (Alemania, Finlandia, Francia y los Países Bajos), tanto en general como específicamente para el sector forestal. Los resultados muestran una integración débil, y en gran medida retórica, de las preocupaciones ambientales en el discurso político sobre bioeconomía. Se identificaron tres marcos medioambientales principales: i) el marco predominante de «el medio ambiente se beneficia del crecimiento económico»; ii) el «medio ambiente como un reto»; y iii) el marco menos aparente del «medio ambiente como un estándar». En general, estos marcos abordan el medio ambiente como un desafío, o como algo que necesita ser salvaguardado con la ayuda de la bioeconomía. A excepción de Finlandia, entre los países estudiados los bosques tan sólo desempeñan un papel menor en el discurso político sobre bioeconomía, mientras que las preocupaciones medioambientales en este hilo argumental se centran principalmente en los aspectos de sostenibilidad en general.

INTRODUCTION AND OBJECTIVES

Bioeconomy has been identified as a new discourse (Pülzl *et al.* 2014) supported by different organisations and at different political levels, e.g. by the Organisation for Economic Co-operation and Development (OECD), the European Union (EU), and also by numerous countries worldwide (Bioökonomierat 2015). Arguments for a bioeconomy make use of the assumption that fossil-based resources are limited and highlight the relevance of biotechnology (Pülzl *et al.* 2014) in addition to naming sustainable development (SD) as the overarching goal. In fact, the emphasis of the bioeconomy discourse on SD goes partly so far as to rename bioeconomy as “sustainable economy” (BMBF 2014). The bioeconomy promises to address major societal and economic challenges and at the same time to create a more favourable environment.

Findings of recent research studies have highlighted that the bioeconomy cannot be considered as self-evidently sustainable and that visions about the relationship between bioeconomy and sustainability differ substantially (Pfau *et al.* 2014). Instead, studies criticise the prevalent economic dimension and, as an alternative, suggest safeguarding the balance of environmental and social concerns (Ramicilovic-Suominen and Pülzl 2017, Kröger and Raitio 2017). While the linkage between SD and bioeconomy has been discussed in these earlier studies, a focus on the environmental perspective in the bioeconomy is missing. Hence, this paper amplifies the existing research in assuming that Environmental Policy Integration (EPI) – which in general refers to the inclusion of environmental concerns in decision-making processes, outputs and implementation of public policymaking (e.g. Hertin and Berkhout 2003) – is essential for achieving the goal of a sustainable bioeconomy.

EPI has been acknowledged already for three decades in international political discourses. Already in the Amsterdam Treaty (1997), the EU and then European Community made significant commitments to EPI. In the EU as well as in many of its member states (MS), EPI is perceived as essential for achieving SD (Jordan 2008). Nevertheless, studies confronting the ambitious and normative goals of EPI with empirical reality have revealed that environmental concerns are integrated only in an incomplete and unsatisfactory way into policies and related instruments in general (Jordan and Lenschow 2010). Additionally, studies on EPI have identified that the manner in which environmental concerns are taken up differs between political levels of the EU and that of its MS (Jordan and Lenschow 2010).

By emphasising the relevance of renewable biomaterials for replacing fossil-based materials, bioeconomy offers a particular chance to understand whether and how environmental concerns are taken into account in the political discourse of the EU. This paper not only analyses the political discourse of the EU but also, for comparative reasons, the political discourses of four MS. It therefore aims to fill the gap of country-based comparative research in studies on EPI as well as on bioeconomy policy.

In the following, more information about the theoretical background of EPI is provided and frame analysis is introduced, serving as the basis for the three research questions guiding this paper. Based on the concepts and forms of analysis, an analytical frame is then devised before empirical results from four country studies and the EU are presented and analysed. The last section is devoted to comparing and discussing the empirical results in order to address the main aim of this paper.

THEORETICAL BACKGROUND

In the EU, EPI has been respected, emphasised and, since the beginning of the 1990s, institutionalised through the fifth Environmental Action Programme (CEC 1992) as a policy that promotes the integration of environmental objectives, particularly in the following sectors: agriculture, energy, industry, transport and tourism. Since 1997, the EC Treaty Article 6 (now Article 11 in the Consolidated Treaty on the Functioning of the European Union) states that “environmental protection requirements must be integrated into the definition and implementation of the Community policies in particular with a view to promoting sustainable development” (European Commission 2012a:53). However, despite meaningful beginnings, ambitions towards achieving EPI have somewhat faded away in the European Union (Jordan and Lenschow 2010). In fact, the European Commission has acknowledged that many of its sectoral policies fundamentally undermine EPI (Jordan *et al.* 2008). Sectors are considered rather slow in accepting ownership of environmental problems and often develop practical interpretations of EPI and sustainability that are inconsistent with the preferred EU interpretation (*ibid.*).

In general, the EPI academic scholarship is, on the one side, devoted to clarification of the normative understanding of EPI (how EPI should be and its positive meaning) and, on

the other side, to its empirical-analytical nature (how EPI is conceptualised) (Hogl *et al.* 2016). The nature of EPI has been a key topic of research focusing on both the normative and empirical-analytical aspects of this concept. In the normative understanding, EPI has often been characterised as an act of “incorporation of environmental objectives into all stages of policymaking in non-environmental policy sectors, with a specific recognition of this goal as a guiding principle for the planning and execution of policy” (Lafferty and Hovden 2003: 9). These authors also place an emphasis on the vertical and horizontal integration of EPI. The integration of environmental as well as ecological concerns into other policies is regarded as fundamental to making EPI a success. Following Lafferty and colleagues, Lenschow (2002) argues that the intention of EPI is not to find consensus in discussions regarding trade-offs between economic and environmental objectives of sector policies but rather to prioritise environmental objectives from a normative point of view (*ibid.*).

In a positive understanding, scholars analytically distinguish between *weak* and *strong* EPI (Jordan and Schout 2006). *Weak* EPI is said to occur when the environment is considered in sectoral policymaking on equal footing with other issues, such as economic growth. In this situation, the core of sectoral policies would remain though new routines might be added. *Strong* EPI is said to occur when environmental concerns are prioritised over other issues. Söderberg (2011), drawing on Baker (2007), adds that strong EPI is supported by an eco-centric worldview while weak EPI is mainly consistent with an anthropocentric worldview and the goal of ecological modernisation. Furthermore, in addition to weak and strong EPI, Söderberg (*ibid.*) added a further classification of the concept into ‘real’ EPI, rhetorical EPI, instrumental learning and absent EPI. As Söderberg focused on EPI as a process of learning, not all of these categories were relevant for the present paper on bioeconomy. However, the differentiation between “real EPI” and “rhetorical EPI” is relevant as it allows one to study at which level the integration of environmental concerns is discussed. While real EPI foresees a consideration in policy goals and strategies, rhetorical EPI does not necessarily imply the integration of environmental considerations into policy practices. Based on these ideas, in this paper we follow the positive meaning in the first research question: *Are environmental concerns integrated into the political discourses of bioeconomy? And if so, whether they suggest a weak or strong EPI, a “real EPI” or a rhetorical EPI?*

Going beyond the pure assessment of weak and strong EPI, this study builds on a cognitive perspective of policy integration, based on the assumption that the position towards environmental concerns rests on the specific environmental frames used in bioeconomy discourses. These frames are defined by Schön and Rein as a set of “underlying structures of belief, perception, and appreciation” (1995: 23). Frames can be regarded as narratives that determine what counts as fact and what arguments are taken to be relevant and compelling (Schön and Rein, 1995). Frames are important as they function as road maps and limit choices by ignoring some options. Though interests and frames are two independent

concepts, “[F]rames are not free-floating but grounded in the institutions that sponsor them” (*ibid.*, page 29). What is perceived as a political problem or solution depends on the frames used in the discourse (Hajer 1993). Discourses are understood as “an ensemble of ideas, concepts, and categorizations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities” (*ibid.*). Many studies exist that are concerned with the analysis of discourses on EPI (e.g. Nilsson and Eckerberg 2007, Nilsson 2005a, Nilsson and Persson 2003, Söderberg 2011, Sjöstedt and Kleinschmit 2016).

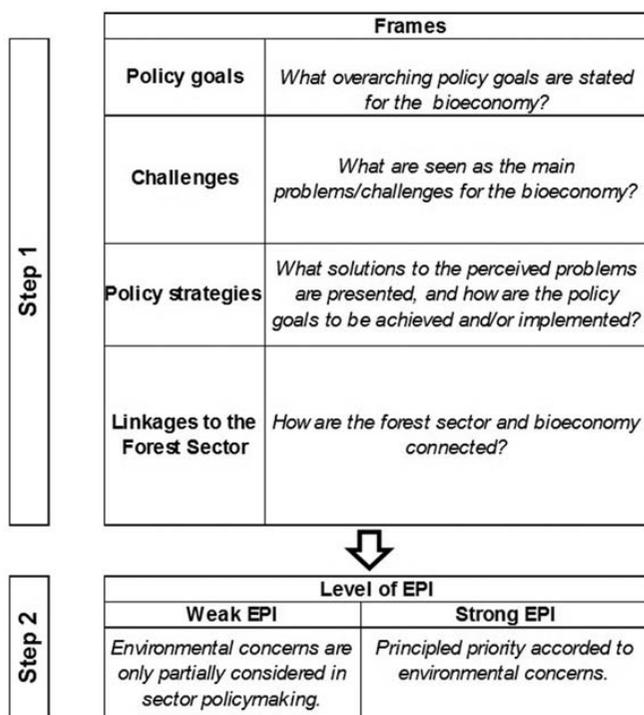
During the last few years, bioeconomy has been increasingly analysed using discourse analysis (e.g. Pülzl *et al.* 2014). New policies, such as bioeconomy, do not appear on the political agenda as they would on a blank paper, but rather are constrained by the context of the already existing political discourse (*ibid.*) Building on the concept of Schön and Rein (1995), the second research question of this paper asks *how the environment is framed in the political discourses of bioeconomy?*

Following the assumption that EPI means assessing the impact of sectoral policies on the “long-term carrying capacities of nature” (Lafferty and Hovden 2003), this paper additionally assesses how environmental concerns are integrated into the bioeconomy discourses with reference to a specific sector. The forest sector has been selected for this exploratory research for two different reasons: (i) the forest sector pays particular attention to bioeconomy (Kleinschmit *et al.* 2014, Pülzl *et al.* 2014), and (ii) former studies on forest policy which identified a lack of EPI, did not take into account the new discourse on bioeconomy (Winkel and Sotirov 2014) or identify the pathways to sustainability in a forest-based bioeconomy that does not focus on EPI (Kröger and Raitio 2017). Therefore the third research question of this paper asks *how environmental concerns are considered in the political discourses on forest-based bioeconomy?*

EPI can be studied as a process, an end-state or an outcome (Nilsson and Persson 2003). Research on the EPI process dimension concentrates on different phases in the policy process and actors’ involvement. The communication and integration of different political levels can also be analysed. Research on the EPI end-state is mainly concerned with the quality of policy integration (weak or strong). Finally, research about EPI outcomes focuses on questions of effectiveness. A more recent state of the art assessment (Runhaar *et al.* 2014) seeks a comparative account in order to analyse factors that make EPI successful. Since the present paper aims to empirically assess the nature of EPI, it concentrates on the “end-state”, analysing the current political discourses on bioeconomy with a focus on its objectives, strategies, actions and advocated policy instruments from a comparative point of view.

RESEARCH DESIGN

In order to identify frames and to explore the role of the environment in the political bioeconomy discourses, this paper

FIGURE 1 *Study framework design* (adapted from Söderberg 2011 and Nilsson 2005b)

applies a two-step approach (Figure 1). It departs methodologically from the assumption that policies are a discursive practice giving meaning to and shaping problems they intend to address; hence they are both an expression of and a prerequisite for social interaction (Holmgren 2015). Therefore, the political bioeconomy discourses firstly needed to be reconstructed for each case study by analysing bioeconomy programmes and strategies as well as forest programmes and strategies with reference to bioeconomy in the EU and at national levels.

The literature search therefore included terms such as “bioeconomy”, “bio-economy” or “bio-based economy” and focused specifically on EU and national MS policy documents and strategies (from Germany, France, the Netherlands and Finland) dating from 2009 to 2014 (the time period within which the first national and EU bioeconomy strategies emerged). Additionally, the recently released bioeconomy strategy from France in 2017 was added as this is an important document and appeared during the process of revising this paper. Particular emphasis was placed on documents dating from this period that specifically and unambiguously refer to and/or mention bioeconomy. A total of 45 bioeconomy-related policy documents and strategies were included in this document analysis (ANNEX 1).

In this regard, a qualitatively focused coding of elements of all bioeconomy discourses was undertaken to structure and group statements relating to the four following themes and questions relevant to understanding policy frames, as adapted from Söderberg (2011) and Nilsson (2005b):

- **Policy goals:** What overarching policy goals related to the bioeconomy exist? Here “policy goal” refers to any vision, objective, target, or intention for policy action clearly and unambiguously mentioned and/or described in the analysed policy document.
- **Perceived problems:** What are seen as the main problems for the bioeconomy? Here “problem” is understood as any question, doubt, uncertainty, or difficulty relating to the realisation of bioeconomy that suggests the need for policy intervention.
- **Policy strategies:** What solutions to the perceived problems are presented, and how are the policy goals to be achieved? Here “policy strategies” may refer to any solution or discussion proposed for solving the identified problems (previously mentioned). “Strategy” may be understood as the value-based, long-term approach to realising policy goals in broad terms.
- **Linkages between forest-based bioeconomy and the political bioeconomy discourse:** How are the forest sector and bioeconomy connected? Here the focus is on how policy documents frame the role of the forest sector in the bioeconomy as well as how forests are connected regarding their meaning/importance for the bioeconomy.

This categorisation of the varying discourses allows for a cross-comparison among case studies. It allows for an assessment of whether environmental concerns have been integrated in political bioeconomy discourses and, if so, to what extent. The quality of the integration is evaluated in two ways: (i) whether environmental concerns are prioritised (strong EPI) or considered amongst others (weak EPI) and (ii) the integration in goals, strategies and instruments to foster environmental considerations in policy practices (real EPI) or a limited integration only in policy goals without specifying the implementation (rhetorical EPI).

In a second step, and in order to trace environmental integration within bioeconomy discourses, a textual analysis was conducted. Based on those elements addressing environmental issues that were identified during the first round of analysis, major environmental frames used were differentiated and used as categories in a second round of qualitative document analysis in order to validate and illustrate their (different) use in the bioeconomy discourses.

The empirical study is based on a comparative approach in order to understand the meaning of EPI in the political bioeconomy discourse of the EU and four of its MS (Finland, the Netherlands, Germany and France). Criteria for the selection of national studies included: a) the existence of a policy discourse debate on bioeconomy at the national level and b) the aim to identify distinctive forest policies by including countries with a range of key objectives and aims (Winkel et al. 2009). These criteria are fulfilled in the sense that the bioeconomy debate is present in all selected countries and that their forest policies differ considerably. Moreover, they are located in northern, southern and central Europe. Finland represents a country with a strong forest sector, whereas the Netherlands is acknowledged as a country with a weak forest

sector that is integrated into nature conservation via political institutions. Germany is selected as representing an “in between” nation that has a vibrant forest sector and, over recent decades, strong ambitions concerning environmental policies (Wurzel 2008). Finally, France is selected to represent a country that is concerned with both environmental protection and the development of the forest sector. In order to avoid mixing and perhaps clouding the empirical results with differences in policies resulting from still ongoing economic transitions, the study does not take into account “new” Eastern European countries.

BACKGROUND OF THE BIOECONOMY POLICY IN THE EU AND FOUR MS

This section provides a brief overview of the state of bioeconomy policy in the EU and four of its MS. This will provide the basis for the more specific analysis of the bioeconomy discourses in the following section.

European Union

There has been a political debate about bioeconomy at the EU level since the beginning of the 2000s. Already during 2002, a biotechnology strategy was published to achieve the Lisbon objectives in becoming one of the leading, then so-called “knowledge-based” economies (European Commission 2002). Soon the term “biotechnology” became displaced by the new concept of a “knowledge-based bioeconomy” (KBBE) (European Commission 2004). An online consultation in 2011 and a number of conferences and workshops were held to inform the strategy process that preceded the development of the actual EU bioeconomy strategy. In 2012, the European Commission published the bioeconomy strategy and action plan entitled “Innovating for Sustainable Growth: a Bioeconomy for Europe” (European Commission 2012b) and a related but more detailed Commission staff working document (European Commission 2012c).

Germany

In Germany’s case, the EU Cologne Declaration “En route to the Knowledge-Based Bio-Economy” developed under the German Presidency in 2007 can be regarded as having set the scene for the German political discourse on bioeconomy (EU 2007). Soon after, in 2009, Germany established an independent government advisory board on bioeconomy (Bioökonomierat) to discuss bioeconomy-related matters and provide scientific information to political decision makers. The Bioökonomierat has since published a number of recommendations for actions (BÖR 2012, 2010), which were mainstreamed into the national research strategy of 2011: “National Research Strategy Bioeconomy 2030: Our Route Towards a Biobased Economy” (BMBF 2011). In 2014, the Federal Ministry of Food and Agriculture published a complementary document to the aforementioned strategy, namely the “National Policy Strategy on Bioeconomy: Renewable

resources and biotechnological processes as a basis for food, industry and energy” (BMBF 2014).

Finland

Finland was among the first Scandinavian countries to pick up on the political discourse on bioeconomy. The Finnish bioeconomy strategy was drafted in a project set up by the Ministry of Employment and the Economy with input from other ministries, researchers and multiple stakeholders. Between 2009 and 2011, a number of documents were published that prepared the ground for the subsequent strategy (e.g., Gustafsson *et al.* 2011, Luoma *et al.* 2011, SITRA 2009). The final version of “the Finnish bioeconomy strategy: sustainable growth from bioeconomy” was published in 2014. Despite the current more critical discourses (e.g. Kröger and Raitio 2017), Finland’s forest-based bioeconomy in particular is seen as the new path towards a sustainable green economy (MEE 2014). The rush to support bioeconomy growth and innovations in Finland is hardly questioned in the political discourses although the Finnish Bioeconomy Strategy promotes interactions between citizens, bioeconomy operators and decision makers both in relation to policy processes as well as in regard to management and use of natural resources (MEE 2014).

France

In 2015, the French government published the national strategy of ecological transition towards SD (SNTEDD) 2015–2020 (Prime minister 2015) where the term “bioeconomy” appears for the first time in a French national political strategy. However, bioeconomy is not a key concept of the national SD strategy, and the report remains rather vague on this subject (*ibid.*, 2015). At the same time, the Ministry of Agriculture in close collaboration with others ministries (economy, environment and research) launched a consultation on bioeconomy and published its national strategy in January 2017 (Ministère de l’Agriculture, 2017). In 2018, a working plan and a strategic council dedicated to the implementation of the national strategy will be established. The bioeconomy is presented as the photosynthesis economy which encompasses all biomass production and processing activities. In this context, the introduction of the bioeconomy concept is directly related to the forest matter and the forest sector is identified as a key actor already engaged in innovative approaches.

Netherlands

The latest Dutch government policy vision on the bioeconomy was published in 2012 (Ministerie van Economische Zaken 2012). It builds on an earlier governmental policy document (Minister van Landbouw, Natuur en Voedselkwaliteit 2007) and on a number of advisory reports (Commissie Duurzaamheidsvraagstukken Biomassa 2013, Probos 2009, Projectgroep Duurzame Productie van Biomassa 2006, Sociaaleconomische Raad 2010, Wetenschappelijke en Technologische

Commissie voor de Bio-based Economy 2011). The current policy vision sketches the mid-term perspective of the government on ‘the transition towards the bio-based economy’, as it is called in Dutch jargon, while taking into account the European and international context. Based on an analysis of the entire chain from biomass production to bio-based applications, the policy vision identifies policy strategies both for the state and for a range of stakeholders to stimulate the bio-based economy in a sustainable way.

BIOECONOMY IN EUROPE – DO ENVIRONMENTAL CONCERNS MATTER?

The following sections summarise the general policy goals of the bioeconomy, the major problems perceived, and the solutions and strategies presented to solve these problems as indicated in the EU and different national bioeconomy strategies in order to identify how the environment is framed. The role of forests and the forest sector in the bioeconomy discourses is also analysed. A summary of the results from the cross-country analysis is presented in Table 1 at the beginning of the next section.

Policy goals

The current EU bioeconomy strategy envisages a shift towards a full bioeconomy to be achieved by 2020. At the same time, it addresses major societal and economic challenges and creates a better set-up for the realisation of related objectives. Multiple goals can be identified in the political discourses on bioeconomy. However, central in the political discourses of the EU and the four studied MS is bioeconomy as a path for shifting from an economy largely based on fossil fuels to an economy based on renewable resources. One of the main motivations behind this shift is to tackle climate change and ensure emissions reduction, i.e.: “. . . reducing the heavy dependency on fossil resources, mitigating climate change and moving Europe towards a post-petroleum society” (European Commission 2012:4). A second major endeavour emphasised in all strategies is growing and strengthening the economy. The EU and the four MS strategies all emphasise this aspect repeatedly, i.e. in the political discourse of the EU it is stated that, “establishing a bioeconomy in Europe holds a great potential: it can maintain and create economic growth” (European Commission 2012:2). In the German and Dutch political discourses, the desire to maintain and enhance their international competitiveness is stressed, i.e. to “. . . accelerate the growth of bio based products, energy, processes, and services, and to strengthen the competitiveness of German industry on a global scale” (BMBF 2011:2). Food security is another goal prominently acknowledged in the bioeconomy strategies of the EU (European Commission 2012: 3–4) and MS. This refers mainly to food security in countries of the global south and the trade-off that might appear when bioresources are used for commodities other than food and fodder.

Apart from these main goals, the various political discourses also referred to diverse indirect or subordinated goals

that are essential to achieving the overarching objective of bioeconomy. For example, means of securing and creating employment are directly related to bioeconomy. The employment issue has been addressed in the EU political discourse as well as in those of various MS. The EU strategy states that “the Bioeconomy Strategy under Horizon 2020 could generate about 130 000 jobs and € 45 billion in value added in bioeconomy sectors by 2025” (European Commission 2012:5). In the Finnish political discourse, the expected positive effect on the economy is directly linked to the welfare of the Finnish society: “the bioeconomy will boost the national economy and employment in Finland and enhance the well-being of the Finnish people” (MEE 2014: 3). Securing and enhancing the long-term supply of renewable resources, whether from domestic resources (Finland), from international imports (The Netherlands, Germany), or from both if necessary (France), is another subordinated goal. Together with the emphasised need for improved resource efficiency is the goal of ensuring the sustainable use of biomass. In some national strategies this goal has been specified in relation to biodiversity and soil fertility (France, Germany).

Another goal present in all strategies that is not so much ‘subordinated’ but rather accompanies the main goal is the “knowledge-based bioeconomy”. For example, the EU strategy states in this regard that the “Bioeconomy Strategy aims to improve the knowledge base and foster innovation to achieve productivity” (European Commission 2012: 4). Also in Finland, in addition to the possibilities for business development in the bioeconomy, deepening cooperation with universities and research institutes is taken into account in relation to innovation development and research activities (MEE 2014:28). The Dutch government considers research, knowledge production and technology development as crucial for the bio-based economy, and fosters interdisciplinary research that is required to connect with European initiatives: “The cabinet aims at more focus on technology, research, cooperation among stakeholders and translation to tangible business cases” (Ministerie van Economische Zaken 2012: 4). It addresses the central role of pioneering research and development as well as the need for technological innovation.

Perceived problems and challenges

There are a number of challenges addressed in the political discourses of the EU and the different MS that are directly interrelated with the abovementioned goals, i.e. food security, unsustainable management of natural resources, dependence on fossil resources, climate change and unemployment. Regulatory failures, market failures and fragmented policies are seen as the main obstacles to an efficient development of the bioeconomy. Finally, poor coherence between decision makers and stakeholders is perceived to be “at the origin of regulatory failures” as is a compartmentalisation of research and innovation funding (European Commission 2012b:25).

Climate and environmental challenges are acknowledged in all strategies. Connected to these challenges are concerns related to the conservation of biological diversity (Germany)

or the limits to ecosystem productivity (France): “Bioresources result from complex living processes [...] it is essential to ensure that these cycles are respected and completed [...] in order to ensure the sustainability of the activities of the bioeconomy” (Ministère de l’Agriculture, 2017:22). Policy documents also express concerns related to unsustainable practices (The Netherlands, Germany): “It is important that sufficient biomass production will be realized without compromising ecosystems and biodiversity” (Ministerie van Economische Zaken, 2012:6). In fact, almost all strategies express concerns around the sustainability of biomass production and consumption. Finally, strategies mention different conflicts that arise from competing uses of biomass or land use (France, Germany), as well as conflicts between different goals (Germany) and interests (Finland), or specifically between economic and local interests (France). Some strategies even express the concern that requirements of environmental and nature protection can impose limitations on agricultural and forest production (Germany, France).

Most national strategies call for a more holistic approach to solutions for enabling bioeconomy and mention challenges such as inconsistent incentives (France and Germany), fragmented or incoherent policies (the Netherlands, France, Germany) and fragmented research (Germany), that are suspected to affect the multiplicity of heterogeneous actors involved in the transition towards bioeconomy. “The Dutch government follows an integral and coherent policy with regard to the bio-based economy and its adjacent policy fields (. . .); use of biomass in the economy asks for smart solutions in a strongly integrated chain to realize public goods” (Ministerie van Economische Zaken, 2012:4). The knowledge-based bioeconomy is expected to thrive on the creation of new technologies and some national strategies express concerns related to the diffusion of bio-based innovation and new technology transfer (Germany) while other strategies mention challenges related to technological constraints and the financial feasibility of new technologies (the Netherlands), or even lack of adequate strategies for enabling these technologies (France).

Adequate financing is a challenge expressed in all national strategies. Strategies often mention inadequate sources of financing with low expenditure on research and development (Germany), or a lack of direct investment (France, the Netherlands). The Dutch policy acknowledges that: “Innovations for the bio-based economy are not always financially sound for the private sector” (Ministerie van Economische Zaken, 2012:3). In addition to this, the shift towards bioeconomy is often seen as being faced with challenges such as path dependency and resistance to change by some sectors (Germany, France). The lack of well-trained specialist personnel is another challenge mentioned at the national level (Germany, France, and Finland).

Policy strategies

In order to tackle the abovementioned challenges by 2020, the EU bioeconomy strategy and its Action Plan are based on three pillars: (1) investments in research, innovation and

skills, (2) enhancement of markets and competitiveness, and (3) policy coordination and stakeholder engagement. The idea of engaging citizens and end-users to reduce the gap between science and society is being promoted. A more informed dialogue, in particular on the role of scientific advancement, and improved interaction between existing bioeconomy-supporting policies at EU and MS level is also envisaged so that more research, infrastructure and knowledge transfer networks can be developed (European Commission 2012b).

Along the same lines, the different national strategies adopt a variety of measures and strategies to tackle the abovementioned challenges. All strategies pledge to promote innovation, research and skills creation. This is to be achieved by investing in innovation and development of new products and technologies, and by funding different projects, i.e. in the Netherlands, a National Innovation Contract between government, industry and knowledge institutions was agreed (Innovatiecontract Biobased Economy 2012). This contract is intended to lead to maximum added value for and sustainability of the Dutch economy and was agreed upon in the context of the so-called National Top Sector Policy. Although the bio-based economy in itself was not identified as a top sector, it is now positioned as a cross-cutting theme for the energy, chemicals, agro-food, horticulture and water sectors. Funding of up to around 500 million EUR (provided jointly by government and industry) over the next four years has been pledged for innovation. Capacity building is another proposed means of promoting innovation. For example in Finland, universities have written their own bioeconomy strategic agendas to assist in better integrating bioeconomy research and teaching in their strategic planning and funding strategies.

Investments are aimed both at the supply and demand side. On the supply side, strategies mention actions such as ensuring the sustainable flow of renewable resources, promoting and encouraging biomass mobilisation (Germany, France, Finland) and applying the cascading use principle (Germany). On the demand side, policy strategies mention different initiatives such as information and social dialogue, targeted information and participative dialogue between stakeholders (Germany). Other strategies aimed to create observatories for biomass (France) and public procurement incentives (Finland) as well as to support biomass certification of consumer products (France, Germany, the Netherlands). Investments in markets and competitiveness are central strategies envisioned in all policy documents. Incentives are aimed at stimulating market demand for eco-products or eco-services (Germany, France, Finland), or at adapting the public procurement code (France).

The strategies also include informative instruments, e.g. incorporating the bioeconomy in the “country image” (Finland). Policy coordination is presented in the strategies as an important instrument for addressing policy coherence, in particular through increased efforts towards achieving transparent, knowledge-based communication between politics, business, science and civil society (Germany, France, the Netherlands).

Linkages between forests and bioeconomy

Forests are generally understood as an important natural resource for the bioeconomy as well as a biodiversity conservator that needs to be managed sustainably. However, the EU bioeconomy strategy builds only tenuous linkages to forests and forestry. While forestry is acknowledged as an important sector for the bioeconomy (European Commission, 2012b:3), a need for improved efficiency of resource use is immediately postulated given that forestry also needs resources to produce biomass. In this regard, the use of forestry residues for reaching the goal of becoming a low carbon society and mitigating climate change is emphasised (European Commission, 2012b:4). In addition, it is argued that new skilled jobs and training within the sector will have to be developed (European Commission 2012b: 5). In this regard, new infrastructure, particularly biorefineries, is expected to create new income and jobs (European Commission 2012b:7).

Although all national strategies acknowledge the significance of forests and the forest-based sector in the shift towards bioeconomy, the degree of importance that they attribute to this sector differs. For example, in the Finnish political bioeconomy discourse, the forest sector plays a highly prominent role and is seen as the main enabler of a bioeconomy. The forest sector also plays a role in the other national strategies. However, forest is less prominent in other strategies and often associated with, or categorised as part of, the agricultural sector.

Furthermore, within a bioeconomy the forest sector is expected to provide sustainable biomass for both domestic uses and export. Whereas the Finnish strategy presents a perspective of unlimited forest resources capable of providing for both the domestic and international market, other countries acknowledge their dependency on imports from abroad (Germany, France, the Netherlands). With the exception of the Netherlands, the forest sector is identified as a strategic industrial sector in all national strategies. In this context, assuring that forests are managed sustainably both nationally and internationally is highlighted in all national strategies. In some cases, internationally accepted sustainability standards and certification of sustainable forest management and biomass are called for (Germany, the Netherlands).

Finally, the role of the forest sector in climate change mitigation is repeatedly highlighted. All strategies highlight the role of forests in CO₂ storage and reduction. Accordingly, the Finnish, German and French strategies encourage the increased use of wood motivated by the positive climate protection effects of using this resource. This is associated with a win-win solution where an increased use of wood is expected to have positive impacts on the climate and where wood can be used to replace non-renewable materials. For example in Finland, the political as well as public discourse via social media in bioeconomy portals emphasise that, despite growing stocks of wood, these resources are underutilised. As such, they highlight the need for innovative means of utilising unlimited forest resources under the forest-based bioeconomy.

ENVIRONMENTAL FRAMES

The major elements of the political bioeconomy discourses of the EU and the different MS are summarised in Table 1. Main elements identified – such as “strengthen growth and the economy”, “create employment”, “market failures”, “inadequate sources of financing”, “enhancement of markets and competitiveness”, “stimulate market demands” etc. – reflect an economic perspective. Environmental considerations or “the environment” are addressed only to a minor extent. Nevertheless, they are named in almost all analysed bioeconomy policy documents culminating in three major frames: (i) Environment challenged, (ii) Environment as a standard, and (iii) Environment benefitting from economic growth. Apart from the general demand for sustainable forest management, environmental concerns have only rarely been taken up.

(i) *Environment challenged*— almost all analysed policy documents and national strategies view environmental considerations as major challenges for a bioeconomy rather than as goals in themselves, i.e.: “. . . climate- and environmental protection. . . are some of the major challenges facing this country at the beginning of this century.” (BMBF 2011:2). The EU differs a little since it understands “natural resource scarcity, fossil resource dependence and climate change” as “inter-connected societal challenges” (European Commission 2012b: 3) and not simply environmental ones. Throughout the EU strategy, the need to limit negative impacts on the environment is repeatedly highlighted: “In order to cope with an increasing global population, rapid depletion of many resources, increasing environmental pressures and climate change, Europe needs to radically change its approach to production, consumption, processing, storage, recycling and disposal of biological resources” (EC, 2012: 2). Environmental challenges, particularly when linked to climate change, are regarded as issues that require immediate attention. In some cases, environmental considerations are seen as imposing certain limitations on intensified biomass production (Germany, France).

(ii) *Environment as a standard*— national strategies often respond to the environmental challenge with environmental standards that should be respected both within national borders but also at EU and international levels (Germany, France, the Netherlands). The German strategy, for example, highlights increasing environmental requirements from society in terms of the way in which goods are produced: “. . . it is important that bioeconomic activities and investments correspond to high environmental standards. . .” (BMBF 2014:70). Similarly, French and Dutch policy documents often frame environmental issues from an operative viewpoint and advocate for the certification of internationally accepted environmental standards. However, this frame is used less often than the other two.

(iii) *Environment benefitting from economic growth*— environmental considerations are quite often framed as an

TABLE 1 *Elements of the political bioeconomy discourses of the EU and four MS*

EU and MS	Main Findings	
All	Address major societal, economic and environmental challenges	Policy Goals
All	Shift from fossil-based economy to an economy based on renewables	
All	Strengthen growth and the economy	
All	Maintain and increase competitiveness	
All	Strengthen R&D	
All	Build capacity, secure and create employment	
All	Reduce emissions (CO ₂)	
All	Resource efficiency/increased use/sustainable use of biomass	
DE, EU, NL	Food security	Problems and Challenges
EU, DE, FR	Regulatory failures	
EU, DE, FR, NL	Market failures/Access to markets	
EU, DE, FR, NL	Fragmentation: research, incentives, policies	
DE, FR	Poor coherence	
DE, FR, NL	Diffusion of innovation, new technology transfer, technological constraints	
FR, NL	Inadequate sources of financing	
DE, FR	Path dependency and resistance to change	
DE, FR, FI	Lack of trained specialists/need for bioeconomy training	
All	Climate and environmental challenges: limits to growth, biodiversity, unsustainable production	
DE, FR, NL	Conflicting interests: uses of biomass, land use, interests, ecological and economic interests	
All	Investments in research, innovation and skills	
All	Funding projects	
All	Enhancement of markets and competitiveness	
EU, FI, DE	Stimulation of market demand for eco-products or eco-services	
EU, DE, NL	Policy coordination and stakeholder engagement	
FR, DE, NL	Information and social dialogue, targeted information and participative dialogue between stakeholders	
All	Promotion of biomass utilisation and mobilisation	
DE, FI	Public procurement initiatives	
FR, NL, DE	Support for biomass certification	forests and the bioeconomy
All	Important natural resource for the bioeconomy	
EU	Efficiency of forest resource use, mitigating climate change and creation of new jobs	
FI, DE, FR	Provision of sustainable biomass for both domestic uses and export	
DE, FR	Sustainable forestry/forest management	
FI, DE, FR	Strategic industrial sector	
DE, FR	Protection of biodiversity	
All	Important role in CO ₂ storage	

additional benefit resulting from the pursuit of other goals, i.e.: “cost-effectiveness and environmental benefits from efficient biomass utilisation” (MEE 2014:15). For example, the German, French and Finnish strategies identify expected environmental benefits as a direct result of the shift towards the bioeconomy. In this sense, the shift towards bioeconomy is understood as firstly boosting the economy and secondly benefiting the environment. The bioeconomy discourses of

MS present the idea that economic growth and development can be in line with environmental protection, exploring attempts to respond to negative environmental impacts of modernisation without necessarily rejecting progress based on economic growth: “the knowledge-based bioeconomy can thus combine economic prosperity with environmental compatibility” (BMBF 2011: 11). This frame supports the win-win ideal of the bioeconomy.

SUMMARISING DISCUSSION

The empirical results provide insights into predominant goals, perceived challenges and supported strategies in the political bioeconomy discourses at the EU level and in the four MS: Germany, Finland, France and the Netherlands. This analysis allowed for an understanding of whether these strategies present a weak or strong form of EPI and identified underlying environmental frames. Furthermore, the results show how environmental concerns have been integrated in forest-focused arguments in the political bioeconomy discourses.

The empirical results show that environmental concerns are raised in the political bioeconomy discourses, though they are not prioritised in the analysed discourses in comparison to other goals, particularly economic goals. Therefore, interpreting the results according to Söderberg's (2011) classification (based on Baker (2006)), only weak EPI is suggested in the political bioeconomy discourses. This means that the environment is considered but not specifically prioritised. In this sense, the strategies start from an anthropocentric perspective that sees "growth as part of the solution to environmental problems, not as part of the problem" (Baker 2006, p. 138).

This result does not come as a surprise given that studies on the bioeconomy-sustainability nexus have shown that bioeconomy is not self-evidently sustainable (Pfau *et al.* 2014) and argue that the economic dimension prevails (Ramicilovic-Suominen and Pülzl, 2017). Though Pfau *et al.* identified a significant attention to sustainability in the scientific bioeconomy debate, the visions in the research debate differ considerably. On the one hand, the research literature on bioeconomy provides an optimistic perspective assuming that sustainability is "an inherent characteristic of the bioeconomy" while on the other hand a more pessimistic view expects a negative impact on sustainability (*ibid.*, p. 1242). While the former position is dominated by a technical focus, the latter refers mainly to negative impacts on the natural environment, naming amongst others the competition for land and resources, uncertainties regarding invasive species and the unrealisable expectations of emissions reduction (*ibid.*). The authors suggest that environmental and social concerns will be taken up while ensuring economic growth if sustainability is considered a central goal of bioeconomy. Ramicilovic-Suominen and Pülzl (2017) are even more critical regarding the options for sustainability in the bioeconomy. They argue that the EU already uses "the 'brand' of sustainable development as a 'selling point' for promoting its bioeconomy strategy" (*ibid.*, p. 9) while focusing on a rather narrow "conservationist, utilitarian and instrumental" (*ibid.*, p.9) understanding of SD. Hence, SD is argued to be a rhetorical concept that promotes technical solutions and economic efficiencies.

The results of this paper support the latter finding by showing that EPI stays mainly on a level of environmental rhetoric. In contrast to promoting a "real EPI", environmental concerns are mainly addressed in rhetorical terms within policy goals (=rhetorical EPI) but not in policy practice, meaning strategies and instruments that aim to foster the implementation of environmental goals. However, variations between the political bioeconomy discourses can be identified. In general,

strategies and instruments dominating the bioeconomy address investment in R&D or dialogue and information processes. These might, in a second step, lead to strengthening the inclusion of environmental considerations but do not provide rules for ensuring this in the first place. In Germany, but also in France and the Netherlands, bioeconomy instruments and strategies hint towards the option of biomass certification to ensure the sustainable production of biomass. Furthermore, the transformation from environmental rhetoric to an EPI implemented in practice might be supported indirectly by the linkage between the bioeconomy strategy and the SD strategy as observed in Germany and the Netherlands. An assessment of how far these strategies ensure the implementation was not within the scope of this paper and deserves further analysis. In the EU strategy, linkages to other former strategies are also available. However, the political discourses on bioeconomy in the EU and Finland do not include direct strategies or instruments to support EPI, hence EPI remains rhetoric. Responding to the first research question of this paper it can be concluded that environmental concerns are considered in the political discourses on bioeconomy but strategies supporting the move from rhetoric to practical change are mostly neglected. Therefore, EPI remains shallow in most of the political bioeconomy discourses.

Responding to the second research question of the paper goes beyond the mere assessment of the positive understanding of EPI. Conducting a frame analysis yields the identification of three major environmental frames in the political discourses on bioeconomy: (i) Environment benefitting from economic growth, (ii) Environment as a challenge, and (iii) Environment as a standard. These frames address the environmental dimension mainly as a challenge or something that needs to be safeguarded with the help of the bioeconomy.

'Environment benefitting from economic growth' is the dominant frame across all political bioeconomy discourses. It matches the arguments of the ecological modernisation discourse, where a combination of technological progress, markets and growth can be aligned with environmental goals (Arts *et al.* 2010). In this frame, nature and the environment are understood as resource providers and thus the consideration of environmental benefits focuses on climate change mitigation. Therefore, this frame provides a non-conflicting vision of bioeconomy suggesting a win-win situation between economic growth and environmental protection. This frame also indicates a strong role for the private sector, not only for technology but also for innovation. Lafferty and Knudsen (2007) criticise the discourse of ecological modernisation when stating that EPI should not mean merely the search for synergy effects and 'win-win' solutions in making sectoral policy choices. Linking this frame to earlier findings of literature on EPI suggests that it might be a general trend in Europe that the emphasis of meanings has changed over time from SD – which is perceived as a broader concept – to EPI and more recently back to SD (Adger and Jordan, 2009). It furthermore supports the European Council's (2006) earlier claim with respect to the Lisbon treaty that SD is an "overarching objective" and the "motor of a more dynamic economy". Environmental policy integration plays only a backseat

role in this context or as Pallemmaerts states: “[t]he recent overriding concern for growth and jobs has been used to call into question the very legitimacy of [EU] regulatory action in many fields, including the environment” (Pallemmaerts *et al.* 2006:ii).

The ‘Environment as a challenge’ frame is prominent in most of the political bioeconomy discourses, which perceive the environment as being threatened and vulnerable. It refers to an environment that faces general challenges rather than being challenged specifically by the bioeconomy. The political discourses on bioeconomy highlight in particular the problem of climate change, thereby arguing that bioeconomy contributes to mitigation by replacing fossil-based resources with renewables. Hence, climate concerns have become fully integrated in policy objectives and are assumed to benefit from the overall bioeconomy strategies. Other environmental challenges such as biodiversity and (un)sustainable use are less visible. Nilsson (2005b) found a similar result in his study on EPI in Swedish energy policy: “(. . .) the integration of ‘climate’ seems to have crowded out other [environmental] issues from the agenda, and concrete policy initiatives are mostly lacking for these issues” (Nilsson 2005b, p.219). The way in which the ‘Environment as a challenge’ frame problematises the environment does not provide a general conflict with the dominant frame of ‘Environment benefitting from economic growth’. Even in those discourses where a certain risk for the environment presented by a shift towards bioeconomy is perceived, e.g. through an increased demand for biomass (e.g. the Netherlands and Germany), the win-win solution of economic growth and advantages for the environment remains uncontested. Instead, another frame remedies the possible mismatch between both frames.

The frame ‘Environment as a standard’ is less prominent in the political bioeconomy discourses. It addresses mainly a general strategy opting for environmental standards to ensure the sustainable use of biomass in a bioeconomy. To a minor extent, institutionalised standards as certification for biomass are discussed – not demanded – in political bioeconomy discourses, e.g. in Germany and the Netherlands. So far there are no standards that apply to biomass used for the production of bio-based products and bio-chemicals, though there are a multitude of certification schemes as well as voluntary and public standards addressing sustainability in the use of biomass for specific supply changes, e.g. in the EU directives “The Renewable Energy Directive” (RED) or “Fuel Quality Directive” (FQD) (European Commission, 2015). Knudsen *et al.* (2015) conclude from a survey of eleven countries that there are only a few (amongst them Finland) who do not support the idea of having more standardised sustainability criteria in the bioeconomy. Expectations regarding these discussed standards go beyond safeguarding sustainability and assume an increase in public acceptance and the creation of new market opportunities (Scarlat *et al.* 2015). The discussion of (harmonised) standards might become more prominent in future political bioeconomy discourses. It might also, as Lafferty and Knudsen (2007, p. 25) assume, support EPI in ensuring the assessment of impacts of policies on life—i.e.,

sustaining capacities will support the prioritisation of the environment.

Though environmental concerns are only of secondary importance in the analysed political bioeconomy discourses, integration and coordination are revealed as being of major importance for a successful bioeconomy. Particularly the EU, the Netherlands and Germany make explicit reference to other policies and substantiate the need for integration by proposing specific actions, e.g. the inter-ministerial bioeconomy group in Germany and in France. The particular focus of calls for coordination is on research, e.g. the EU highlights the relevance of coherence between research and innovation activities. In Finland, coordination specifically with forest policy can be observed with the same actors supporting the bioeconomy implementation programmes. These interactions are less about supporting the integration of environmental concerns and more about reflecting specific influential vested interests fuelled by discourse coalitions with a shared economic framing.

The prominent role of forests and the forestry sector in the political bioeconomy discourse in Finland differs from the attention paid to forests in the other countries and the EU. The wood-based industry in Finland is more important than in any other country in Europe. As such, the current discourse in Finland presents a perspective of unlimited forest resources and the assumption that (bio)technology can foster sustainable economic growth. Whether and how environmental concerns are integrated is not explicit or is supposed to become self-fulfilling with the increased institutional freedom in Finnish forest policy and the new Forest Law. The other countries acknowledge forests only as one of a diverse set of resources for biomass. In the Netherlands and Germany, the dependency on importing bio-based resources from other countries is presented as a challenge. SD is presented as an integral part of forest policies institutionalised as sustainable forest management. In France as well as in other countries, EPI is regarded as something that already occurred in the last decade, e.g. through the Natura 2000 framework, implementation of certification schemes or like in France through the “Grenelle” forum (Sergent 2013, 2014). However, this EPI mainstreamed in sustainable forest management is criticised elsewhere as a strategy to limit the influence of environmental actors (Winkel and Sotirov 2014).

CONCLUSION

To sum up the empirical results, this paper supports findings of earlier papers in concluding that the bioeconomy discourse is dominated by economic goals (Ramicilovic-Suominen and Pülzl 2017). In contrast, environmental concerns are only considered to a limited extent in the political bioeconomy discourses of the EU and the four observed MS. This result is complemented with more detail in this paper through the finding that EPI it is not only weak but additionally and mainly rhetorical and that it depicts the environment as a problem rather than a goal—even less prominent is the goal of addressing EPI directly in strategies and instruments. A

major exception is the issue of climate change which is prominently raised in the bioeconomy discourses and is assumed to be solved through the bioeconomy. To ascertain whether this focus is the main reason for the exclusion of other environmental issues would need further research, complementing the document analysis with expert interviews.

Three major environmental frames were identified in the empirical work of this paper: (i) The dominant frame of ‘Environment benefitting from economic growth’ matching the discourse of ecological modernisation, (ii) the ‘Environment as a challenge’ mainly addressing general challenges like climate change instead of challenges resulting from a bioeconomy, and (iii) the less visible “Environment as a standard” frame that might become more prominent in the future. In general, these frames address the environment mainly as a challenge or something that needs to be safeguarded with the help of the bioeconomy.

Environmental concerns are addressed only to a limited extent in the discourses on forest-based bioeconomy. This results not least from the restricted acknowledgement of forest resources in the bioeconomy discourses. Forest resources only play an essential role in the Finnish bioeconomy discourse where forest resources are perceived as unlimited. Countries with fewer forest resources are more hesitant in thinking that a shift towards bioeconomy can be achieved without importing bio-resources, e.g. Germany and the Netherlands.

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ANNEX 1: LIST OF ANALYSED DOCUMENTS

EU

1. European Commission 2012 Innovating for Sustainable Growth: A Bioeconomy for Europe SWD(2012) 11 final
2. European Commission 2012 Accompanying document Communication on Innovating for Sustainable Growth: A Bioeconomy for Europe
3. European Commission 2013 COMMUNICATION FROM THE COMMISSION A new EU Forest Strategy: for forests and the forest based sector/* COM/2013/0659 final */
4. European Commission 2013 European Commission (EC). 2013b. A blueprint for the EU forest-based industries. Brussels: European Commission. Brussels, 20.9.2013, SWD(2013) 343 final
5. EEA 2014 European Environment Agency. 2014. Resource-efficient green economy and EU policies. EEA Report, No. 2/2014.
6. European Commission 2014 COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Towards a circular economy: A zero waste programme for Europe /* COM/2014/0398 final/2

Germany

1. Federal Ministry of Education and Research (BMBF) 2011 National Research Strategy BioEconomy 2030. Our Route towards a biobased economy
2. Federal Ministry of Education and Research (BMBF) Forest Strategy 2020
3. Federal Ministry of Education and Research (BMBF) 2014 National Policy Strategy on Bioeconomy. Renewable resources and biotechnological processes as a basis for food, industry and energy
4. European Union 2007 En route to the knowledge-based Bioeconomy
5. The Federal Government 2002 Perspectives for Germany: Our Strategy for Sustainable Development
6. Federal Ministry of Economics and Technology (BMWi) 2010 Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply
7. Federal Ministry of Economics and Technology (BMWi) 2010 Raw materials strategy: Safeguarding a sustainable supply of non-energy mineral resources for Germany
8. Federal Ministry of the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) 2012 German Resource Efficiency Programme
9. Bundesregierung/ The Federal Government 2012 Biorefineries Roadmap

France

1. Dominique JUILLOT 2003 The French wood based sector – competitiveness as the sustainable development issue
2. Thierry CHAMBOLLE 2006 Action plan to promote investment and entrepreneurship in the field of Eco-Technologies
3. Ségolène HALLEY DES FONTAINES 2008 Grenelle Environment and forest conference, Forestry Action Plan
4. Economic Council for Sustainable Development 2009 Green growth
5. General Commission for Sustainable Development (Ministry of ecology) 2010 Strategic green industrial sectors

6. Ministry of Agriculture, Ministry of ecology, Ministry of industry 2010 The non-food uses of biomass
7. Prime minister 2010 National Strategy for Sustainable Development (2010–2013)
8. Etude PIPAME 2012 Actual trends in new wood based product market to 2020
9. Jean Yves CAULLET 2013 Wood and Forests of France
10. Christophe ATTALI 2013 Towards an integrated forest and wood based industry
11. National Industry Council 2014 The contract for wood industry
12. Law for Agriculture, Food and Forestry 2014
13. CGAAER (General Council of Food, Agriculture and rural areas) 2014 Possible contributions of Agriculture and Forestry to climate change mitigation
14. Prime minister 2015 National Strategy for Ecological Transition toward Sustainable Development (2015–2020)
15. Ministère de l'Agriculture 2017 Une stratégie bioéconomie pour la France. Enjeux et visions

Finland

16. Ministry of Employment and Economy of Finland 2014 Finnish Bioeconomy strategy
17. Finnish Government 2014 Finnish Forest Law
18. Ministry of Agriculture and Forestry Ministry/Finnish Government 2008 Finnish National Forest Programme 2015
19. Ministry of Agriculture and Forestry Ministry/Finnish Government 2008 METSO programme

The Netherlands

20. Minister van Landbouw, Natuur en Voedselkwaliteit 2007 OVERHEIDSVISIE OP DE
21. BIO-BASED ECONOMY IN DE ENERGIETRANSITIE
22. Dutch government long-term vision on the biobased economy 2012 Hoofdlijnennotitie Biobased Economy
23. SER
24. Probos
25. Commission Cramer
26. Commission Corbey