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RESEARCH

A Norwegian seaweed utopia? Governmental narratives of coastal communities, upscaling, and the industrial conquering of ocean spaces

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Abstract
Algae-based biomass occupies a prominent role in policy narratives for a more sustainable future situated between Blue Growth Strategies and European (Blue) bioeconomy development. Especially in Norway, the developing seaweed farming sector is portrayed as a novel bioresource sector entailing an array of benefits to remediate global as local environmental and socio-economic challenges. Accredited with massive growth potentials and framed by large-scale industrialist rhetoric with a future in conquering ocean spaces through technological fixes, the sector's development faces multiple challenges. Additionally, the assumptive growth-centred policy narratives employed leave little room for small-scale, locally embedded alternatives called upon by many experts on sustainable and socially just blue resource governance. The paper addresses this issue by conceptualizing Norwegian seaweed farming as an assembling process with a focus on (policy) narratives as a means for governmental spatial interventions. Based on qualitative data with a focus on active Norwegian seaweed farmers' perspectives for the sector's current practices and future developments, the paper assesses the relations and contradictions between the optimistic key policy narratives, current sector developments, and the entrepreneur positionalities that shape the reproduction processes of this Norwegian seaweed assemblage. The paper shows that strong beliefs in extensive growth and technological solutions to tackle the fluid materialities of seaweed production are widespread among entrepreneurs. Paired with policy strategies and a development environment rooted in similar narratives, this creates a current development approach that reduces challenges to technological and administrative domains and neglects the (local) socio-economic and sustainability potential vested in alternative, small-scale approaches.

Keywords Blue bioeconomy · Seaweed farming · Governmental narratives · Policy assemblage · Norway

Introduction

Despite marginal capacities in Europe, algae-based biomass, particularly aquaculture, has come to occupy a prominent space in the political narratives for a more sustainable future situated between Blue Growth Strategies and European (Blue) Bioeconomy development (EC 2020, 2019; EUFOMA 2020). Featured prominently alongside agriculture, forest biomass, and fisheries on the EU's Joint Research Centres (JRC) Bioeconomy knowledge platform, algae biomass is presented as the fourth pillar of a future European bioeconomy despite its current production of approximately 0.3 Mt (wet weight) (Araújo et al. 2021). Hence, the recent political and scientific prominence of the algae biomass sector is not so much about its current importance in the European bioeconomy production system as it is about the assumptive narratives for future bioeconomy and sustainable development potentials (e.g. Albrecht 2019).

Macroalgae-based aquaculture development has seen a sharp increase in volumes over the last decades, yet it is largely reserved to nations in Asia such as China, Indonesia, and the Philippines while the bulk of European algae biomass is exploited by wild harvesting in Norway, France, and Ireland (Araújo et al. 2019, 2021). Wild harvesting in Europe has remained relatively stable over the past decades but is connected with environmental degradation (Barbier et al. 2019). Consequently, growth potentials in Europe are seen predominantly in the production of algae

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biomass through aquaculture, particularly macroalgae (EC 2019, 2020; Seaweed for Europe 2021), also called seaweed farming. A key aspect of seaweed farming that positions it as a prominent sector of sustainable economic policy is the large array of benefits accredited with increased utilisation/production. Its manifold use in food, feed, chemicals, energy, and bioplastics, to name only the most prominent, are paired with the benefits of "zero input" production (e.g., no fertilisation), landless forms of production, and the attributed health benefits of the deriving products be they for animal health (feed products) or humans (food products) (Barbier et al. 2019; Araújo et al. 2021). Additionally, it entails potentials to relieve pressure from competitive land use in biomass production and can absorb anthropogenic pollution such as phosphorous and nitrogen deriving from agriculture, but it also acts as a potentially effective CO2 absorbent (Ullmann and Grimm 2021; EUMOFA 2018). This makes it a strong and currently largely undisputed sustainable component for European bioeconomy development in addition to promises of revitalised (coastal) economic development and green economic growth potentials. Accordingly, the EU has established blue bioeconomy strategies, and many coastal European countries are developing policy strategies and support systems to facilitate the sector's development (see also Seaweed for Europe 2021. EC 2020; Araújo et al. 2021). Especially, Norway has seen hype in seaweed farming licenses, optimistic policy narratives, and media coverage for its developing sector (Albrecht and Lukkarinen 2020).

The European seaweed farming sector is still in its infancy, yet its future development is envisioned through a rather homogenous lens in European policy narratives, media reporting, and entrepreneurial storylines: extreme growth (e.g. Seaweed for Europe 2021; EC 2020). Based on the current low numbers, the sustainable credentials promised by seaweed production and EU bioeconomy economic growth-centred policy in general (e.g. Albrecht et al. 2021; Vivien et al. 2019; Voyer et al. 2018), this might be considered a logical direction. At the same time, it raises the question if the development of a policy realm such as seaweed aquaculture within the blue bioeconomy and its homogenous narratives, which focus on the rapid extension of industrial large-scale production (e.g., Seaweed for Europe 2021; EC 2020), leave room for the alternative, locally embedded and potentially small-scale approaches called upon in critical bioeconomy and blue economy research (e.g. Campbell et al. 2021; Hadjimichael 2018; Albrecht and Lukkarinen 2020; Garland et al. 2019; Barbesgaard 2018; Ramcilovik-Suominen et al. 2022). It should therefore be asked if seaweed portrayed as the "hidden champion" of future blue bioeconomy development (Seaweed for Europe 2021) and aligned with massive growth potentials creates a (rhetorical) seaweed utopia rather than enabling an active engagement with the multiple possibilities it possesses, and which could take a more balanced and potentially more locally focused approach.

The paper aims to address this gap by analysing policy narratives, their translation processes, and role as governmental instruments (e.g. McCann and Ward 2012; Johnsen 2017; Albrecht and Lukkarinen 2020; Albrecht et al. 2021) within the Norwegian seaweed farming sector. It studies the dominant narratives on future developments within the sector and scrutinises the portrayed role for alternative, small-scale approaches. Based on assemblage conceptualisation (e.g. Baker and McGuirk 2017; Winder and LeLe Heron 2017; Campbell et al. 2021), it focuses particularly on the perspectives and positionalities of seaweed farmers in Norway and their multiscalar socio-spatial processes that guide individual and institutional translations of blue bioeconomy policy into practices. Hence, as Voyer et al. (2018, 606) claim, it consequently provides novel insights on the enactment of blue bioeconomy policies exemplified through seaweed farming in Norway.

Policy narratives and translation in a seaweed assemblage

Similar to research on the bioeconomy in general (Bugge et al. 2016; Vivien et al. 2019), blue bioeconomy and seaweed aquaculture research is dominated by techno-innovative and biological accounts that predominantly analyse the potential development of the sector in terms of opportunities, challenges, and solutions (e.g., Broch et al. 2016; Stévant et al. 2017; Theuerkauf et al. 2019; Hasselström et al. 2020; Araújo et al. 2021). Yet, there is a growing stream of critical research calling for a relational, geographical assessment of the blue economy and its socio-spatial processes that are highly relevant to understanding ongoing developments in the seaweed farming sector.

Winder and LeLe Heron (2017) stress the mobilisation of geographical knowledge to assess blue economic processes through an assemblage approach that allows ontological openness and multiplicity for the assessment of the blue economy and its practices. This is echoed by Garland et al. (2019), Axon (2018), and Campbell et al. (2021) who stress the value of geographical concepts such as scale, power, space, and their relationality to understand blue economies as socio-spatial assembling processes of emergence (see also Anderson et al. 2012; Woods et al. 2021). Hence, thinking "blue" geographies not only requires scrutiny of the fluidity of ocean (or wet) spaces into their realms of governance (Peters and Steinberg 2019) but also their ties to the related (policy) narratives and positionalities of entities that guide individual, institutional, or (dominant) regime conduct (e.g. Sheppard 2002; Honeck 2018; Albrecht and Lukkarinen 2020). Hence, to reach a particular understanding of seaweed

farming development, it is treated as assemblage. Following DeLanda (2016) and Woods et al. (2021), an assemblage is a relational entity reproduced by various material and expressive components through processes of territorialization and coding. Components may territorialize an assemblage, thus stabilize its structures and homogeneity, or act as forces of deterritorialization, fostering heterogeneity and new development trajectories. Coding is framed by expressive components to define the assemblages' identity as a whole and is henceforth a key part of territorialization (Woods et al. 2021, 5). Particularly, the role of expressive components in these processes is scrutinized hereafter.

Choi (2017, 39) denominates the blue economy as a "governmental project through spatial interventions" based on multiple, competing rationalities (see also Dean 2010). Similarly, Johnsen (2017) displays Norwegian fisheries as a governmental space supported by images, models, and interventions as technologies of power intended to steer development towards a certain direction. Hence, (policy) narratives based on a variety of governmental rationalities play a key role for current potentials and future development of a sector and its policies. Bioeconomy governance regimes and their affiliated policies have been frequently aligned with a diverse set of underlying visions. For instance, Levidow et al. (2012) divide the bioeconomy into biotech, bioresource, and bio-ecological visions. Similar separation into three visions has been analysed by Vivien et al. (2019), highlighting the competitive character of these narratives for future developments. Moving into aquatic spheres, Silver et al. (2015) and Voyer et al. (2018) have undertaken similar attempts to categorise the blue economy and its political and economic discourses. Voyer et al. (2018), 604-606) have evaluated four key lenses that are employed to delineate the blue economy: (1) oceans as natural capital, (2) oceans as livelihoods, (3) oceans as good business, and (4) oceans as a driver of innovation. While these lenses appear partially overlapping in policy documents and contain a variety of more or less attached sub-themes, according to Voyer et al. (2018)), they all contain rather bound regimes of actors involved in their articulation. With the prior two rooted in a bio-ecological vision, focusing on protection, small-scale developments, and local utilisation, the latter two align well with the biotech and bioresource visions focused on large-scale solutions, technological breakthroughs, and economic growth (Levidow et al. 2012; Voyer et al. 2018). Such visions and their articulated values directly shape the political and public uptake and understanding of a sector's or policy field's potential, and its development trajectories consequently affect its final outcomes (e.g., Birch 2017).

Policy narratives must be understood in this way as a key component to reproduce such policy visions as they are intentionally and unintentionally employed by various groups to mobilise their agency and the related best (policy) practices (e.g. McCann and Ward 2012; McCann 2013). They become an active feature that displays and affects the competing rationalities at play in the governmental project of the blue (bio)economy (cf. Choi 2017; Albrecht et al. 2021). Focusing on the content, origins, and relations of and among policy narratives allows for an assessment between dominant narratives and potential counter narratives for the development of a particular policy field (Honeck 2018). This is not to equate policy narratives with a representation of their policy field's development or its current processes as they contain strong assumptive components and are selective in their content and resulting rhetoric (e.g. Albrecht 2019; Albrecht et al. 2021). They nonetheless are an important expressive component in the respective assembling processes (cf. DeLanda 2016) and the sectors' aims for development (cf. Albrecht and Lukkarinen 2020). The role of policy narratives in understanding a particular blue (bioeconomy) sector also ties in with the notion by Winder and Le Heron (2017, 14) on the importance of imaginaries to frame the blue economy "as an investment space." While the full role of such expressive components comes to the fore in combination with the fluid materialities for the (de/re)territorialization processes of ocean assemblages (Steinberg and Peters 2015; Fairbanks 2019) and is decisive for assembling a seaweed moment, these aspects have been treated elsewhere in detail (see Albrecht (forthcoming). Accordingly, hereafter, it is not the aim to provide an inclusive display of the seaweed farming assembling processes but to provide an understanding of how particular expressive components of assembling (DeLanda 2016; Savage 2020) shape the power laden rhetorical policy discourse and to provide "an analysis of the potential ways of being (capacities) that the assemblage affords" (Boucquey et al. 2016, 4).

Policy narratives and mobile policy as an assemblage are engaged in a process of constant translation and mutation on their journeys between administrative and institutional levels of policy making, networks of policy learning/influence, and individuals involved in the workings of the above (cf. McCann and Ward 2012; McCann 2013; Wood 2016; Albrecht et al. 2017). Yet, and of key concern for this study, the narratives employed for or distilled from these policy expert translation processes directly impact the development trajectories at the level of implementation as entrepreneurs potentially seek an alignment with these narratives. Such alignment must be understood as generated through governmental means of steering the blue (bio)economy by spatial interventions (Choi 2017) which in turn are directly linked to the wider processes of assembling a seaweed "moment" (cf. Winder and LeLe Heron 2017). Hence, policy narratives as governmental instruments and as key expressive components in the assembling processes of blue (bio)economy governance reproduce the positionalities of entities, affect

their governance conduct, and consequently steer development trajectories (cf. Sheppard 2002).

To sum up, following the potential effects of policy narratives and their translations for the development trajectories of a policy/industrial realm, it becomes important to understand their alignments to sectoral visions such as portrayed by Voyer et al. (2018), Silver et al. (2015) or Levidow et al. (2012). Hence, which visions are represented in the narratives and how are they evaluated in terms of their potential for sectoral development? Considering the common employment of assumptive and selective narratives in bioeconomy policy (e.g., Keen et al. 2018; Albrecht 2019; Albrecht and Lukkarinen 2020), a focus on narratives allows us to assess how potential alternatives to the dominant imaginary are integrated, marginalised, or dismissed. This allows us to evaluate how and if particular policy narratives limit the scope of policy translation and thereby marginalise the full potential for development beyond the dominant current large scale and resource heavy vision (e.g., Hadjimichael 2018; Campbell et al. 2021; Albrecht and Lukkarinen 2020). The remainder of the paper will therefore scrutinise the Norwegian seaweed farming sector and its narratives with a focus on the potentials for development rooted in the bio-ecological side of the visionary spectrum.

Methods

The paper is based on a qualitative mixed methods approach rooted in case study design (Yin 2018). Analysis has been guided by the study of policy assemblages (Baker and McGuirk 2017) with a particular sensitivity to the "narrativising" of assembling processes (Boucquey et al. 2016, 3). The core set of empirical data for the study derives from non-structured research interviews with seaweed farming entrepreneurs in Norway. Online search and snowballing methods with respondents and the Norwegian Seaweed Association were employed to assess currently active seaweed farmers and suitable related entrepreneurs to be contacted for the research. Interviews were conducted with 11 seaweed entrepreneurs from June 2019–January 2022. Seven respondents were engaged actively in seaweed farming, two had a focus on manual wild harvesting, one was previously a farmer who is now involved in technology development, and one was engaged in processing local seaweed products. From the interviewed farms, all but two are currently microentrepreneurs or in their pilot phase while the geographical distribution of interviewed farmers covered sites from Bergen to the Lofoten.

Additionally, interviews were conducted with the Norwegian Fisheries Directorate in Bergen (2019), the Norwegian Seaweed Farms Association (2019 & 2021), the Norwegian Seaweed Technology Center/SINTEF (2019), Norwegian Environmental NGO Norges Miljovern Forbund (2019), and three interviews with institutional stakeholders related to seaweed farming in More and Romsdal counties (2019). Supplemental information has been drawn from interviews with two NGOs, one European Commission representative, one expert from the Federation of European Aquaculture producers, and one representative at the Mission of Norway to the EU during a visit to Brussels (2019). Interviews lasted from 45 min to 2.5 h. Interviews with seaweed entrepreneurs were conducted online except for one, while the other interviews in 2019 were conducted in person. Additionally, a field visit to one seaweed farm was conducted in 2019. Interviews were transcribed and coded with a focus on sectoral and individual companies' trajectories and perspectives in relation to particular development narratives, particularly the dominant biotech/resource narrative and contrary a bio-ecological narrative (e.g., Levidow et al. 2012). Key focus of data analysis highlighted the processual context, materialities, and labours that produce the narratives and henceforth the assembling processes (Baker and McGuirk 2017; Savage 2020).

Same analysis method was employed for a supplemental qualitative analysis of policy strategies, documents, and reports from the EU and Norway and a periodical screening of Norwegian seaweed entrepreneur and association websites from 2019 to 2022, to dissect key narratives and their public framing on seaweed farming. This included analysis of the producers' own content (e.g., stories on production, happenings) and external content displayed on these sites, such as media reports, as both are important to create and establish certain sectoral narratives. Combined, this data allows a triangulation of narratives employed within the sector stemming from interviews, written storylines, and external sources.

Seaweed farming in Norway

Algae aquaculture is a fast-growing sector with an increase of 24.5 Mt in annual harvests globally over the past 20 years and a current annual production of 35.1 Mt which is dominated by marine macroalgae/seaweed farming in Asia, accounting for 99% of production (FAO 2022, 26). Despite thousands of potential seaweed species to be farmed (e.g., Araújo et al. 2019, Seaweed for Europe 2020), the sector is dominated by six seaweed species making up 92.5% of global production (FAO 2022, 45). In addition to seaweed farming, a minor and decreasing share of 1.1 Mt in seaweed production is exploited through wild harvesting (Ullmann and Grimm 2021). A different picture evolves in Europe. Wild harvesting, particularly by industrial dredging, is the dominant means of production in terms of tonnage harvested while production from seaweed farming in 2019 was less than 4% of European production (Cai et al. 2021; Araújo et al. 2019). Yet, the focus for growth in Europe is clearly on seaweed farming. Within Europe,

aside from the Russian Federation which has a rather strong seaweed farming industry and produces more than 10,000 tonnes annually, France and Norway are the main producers of cultivated seaweed in Europe (FAO 2022).

Specifically in Norway, the seaweed sector has seen much political and entrepreneurial hype over the past years with the number of licenses increasing from 54 in 2014 to 511 by 2020 (Fiskeridirektoratet 2023). Upon closer scrutiny, this growth is more modest in terms of production than it initially appears with 23 companies currently engaged in active production. While official commercial production statistics for 2021 state 246 tonnes (Fiskeridirektoratet 2023), experts from the Norwegian Seaweed Association estimated the harvest from seaweed farms at roughly 400 tonnes (Interview A). The difference between commercialised harvest and overall harvest also points to the fact that many of the companies are still at an early stage of development and not necessarily commercially active despite ongoing production. Finally, these numbers must be set into an additional context, as more than two-thirds of the Norwegian production is produced by two main companies, one owned by a large salmon producer, and the second, a spin-off initially established by seaweed researchers. Hence, the majority of current seaweed producers in Norway are of very small size with an annual production of less than 50 tonnes.

Like most Norwegian marine development, the policy environment and public debate related to seaweed farming in Norway are clearly embedded in a blue growth framework (e.g. NFD 2021). While seaweed appears not as prominent as in EU policy documents (cf. EC 2020, 2022), it is given an important role to diversify the Norwegian aquaculture and seafood production sectors and to act as a tool for climate change mitigation in Norwegian policy strategies (Norwegian Ministries 2016; MTIF and MPE 2017; NFD 2021, see also Albrecht and Lukkarinen 2020). Furthermore, a variety of reports from Norwegian research institutes portraying growth potentials of many million tonnes for Norway (e.g., Olafsen et al. 2012; Skjermo et al. 2014; Broch et al. 2019) have clearly contributed to the Norwegian seaweed farming hype. Calling for a need to upscale and aiming to industrialise the currently immature, small-scale dominated sector also is a key component of many research projects related to seaweed farming (cf. Norderhaug et al. 2020; Solvang et al. 2021). Given the current state of the sector, a focus on growth and maturity is of little surprise. Yet, considering the calls by critical blue (bio)economy scholars (Hadjimichael 2018; Pauly 2018; Campbell et al. 2021), it should be questioned if maturity must equal large-scale or industrialised solutions as predominantly portrayed in the public debate on Norwegian and European seaweed farming or if there remains room for development towards small-scale, locally embedded, bio-ecological visions (Levidow et al. 2012; Voyer et al. 2018; Campbell et al. 2021) with a focus on the multiple potentials of seaweed farming.

Seaweed narratives: growth as a common denominator?

Policy narratives

When studying seaweed narratives in the Norwegian context, it should be noted that, due to the prominence and dominance of the salmon-focused aquaculture and fishery sectors in both political debate and as key economic pillars of Norwegian aquatic biomass production, seaweed policy narratives play a minor role in institutional policy documents such as the Norwegian Bioeconomy Strategy or the Norwegian Ocean Strategy. However, they are propagated as a supplemental growth sector with high innovative potentials (MTIF 2016; MTIF and MPE 2017; MTIF 2022a). The rationales of the bioeconomy strategy that envision this growth potential point to a central initiating force that has driven the extreme growth of seaweed narratives in Norway, a 2012 working group report by the Norwegian Society of Sciences and Letters (DKNVS) and the Norwegian Academy of Technological Sciences (NTVA) (Olafsen et al. 2012). Estimating growth potentials at 4 Mt and 20 Mt of production by 2030 and 2050, it provides the direction that profitable development requires an industrialised scale with extensive use of mechanical automatisation (Olafsen et al. 2012, 74). While the basis for this estimate is a model calculation of natural and technical potentials with no concrete consideration of socio-economic influences on such potential development, the estimates from this report are repeatedly employed in news reports and particularly by key marine-focused research institutes at science-policy and science-professional interface events.

The constant employment of these estimates supports to boost policy narratives of a new "billion [kroner] industry" (Ilaks 2016), seaweed as the "green gold" (TU 2020), and Norwegian seaweed farmers as key actors on the "multi-billion market for seaweed" (Nordicfoodtech 2021). This narrative boosted by news feeds and presented at professional events is supplemented by reoccurring links to the need for upscaling and a standardised, automatisation of production (cf. Solvang et al. 2021) as well as an extensive increase of farming area, often envisioned to be materialised through the conquering of offshore spaces (cf. Broch et al. 2019; Norderhaug et al. 2020). The sustainable credentials and benefits of seaweed farming are additionally tied to their potential as a CO2 sink, hence, formulated to increase with the scale of operations in the future (Broch et al. 2016) and thereby providing sectoral growth with governmental rationalities of increased sustainability and increased potentials for climate change remediation. These aspects neatly align with overall Norwegian policy narratives for economic development. For instance, in its *Green Industrial Initiative* (Norwegian Government 2022) imaginaries of a workforce efficient, low

carbon and highly technical innovative development for sustainable resource use are displayed, while seaweed farming is highlighted as a measure for carbon capture in the *Blue Ocean Green Future* Report (MTIF 2022b).

The new Norwegian Aquaculture Strategy (NFD 2021) takes a more cautious approach in relation to uncertain health effects for human consumption and calls for more research. It also highlights strong future potentials and climate friendly attributes but, due to potential health risks, suggests a focus on one species at a time to assure sufficient knowledge (NTF 2022, 71). Additionally, some more cautious and critical notes have been raised and contribute to the dominant seaweed narratives raising potential challenges of areal conflicts, health effects (iodine & arsenic), technological or market developments, and negative environmental affects (Aftenposten 2020; see also Hancke et al. 2018) that may potentially accompany a future large-scale industry. Hence, even the cautious voices not so much question the dominant public narrative of extensive growth itself, but rather, they infer that reaching these potentials requires efforts, technological solutions (e.g., processing for iodine reduction), much financial and research input, and some caution.

Turning attention to the potentials for an alternative pathway, or narratives related to a bio-ecological, locally focused vision (e.g. Levidow et al. 2012; Voyer et al. 2018), in public policy narratives on seaweed sector development, a rather superficial picture arises. With sustainability credentials predominantly reserved for zero input systems of seaweed farming and its CO2/nutrition absorption capacities, local impacts remain the most common narrative component in that regard. Yet, with statements like "Green industrial establishments must be well-anchored in local communities" (MTIF 2022a, 28) describing economic development in general, we quickly return to the usual bioeconomy benefit and green growth rhetoric for rural/coastal areas as in many other policy narratives (cf. Albrecht et al. 2021; Albrecht and Lukkarinen 2020). While the interrelations of small and large enterprises in Norway's coastal production systems are highlighted, benefits are expressed predominantly in a generic, quantifiable measure (jobs, tax revenue). Hence, considerations of a decentralized, locally focused, low-tech, and small-scale approach as one potential pathway for future development of the sector, even only as a supplemental part, remain invisible in Norwegian public policy narratives thus far.

Entrepreneur narratives

Contrasting public policy narratives, especially the boosted narratives of extreme growth potentials with the individual narratives of the farmers involved, a more diverse spatial imaginary of future trajectories of the sector appears. The boosted narratives of millions of tonnes of potential growth within the coming decade are largely considered too optimistic. Yet, these narratives were sometimes described as *"…the idea of [XXX] to give statements like that is* [to say] *seaweed is a very interesting species and* […] *we don't know the technology so please give us money…*" (Interview B) to develop technologies. Other views, while doubtful about the numbers themselves, expressed the indirect benefits of these optimistic narratives in terms of their role for marketing and facilitating investor interest for their own company and the sector (Interview C). Nonetheless, statements such as *"…it's a big number and it will not happen in the next ten years, but it could happen"* (Interview D) or *"I would say yes, it is physically possible to do it but it's going to take lot of investment"* (Interview E) indicate that many farmers support these narratives as long as various market and regulative forces and technological aspects of offshore farming align. This indicates that boosting such assumptive narratives must be considered as more than awareness and investment raising processes in sectoral governance.

Focusing on the individual farmers' positionalities and the narratives for their own and the sector's near future development, an optimistic growth culture prevails nonetheless. Contrary to the millions of tonnes envisioned in public narratives, the near future visions range from several hundreds to tens of thousand tonnes within the coming years. Though small in comparison, it must be pointed out that in most cases, the farmers' own growth narratives imply rather substantial (sometimes more than a 50-fold) increase of their current production levels. Hence, while statements such as *"we've spent 10 years getting here, I think we're going to spend the next 10 years exploding massively"* (Interview F) and "*it's a potential to grow offshore within the next 10 years […] if you go really large scale, I think offshore is going to be fantastic"* (Interview C) are expressed, the more modest growth narratives also contain some key framework conditions deriving from the positionalities of the farmers which shape their governmental imaginaries. These are generally related to the economies of scale debate and are rooted in the unprofitability of most current seaweed farmers. A representative of the Norwegian Seaweed Association put it *"…the up-scaling now, it's ahead of us and they [the farmers] have to solve this to start to earn money"* (Interview A).

There are some key underlying aspects that shape this imaginary. First, in most seaweed farmers' narratives becoming profitable is directly linked to increasing tonnages of production in order to compensate for high investment costs. Second, scaling-up production is directly linked to a need for automatisation, and technologisation is seen as a requirement for the remediation of bottlenecks in production systems. Third, while investment intensive, automatisation is portrayed as a counter measure to the high Norwegian labour costs and therefore to increasing efficiency. Fourth, based on recurring challenges with their farming systems and partially

unsatisfactory production results, a narrow focus on one or two species accompanies the need for quick growth. Finally, being big is described as required to be taken seriously in Norwegian resource-based economic development and its related policy spheres. It was inferred that aside from investor requests for high tonnage and respectively secure returns, the recent inclusion of seaweed in the prestigious and financially beneficial Norwegian Seafood Council that funds research and promotes products internationally (NFD 2023) has been linked to the strong scale-up potentials of the sector. Hence, there are interrelated rationalities at play that guide the farmers' positionality to consider the need for growth and consequently reproduce a shared dominant strong growth development narrative. Considering that several respondents stated production amounts of 200–300 tonnes to break even, their own aims for development being well above this threshold further indicate that just getting a mature and profitable business is merely a base component of the urge to grow much bigger and align with the dominant growth narrative.

While many farmers align their governmental conduct and spatial imaginaries with the wider policy narratives of strong growth, there are also critical voices of this publicly boosted narrative. Their criticism is not only focused on the envisioned growth trajectories, they are also calling for an increased engagement with the multiple, untapped potentials of various seaweed species and a more diverse sector development. This viewpoint is most prominent with the companies engaged in wild harvesting (not by dredging) and portrayed as a key component of their business. However, it was also expressed by one of the seaweed farmers. In this somewhat alternative narrative, the multiplicity of seaweed and strong consumer engagement with the product and sustainability takes centre stage. In this vein, one respondent stated that "*I want to do a high-end product and I put a lot of care and attention into how we treat the product or how we harvest it and the story around it. It's just for me a way of inspiring people how they're part of the ecosystem, to make them understand that food is a way to …where you really make an imprint on everything around you…*" (Interview G). The promotion of this alternative narrative is paired with criticism of the dominant development imaginary, and one of the farmers stated that "*I think that from the beginning onwards the potential that rests within local and regional developments, also with small farms, […] was very much underestimated and somehow bulldozed...*" (Interview H). Hence, in the alternative narrative, there is a clear focus to engage with the multiple potentials of seaweed as a natural resource, and comparisons to terrestrial small-scale organic agriculture and the potentials of multiple crop rotation were drawn to visualise an alternative imaginary for seaweed farming development in contrast to the dominant large-scale monoculture vision.

When moving beyond the common denominators of this alternative narrative in relation to the different entrepreneurs' positionalities, a more diverse picture arises and highlights the governmental power relations inflicted by the dominant growth and technological fix focused narrative. While on one side, the small-scale, multiple and local approach prevailed, and upscaling is considered as an economic necessity; on the other side, it was stated that wild harvesting of small amounts is merely a means to bridge the time till farming, and particularly, the markets have overcome their current limitations and profitability challenges. "*The good thing about wild harvesting, […] you can access the species that are not farmable yet*" and "*In the long run, I think the way to go is farming, absolutely. To get new species as well, dulse, truffle seaweed, and nori […]. For one thing [species], we have the technology, we have the ocean space, we have everything […] I think we can produce quite a lot quickly. But where is it going to go?*" (Interview I). Hence, there is an entrepreneurial alignment with the growth narrative on the one side, but there is also a focus and rhetoric on sustainability and multispecies benefits on the other hand, though the latter is not yet very common. Generally, when promoting small-scale development or planning for future upscaling, both approaches base their positionality on the production of a high-quality niche product, entailing certain economic and ethical values and often target speciality shops and high-end restaurants. The focus on the high-end speciality markets is further promoted by the situation that "*the most sceptical customers, they're here by the coast of Norway*" (Interview H) which limits the local market.

Finally, local integration of production and market is a complex component of seaweed farming, and the issue of locality is raised in narratives by both the growth proponents and alternative proponents. The potential to cater to local processors and markets, if available, has been raised as "*the Norwegian market will probably be big enough for the next five years*" (Interview D), and it was highlighted that there is currently no competition within the Norwegian market and beyond for the high-quality products farmed in Norway. Yet, this statement was combined with statements about a lack of demand or too high/wrong demands to be fulfilled by the current small production levels. This pushes most producers to venture towards international speciality markets, particularly Germany with its high demand for organic and lifestyle products but also to the USA. Yet, hopes for upscaling in the narratives rely on convenient food and feed markets as well as their processing and supply chains. Currently, the first steps of processing such as drying, milling, freezing, or fermentation are predominantly done by the farmers. Further processing into value added products in local facilities is rare, with many farmers either selling their own final products (e.g., dried seaweed flakes) or selling in bulk to international processors/whole sellers. Hence, farmers following

a strong growth narrative expressed the potential need for improved coastal landing and processing facilities which would provide capacities for new local livelihoods. Yet, in their vision of the local development narratives, it is directly accompanied by strong needs for centralisation, automatisation, and integration into existing food/feed processing systems rather than through scaled down decentralized local value chains. Consequently, this development narrative effectively reduces a coherent distribution of the potential social benefits throughout coastal Norway. Nonetheless, one of the few actors in this field stated that "*[we] wanted to contribute more directly to building sustainable jobs…*" and raised the importance that "*companies [should] have their administration, their production and their full value creation in small coastal communities*" (Interview J) for the creation of healthy communities along the Norwegian coast. This narrative is repeated to some degree by the locally active farmers but is restricted by aspects of their positionality, which is derived from their development trajectories and narratives as mentioned above, and the materialities of seaweed farming. While the latter's contributions to assembling are addressed in detail elsewhere (Albrecht forthcoming) the narratives and expressive components above highlight many frictions between the sectoral narratives as well as challenges that entrepreneurs face when aiming to follow an alternative development narrative or even find a middle ground of development. Hence, the final section will discuss the effect of these contrasting, partially mutual exclusive and competing narratives as governmental means of ocean governance, in this case, Norwegian seaweed farming development.

Concluding discussion: seaweed narratives and the delineation of coastal futures

The differing and partially contradictory policy narratives expressed above must be treated in a similar vein as Johnsen (2017) describes for the spatial interventions by modelling and mapping of Norwegian fisheries even though they do not portray institutionalized governance instruments such as zoning plans or regulative frames. The spatial modelling of future seaweed farming potentials (Olafsen et al. 2012) as an initiating expressive component is a spatial intervention to ocean governance that continues to act as an influential technology of governmental power relations and strongly shapes the Norwegian seaweed assemblage (cf. Choi 2017) as it affects which trajectories and respective modes of governmental conduct entities follow to achieve the same. Thereby, a dominant policy narrative and spatial imaginary of strong growth and automatisation appears clearly from the empirical data. Alternative narratives and the frictions between various narratives and entrepreneur positionalities point nonetheless clearly to the performing role of multiple (wet) ontologies and fluid materialities that deterritorialize, the assembling of Norwegian seaweed farming (e.g. Albrecht forthcoming; Steinberg and Peters 2015; Winder and LeLe Heron 2017; Fairbanks 2019). Similarly, the processes described confirm the selective and assumptive characteristics of the spatial imaginaries employed to boost (dominant) policy narratives assessed in other fields of governance (Keen et al. 2018; Albrecht et al. 2021). While a focus on the concrete role of material components has been conducted elsewhere (Albrecht forthcoming), unfolding the various narratives offers important insights into the expressive de/re-territorialization processes and acts of coding (cf. Woods et al. 2012; Savage 2020) of seaweed and ocean governance not merely from a Norwegian perspective.

While it is beyond the scope of this study to evaluate the implications or potentials of the dominant narrative on their integration into formalized spatial governance instruments (e.g., coastal planning, policy strategies) or the potential spatial extension of the sector, the findings allow for a more precise evaluation of the current role and henceforth capacities of assembling (Boucquey et al. 2016) guided by or open to alternative spatial imaginaries for seaweed farming. Accordingly, we need to unfold the implications of (dis-)alignment with the related visions described by Voyer et al. (2018; *oceans as natural capital* & *oceans as livelihoods*) and Levidow et al. (2012, *bio-ecological*) and the more generic calls for a localised, small-scale development with a focus on the multiplicity of ocean spaces (cf. Hadjimichael 2018; Campbell et al. 2021) in Norwegian seaweed development. As apparent from the entrepreneur narratives presented above, their challenging positionalities that entail active engagement with the complexities of seaweed farming create some counterweight to the optimistic growth rhetoric employed. Yet, considering that these challenges are predominantly attributed to technological or operational deficiencies, such as lack of current knowledge, technology or market structure, and therefore a matter to be solved by socio-technical fixes, such as technical innovations or policy support, they have limited capacity to open up development trajectories based on alternative narratives. Hence, while challenges deriving from the fluidity of ocean governance (Steinberg and Peters 2015) perform as expressive components that link entrepreneur narratives in the material practices of farming and their respective business environments (Albrecht forthcoming), they do appear to raise few engagements of farmers to consider development trajectories other than aligned with the dominant policy narrative. This clearly raises the role of the dominant narratives in governmental conduct as the role for small-scale and locally focused farming takes the form of a temporal nuisance rather than an alternative. Yet, there are more expressive components at play that marginalise alternative narratives.

Strong, even extreme growth trajectories are predominantly regarded as a deed to humanity and a key in fighting climate change as it allows for the replacement of less-sustainable (food) products. Hence, the currently undisputed sustainability credentials of seaweed farming in a European context provide strong governmental rationalities for entrepreneurs to seek growth. The dominant and publicly boosted policy narratives, linking growth potential modelling with carbon and nutrient sequestration potentials (cf. Broch et al. 2016; Norderhaug et al. 2020), reproduce a spatial imaginary that functions as an effective force of territorialization for seaweed farming trajectories. This is reinforced by the lack of a public counter narrative as well as expressive and material components that could function as forces of deterritorialization (e.g. Savage 2020; Albrecht et al. 2021; Albrecht et al. forthcoming). Similarly, as pointed out above, the few cautious and publicly voiced expressive components, such as those raised in the new *Norwegian Aquaculture Strategy* (NFD 2021), are strengthening the call for technical innovation, more investments, and a one to two species approach. Additionally, the perceived positionality of farmers to operate within a domestic, and even more so in an international market, with space for everybody to grow, paired with the strong belief in technological fixes translates the current challenges in farming, hence, potential forces of deterritorialization, into governmental rationalities that align individual development trajectories with the dominant governmental narrative.

Looking at the assembling of this Norwegian seaweed farming moment and its key spatial processes (cf. Winder and LeLe Heron 2017), there is a stunning lack of expressive components, such as policy narratives or spatial imaginaries with the potential to open-up avenues for alternative pathways aligned with socio-ecological visions of blue bioeconomy development (Levidow et al. 2012; Hadjimichael 2018). While there is a lack of promotion in dominant policy narratives aside from the usual rhetoric of regional development and benefits, the few entrepreneurs who promote such alternative visions draw their governmental rationalities largely from spatial imaginaries and narratives beyond the territorialization process of the Norwegian seaweed farming assemblage. They draw on relations of exteriority (e.g. DeLanda 2016) that promote aspects of social innovation, personal engagement with nature, locality beyond statistical indicators, and the multiple potentials that derive from the fluid materialities of ocean space and not merely those superficially raised in the dominant (policy) narratives and the overall coding practices of its supporting entities. Nonetheless, their positionality of expressive and material engagement with the Norwegian seaweed farming assemblage provides little room to unfold governmental rationalities and embark on these alternatives as the pairing of sustainability and multispecies practices and rhetoric exemplified above, with plans for strong international growth in the future suggest.

Finally, the question should be asked if there is even a need for an alternative narrative considering the lack of expressive and material components that may deterritorialise the current reproduction of the Norwegian seaweed assemblage, particularly in regard to its just sustainable transformation potentials. The key aspect therein currently appears in relation to the reconnections between sectoral development on the one side and the delineation of to whom and how the benefits of such development should be attributed. Company shares and investor benefits are likely to prosper from continuous growth, technical innovation, and efficient and automatised solutions, while their investment needs are foreseen to result into centralised cooperate solutions. Contrary, the disalignment of most sectoral development narratives and their coding efforts with visions akin to Voyer et al.'s (2018) *oceans as livelihoods/natural capital*, Levidow et al.'s (2012) *bio-ecological* approach, or calls for a strongly locally focused blue economy development to avoid mistakes of past developments in coastal governance and resource exploitation (e.g. Hadjimichael 2018; Campbell et al. 2021) are problematic for the just sustainable transformation capacities of seaweed farming sector. While the coding of the sector through these narratives does not prevent potential endeavours by some entrepreneurs towards the same, it nonetheless discards it as a political/sectoral agenda worth following. The result is that while many publicly oriented expressive components of seaweed farming assembling align to a certain degree with these alternative visions, the sectoral development narratives and entrepreneurs' individual development narratives that predominantly guide governmental conduct of the sector (e.g. Choi 2017) clearly depart from the same. This in turn has direct implications on the reproduction of institutional governance instruments such as planning frameworks, subsidies, or support programmes align with this dominant narrative. This renders a deterritorialization of the Norwegian seaweed farming assemblage towards alternative, local blue bioeconomic trajectories and potentially more radical transformations of ocean governance merely a force of friction at the edge of the sectoral realm.

This is not to say that imaginaries framed in the dominant narratives and strongly present in the governmental rationalities of most farmers are detrimental to a sustainable sector development per se or that they should be replaced by an alternative locally rooted and less growth-oriented spatial imaginary. Yet, considering the power laden role of narratives as governmental tools of spatial interventions, there is a need to publicly and politically boost the role of alternative spatial imaginaries in line with a socio-ecological vision of

the bioeconomy as a supplemental expressive component to reterritorialize the Norwegian, but also the wider European seaweed assemblage and better align with the complex coastal spatialities and dependencies at stake. This will also provide farmers and processing entrepreneurs currently at odds with the dominant growth narrative with the governmental power relations and their accompanying expressive and material components (e.g., policy support, programmes, investments) to venture into novel territories on the multiplicity of seaweed farming beyond the biorefinery. Time will show the real potentials and implications of seaweed farming in Europe, and more research on the material and expressive components for both large- and small-scale developments is needed. At present, to prosper under the current spatial imaginary without a strong growth focus seems more utopic in the Norwegian seaweed farming assemblage than the envisioned conquering of offshore spaces.

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