A full package of gains? Lay perspectives on a bioeconomic transition in Norway

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Acknowledgements:
This study was financed by The Research Council of Norway, through their research program on sustainable innovation in food and bio-based industries (BIONÆR, project number 244608). We want to thank our former colleague Reidun Heggem, who participated in research design development and data collection.

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Abstract

A sustainable bioeconomy based on production and consumption of food, products, and materials within healthy ecosystems is considered a promising response to global challenges like climate change and environmental degradation combined with a growing population. However, ultimately, it is the public as consumers and citizens who provide the market and governance for bioeconomic development. In this paper, we explore lay perspectives on a bioeconomic transition based on eight focus group interviews with lay people in Norway. Overall, we find that the public appears quite positive towards the idea of a bioeconomic transition due not only to expected global gains, but also to individual gains. The findings are relevant for the design of further bioeconomy-related policies aiming to achieve wide public acceptance.

Keywords: bioeconomy; social acceptance; valuation; collective gains; individual gains; perceived naturalness

Introduction

The transition to the bioeconomy has been high on the international policy agenda in recent years because of its potential to tackle several of the world's complex problems. According to the European Commission (2012), a sound method of applying renewable biological resources for various sectors could ensure food security for an increasing world population, create huge numbers of new jobs, limit the depletion of natural resources, decrease environmental pressure, and foster the shift towards a low carbon society. Thus, a sustainable bioeconomy based on production and consumption of food, products, and materials within healthy ecosystems is considered a promising contribution to the achievement of several of the Sustainable Development Goals (SDG) (European Commission, 2018). Among them, SDG 2 - zero hunger, SDG 7 - affordable and clean energy, SDG 8 - decent work and economic growth, SDG 12 - responsible consumption and production, and SDG 13 - climate action, are central goals being addressed.

The bioeconomy is broadly defined as 'the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy' (European Commission, 2012, p. 9), and its sectors and industries include 'agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries' (European Commission, 2012, p. 9). The bioeconomy requires the use of biotechnology on a large scale (Scarlat et al., 2015) and captures three usage sectors of biological resources: biomass for food/feed, industrial bio-based products, and bioenergy (Meyer, 2017).

The envisaged transition to a bio-based economy is expected to have significant consequences for society as such. Certainly, the transition to a bioeconomy requires large-scale changes in our economic, social, and cultural systems. Public opinion and lay people's choices are likely to play significant roles in the bioeconomic transition, as ultimately it is the public as consumers and citizens who provide the market and governance for bioeconomic development (Sleenhoff et al., 2015). A successful bioeconomy will require socially and democratically accepted and supported objectives (Aguilar et al., 2018). Hence, the transition

to a bioeconomy will among other things depend on the public's perceptions and valuations of bioeconomic developments.

As most publications on bioeconomy are in the natural and engineering sciences, there is a need for more social science research in this field (Bugge et al., 2016; Sanz-Hernández et al., 2019) regarding both implementation and impacts. In the social science literature there has been a strong focus on a system and policy perspective on the bioeconomy (see Goven and Pavone, 2015; Birch and Tyfield, 2012). Some research has also been undertaken on potential bioeconomic actors' perspectives. For example, in Norway empirical research suggests that there is a large sector-wide variation in expectations related to bioeconomic development (e.g., agriculture has a quite modest view on its own role so far) (Hansen and Bjørkhaug, 2017).

Limited research has addressed lay people's perceptions. We address this gap, in a Norwegian context, by examining closely the following question: What are the prospects for lay people's acceptance of a bioeconomic transition in Norway? Based on the analysis of eight focus group interviews with lay people, we explore the public's perceptions, considerations, and valuations of the bioeconomy and various bioeconomic developments in different areas of Norway. In line with previous research in related fields, we consider perceived necessity, risks, and ethical trade-offs. The social acceptance of several of these developments has been investigated separately by previous studies (e.g., see Stigka et al., 2014; Gupta et al., 2011; Costa-Font et al., 2008). However, in this study we examine the perceptions of these efforts jointly, together, within a bioeconomic frame as part of a bioeconomic transition as such.

We start by providing some relevant background information on Norway as the context of our study before presenting the theoretical lens and defining social acceptance in the context of the bioeconomy. Next, we describe the methodological approach. Then, we present our analysis of lay perspectives on the bioeconomy and continue with a discussion of the results before we offer some concluding remarks.

Heading towards a bioeconomic transition in Norway

Norway is one of the countries that has committed itself to a transition from its oil-based economy to a bio-based, circular, environmentally friendly, zero-emission economy. The country aspires to increase biomass production, particularly in the marine and forestry sectors. Furthermore, it advocates for more efficient use of waste products in the industrial and agricultural sectors (Hansen and Bjørkhaug, 2017). The bioeconomy could particularly lead to new economic growth in rural, coastal, and industrial areas. The Norwegian government (The Norwegian Ministries, 2016) follows mainly four priority areas that foster the transition to the bioeconomy: 1) cooperation across sectors, industries, and thematic areas, 2) markets for renewable bio-based products, 3) efficient use and profitable processing of renewable biological resources, and 4) sustainable production and extraction of renewable biological resources. As Carrez (2017) notes, the expressed framework and objective of the Norwegian bioeconomy strategy is mainly to support companies in developing their advantages and to promote innovation. While there are high expectations related to this strategy, both among policy makers and industry organisations, the bioeconomy is still a concept under development in Norway (Hansen and Bjørkhaug, 2017).

Up until now, there has been no international agreement on how the bioeconomy should look and what type of society it would sustain (Hausknost et al., 2017; Bugge et al., 2016;

McCormick and Kautto, 2013), nor has the bioeconomic concept been intensively communicated to the wider public in Norway. This makes it difficult for people to obtain hands-on knowledge and an understanding of the bioeconomic transitions and their impact on daily life, which consequently may influence levels of social acceptance.

Social acceptance in the context of the bioeconomy

'Social acceptance' is a term widely used in energy research (see Höltinger et al., 2016; Ganzevles et al., 2015) and new agrifood technology research (Ronteltap et al., 2016). Within the bioeconomy, we move across such sectors and consider them as combined. The purpose of examining social acceptance is to extrapolate future behaviour from current attitudes (Kraeusel and Möst, 2012). There are many ways to define social acceptance, and our use of this concept is adapted to what we have been able to examine through the chosen method in our study. However, we have been looking for something more than just the lack of noticeable opposition. Following Kraeusel and Möst (2012), we consider social acceptance as a positive, prevalent opinion or attitude towards an innovation within focus groups or society as such.

The social acceptance of new developments is basically a question of valuation. How various kinds of value are produced, differentiated, assessed, and institutionalised is explained by Lamont (2012), who focuses on valuation and evaluation as something that happens based on practices and experiences 'through latent or explicit dialogues with specific or generalised others (often made available through cultural repertoires)' (p. 205). The author explains valuation as a social and cultural process where values are determined based on categorisation and comparison of units and within a multitude of hierarchies of worth. At a minimum, valuation implies determining in what category/entity type the entity under consideration belongs (e.g., Zuckerman, 1999; Lamont, 2012), and then it becomes possible to consider whether and how this category fits in one or several hierarchies. Among others, Lamont refers to Boltanski and Thévenot (2006; 1991) who point to the existence of multiple hierarchies of worth (including different valuation criteria), often referred to as *heterarchies*, which implies that different definitions of worth may be employed by different social groups or in different settings (Lamont, 2012). For example, while market logic favours valuation centred on profit maximisation, industrial logic emphasises productivity, and civic logic emphasises civic solidarity within the commonwealth (Lamont, 2012, p. 208). Hence, the relevant hierarchies of worth that are employed are likely to affect social acceptance.

A widely adopted framework is presented in Wüstenhagen, Wolsink, and Bürer's (2007) 'triangle of social acceptance' (Fournis and Fortin, 2017). Wüstenhagen and his colleagues distinguish between three dimensions of social acceptance capturing socio-political, community, and market acceptance. Their framework was originally developed to assess social acceptance for renewable energy projects, but it is also relevant for bioeconomic developments that include renewable energy transitions as one component.

Wüstenhagen and colleagues' (2007) three dimensions can be operationalised for the bioeconomy as follows: *Socio-political acceptance* constitutes the broadest definition of social acceptance, addressing policies and technologies and enabling a bioeconomy. It considers the general public acceptance at a macro level including, in addition to the public, stakeholders and policy makers as important user groups. *Community acceptance* refers to the specific acceptance of siting decisions by local groups. In the context of the bioeconomy, this can include decisions on where to locate bioeconomic plants, for example, in short-rotation coppices of willows for the production of biomass. Three aspects of justice are relevant to

community acceptance: distributional justice (e.g., sharing costs and benefits equally), procedural justice (e.g., fair treatment of all relevant local groups in the siting process), and trust (e.g., related to justice but also to the expertise of the company promoting or implementing bioeconomic products) (Ganzevles et al., 2015). *Market acceptance* describes the acceptance or adoption of various new bioeconomic products by the market, capturing the supply and demand side. Here, we can differentiate between intra-firm acceptance, acceptance by investors, and acceptance by consumers (Ganzevles et al., 2015).

The social acceptance dimensions, as they are described above, seem to a large extent to depend on the employment of different logics and heterarchies of worth, e.g., socio-political acceptance reflects a civic logic that emphasises collective interests and the common good, while market acceptance, among other things, surely involves a market logic. Different levels of acceptance (and systems of worth) are further closely connected to individuals' roles as both citizens and consumers, as it is often pointed out that people have and express different preferences in these roles (e.g., Lewinsohn-Zamir, 1998; Tienhaara et al., 2015). In the consumer role, the individual is primarily understood to be an agent acting mainly for him/herself (and the closest family), while in the citizen role the individual is understood to be acting more on behalf of society and evaluating alternatives from some kind of social welfare perspective (Tienhaara et al., 2015). When it comes to the citizen role and perspective, individuals are citizens at different levels since they are, and perceive themselves to be, members of various communities simultaneously (Lidström and Schaap, 2018). These range from the local community to the national community and further to the world as a global community. Citizen perspectives at different levels are reflected in the descriptions of the social acceptance dimensions. While socio-political acceptance reflects a broader (national to global) citizen perspective, community acceptance seems mainly to be based on a local citizen perspective. However, one perspective does not exclude the others; it is possible to combine various citizen perspectives or citizen and consumer perspectives at the same time, as exemplified through the concepts of sustainable consumption and citizen-consumer (e.g., Seyfang, 2006; Evans, 2011).

Social acceptance is a dynamic process (Wolsink, 2010) that is influenced by different criteria of valuation (Lamont, 2013). Essential, general criteria include perceived benefits, costs, risks, and ethics (e.g., see Ronteltap et al., 2007; Wüstenhagen et al., 2007; Costa-Font et al., 2008; Fytilli and Zabaniotous, 2017). Fytili and Zabaniotous (2017) further point to several variables that may influence the ways products or processes are valuated, i.e., whether or not something is perceived as beneficial, as a cost, as risky, and/or as ethically right. Some variables in this respect include consciousness of global challenges, perceived fairness in decision-making processes, knowledge of relevant technologies, cultural or material traits in the local context, and trust towards decision-makers and other relevant stakeholders. Furthermore, in terms of risks and benefits, perceived naturalness has been shown relevant for the social acceptance of bioeconomy-related products (e.g., Frewer et al., 1997; Tenbült et al., 2005). Understandings of naturalness may then emphasise the modifications an entity had to go through to come into being, current product features (where certain features are viewed as natural and others as unnatural), and/or to what extent people are accustomed to a particular object (Siipi, 2008). Naturalness may work as a trust factor, especially on occasions where other kinds of trust factors such as a well-known trademark or previous personal experience are absent (Scott, 2017).

The research literature on bioeconomy-related products, projects, and processes reveal many correlations between variables when it comes to what matters for social acceptance. For

example, research on attitudes to new food technologies indicates that the perceived risks of new technologies are reduced if people perceive a tangible benefit from them (Brown and Ping, 2003; Siegrist, 2008). The technology that produces the food can also play an important role in the perception of the benefits and thus for the overall acceptance of new food technologies (Siegrist, 2008). Further, when people lack knowledge on a particular technology, their levels of trust in the stakeholders/companies that develop these technologies influences social acceptance. This relates directly to perceived costs and benefits since higher levels of trust would involve a stronger perception of benefits (Huijts et al., 2012). Perceptions of naturalness are deeply embedded in different risk perceptions. Technologies that are considered as more natural are also perceived as less risky and are more positively valuated (Ronteltap et al., 2016).

As presented here, social acceptance of the bioeconomy relies on many criteria, conditions, and perspectives. Questions raised when analysing the empirical material have been: How are the bioeconomy and bioeconomic developments valuated on the different dimensions of social acceptance? What aspects of the bioeconomy potentially attract lay people and how/why? What is problematised and how/why? How do perceptions of benefits, costs/risks, naturalness, and ethical fit influence the social acceptance of the bioeconomy? And, what logics/hierarchies of worth seem to be the basis for valuation?

Data and method

In this study, we conducted eight focus group interviews including 53 lay people in Norway. We chose focus group interviews since they enable us to investigate people's opinions, understandings, preferences, and concerns and allow the exploration of not only *what* but also *why* people think as they do (Kitzinger and Barbour, 1999). In addition, by studying the groups' discursive dynamics, it is possible to understand how these arguments are constructed and contested. Focus group approaches are widely used for understanding social issues and have a well-established methodology and validity that we follow (e.g., Morgan, 1997). A statistical survey as an alternative method would be problematic since the bioeconomy is not a concept or a phenomenon that most people are familiar with. Rather than aiming towards quantifying purposes, this study is explorative as we look for the various perspectives on and assessments of the bioeconomy relevant to social acceptance.

Prior to the data collection, we designed an outline/basis for the focus groups that was anchored in answering questions such as: What is the bioeconomy; what is *new?* Is anything added to the traditional sectors that we have known 'forever'? And, not least, what aspects of the bioeconomy could be of relevance and interest to lay people? We decided to present the focus groups with various potentially controversial examples within the bioeconomy both to raise their interest and to reveal where people draw their personal ethical and risk limits that influence social acceptance. That being said, we identified and used concrete/real life examples of bioeconomic developments, and if every aspect was not yet fully relevant to Norway, they might very well be so within the next decades.

In order to ensure a diverse sample, we approached *kindergartens* simply because kindergartens assemble people – more precisely superiors (parents and grandparents) – with different socio-economic backgrounds. In addition, both generations have a relatively wide age range, which enabled us to recruit interviewees of all ages between the 20s and the 70s. Gender variation was also ensured. Furthermore, we decided to carry out the interviews in different parts of the country, both in urban and rural areas, to take into consideration potential variations among places and local cultures that could influence people's perceptions

and viewpoints. It should be noted that variation in social background was gained at the sacrifice of childless persons. By contacting kindergartens, we excluded interviewees who do not have children. Their opinions might differ from those who have children, although people without children constitute a highly diverse group. Notwithstanding, we assessed children/no children to be a variable of less relevance than social background when it comes to gathering various perspectives on or related to the bioeconomy.

We approached kindergarten leaders in selected areas by email and attached an invitation/information letter for the superiors to distribute in the kindergartens. We then arranged for a kind of paid participation: If the kindergarten recruited about eight superiors of different ages and genders for an interview, and if we were allowed to use their premises in the evening to carry out the interview, the kindergarten would receive a payment of 3,000 NOK (about 350 EUR) to spend on the related group of children. In this particular case, we found it appropriate to use paid participation since the research topic does not appear as obviously relevant to kindergartens, children, nor the parent role. In addition, we needed the project to wake sufficient interest and goodwill among two segments: kindergarten leaders (who were asked to recruit interviewees) and a satisfactory number of superiors. Thus, we considered an economic incentive to be necessary.

Several of the interviewees seemed to participate in the focus groups the same way as they participated in voluntary work (i.e., a collective work effort which leads to a common goal that benefits everyone) of any kind on behalf of the kindergarten. We see this as a strength, preventing us from creating a bias where we would only interview people highly interested in environmental issues and/or societal development.

As expected, the interviewees were not familiar with the bioeconomy concept nor with the national pursuit for a bioeconomic transition. Thus, we delivered a short, neutral introduction about the bioeconomy. We lifted general key points from bioeconomic plans and visions: 1) that a move from non-renewable resources to full exploitation of renewable resources is pursued, 2) that technology will be a key driver, 3) that the vision of the bioeconomy is to meet the largest challenges society is confronted with (related to feeding a growing population, climate, environment, jobs), 4) the bioeconomy is predicted to be one essential component in Europe's economy within 40 years, and 5) that high funding/investment is already being spent on this transition.

We applied an explorative approach to examine how lay people would perceive various bioeconomic developments. Recent research on the bioeconomy encompasses a broader perspective including multiple sectors such as health and the chemical and agricultural industries (Bugge et al., 2017). To capture this broader understanding of the bioeconomy, we included themes from these different sectors in the study design.

Thus, we chose five themes expected to be of common interest and initiated open discussions around these issues (summarised in Table 1). First, we asked for the interviewees' views on new kinds of *land use*. This included new (cultural) landscapes like short rotation coppices and increased forestry/logging related to increased production of biofuels. Other land use issues that we introduced were feed versus fuel from a global perspective, production of bioenergy at the sacrifice of food production (replaced by more import) from a national perspective, and the issue of localisation, for example, of biogas plants: is it more acceptable to have such an installation in the vicinity rather than a more ordinary industry? Second, we examined the interviewees' views on *extended use of waste*, focusing mainly on human

sludge but also on consumer products with a more debatable content such as 'bird poop facials'. The last-mentioned issue does not, of course, represent an innovation that may contribute to saving the environment as such, being more relevant to new opportunities for business development based on new use of bioresources. Third, we focused on *gene technology*. When is this socially acceptable when it comes to food? Is it acceptable when the purpose is to make food resistant to fungus and to avoid the use of pesticides, or when the purpose is to grow rice with vitamin A ('golden rice') to avoid blindness and death among women and children in developing countries? Or is the purpose to grow food that appears as delicate as possible? Also, the interviewees' acceptance of gene technology related to medical treatment was examined. Fourth, we asked for the interviewees' views on various kinds of *new/alternative foods*. This included cultured (laboratory-grown) meat, bugs as a promising but more or less unexploited source of protein, and 3D-printed food. Fifth, we also introduced the interviewees to new *bacterial-grown products* in terms of clothes grown out of bacteria (mostly as a gimmick to show them the spectre of the innovations that are already under development).

Table 1. Overview of topics addressed in the focus group interviews

Bioeconomic relevant theme	**Practical example**
New land use	Changed landscape (willow coppices, clear-cutting areas); feed vs fuel; localisation of bioeconomic plants
Extended use of waste	Sewage sludge; 'bird poop facials'
Gene-modified organisms (GMO) / biotechnology	Food (strawberries, 'golden rice') and medicine
New/alternative food	Cultured meat; insects; 3D-printed food
Bacteria-grown products	Clothing

Each of the interviews lasted for 2–3 hours and were recorded and subsequently transcribed. The material has been qualitatively analysed through meaning condensation and meaning categorisation (Kvale, 1996) using NVivo, software that enables efficient cross-sectional coding as well as search and retrieval of the coded data (Spencer et al., 2003).

Results: lay perspectives on the bioeconomy

In this section, we explore the prospects for lay people's acceptance of a bioeconomic transition in Norway. After a presentation of the aspects of the bioeconomy that clearly attract lay people, objections and reservations as well as indicated degree of commitment are pointed out.

Collective benefits: for a better society

All in all, the interviewees appeared as positive to the idea of a bioeconomic transition as such. The communicated, superior objectives of a bioeconomy transition are, understandably, easy to agree on. For example, visionary solutions that include reductions of hunger, disease, and mortality rates are easy to approve. No one was critical of the idea of a bioeconomy. Except for a couple of interviewees who questioned whether or not meeting people's energy needs with plant material is a realistic goal, the interviewees at large expressed a perception of the bioeconomy as a promising and prevailing solution to significant global challenges. This widespread perception is clearly reflected in a statement by Edvard from a rural focus group in central Norway:

> Interviewer (after having presented central bioeconomic visions): Do you believe in this? Does it sound doable to meet the mentioned needs?
> Edvard: Yes, definitively. You know, there are so many resources that get wasted, and new energy sources are needed. So yes, absolutely.

Beate (from another rural group in central Norway) had similar thoughts about the bioeconomy:

> Clearly, new thoughts are required when it comes to the food issue at the global level, maybe not on behalf of ourselves necessarily, but there are places in the world where they don't have food.

And at the end of the interview with an urban group in southeastern Norway, Kristina emphasised the possibilities rather than potential threats of bioeconomic developments:

> I just want to add that my basic attitude towards the bioeconomy is very positive. I want development and change, and I think that one should focus on the positive aspects, as with gene manipulation – what it is possible to gain from it. It is not only scary and dangerous and capable of changing the natural cycle. It can save people, too!

For people concerned with ecological issues, the value of a move from fossil-based to non-fossil-based production and consumption is obvious. However, among those who were not much concerned with anthropogenic climate change and/or environmental issues, a change away from oil was, notwithstanding, regarded as necessary:

> But… renewable energy has to become more important. I believe it will happen. Because we know the oil won't exist forever. So, something new has to come, when the world moves forward. (Annika, urban group, central Norway)

There was still a common understanding that, in the long run, new energy sources are needed as the oil reservoirs in any case will come to an end someday.

Furthermore, the interviewees at large perceived the bioeconomy as a quite comfortable solution to huge, practical challenges. Thus, the interviewees saw a bioeconomic transition as a reasonable effort, as more realistic and more attractive than, e.g., massive, enforced cuts in consumption. As Ingrid (urban group, central Norway) commented, 'Everyone burns for new technology in relation to development and research […] These are easy solutions for future compared to pulling a claim down over the head of someone'.

The material as such reflects quite high socio-political acceptance for a bioeconomic transition due to expected collective, worldwide benefits. Also, when focusing on more concrete bioeconomic solutions, we found positive attitudes. For example, gene modification for the purpose of medical treatment was highly valuated, with the exception of a couple of interviewees who were skeptical due to the potential lack of ethical interventions in the future.

Willow coppices, grown for use in the production of bioenergy and related to localisation questions, was one of the issues on which the lay response was more spread out. However,

the following dialogue on this topic from a focus group in an urban area in central Norway reflects that negative views are not necessarily unconditional:

> Anders: I guess this is typically a thing that no one wants to have close to their home, fully visible, but …
> Interviewer: Is it worth it, related to …
> Anders: It may be so. If the gain is considerable.
> Anja: And I think that if people realise the severity that we soon are out of oil, and we get desperate, that 'now we need something here, and this works …' and that 'this is what is needed to maintain our standard of living', then I think the general willingness will be higher.

This dialogue excerpt suggests that acceptance of more specific and local solutions, despite certain negative consequences, may be achieved as long as the utility value is considered sufficiently high. Preservation of our standard of living is something that affects both 'the collective' and individuals in a positive way, and thus solutions to this are certainly ascribed high value.

Individual benefits: perceived naturalness

Many of the interviewees also explained their positive attitudes towards bioeconomic solutions by pointing to what they perceived as natural qualities regarding this matter. This corresponds among other things to previous research on social acceptance of various kinds of food technology (Ronteltap et al., 2016; Tenbült et al., 2005; Connor and Siegrist, 2010). For example, when discussing facial treatment with bird excrement, Eva (from a rural group in central Norway) said, "It's enough if the label says 'hundred percent natural'. I do not need to know more than that". Two women from an urban group in the northern Norway discussed the same issue:

> Hilde: Actually, one should be more skeptical towards products that are chemically fabricated.
> Hanna: Yes, I agree. In any case, this is natural, as you said.

Sewage sludge as a fertilising substance was also assessed in a positive way based on its natural qualities, among others by Berit, from a rural area in central Norway: 'I think: Rather this [sewage sludge] than chemical fertiliser, as I believe that is much more dangerous'.

Among other things, naturalness, as something distinct from chemicals, was perceived as harmless to people's health. As Erika, from another rural group in central Norway, said during a discussion on gene modification to prevent fruits and vegetables from being infected with plant diseases:

> So there are no chemicals involved in gene modification? I think gene modification sounds better than pesticides at least, as it is not carcinogenic or noxious.

The quotations on naturalness demonstrate how this quality trumps what is recognised as less natural based on people's assessments. Naturalness is valued as desirable not least because it appears as more trustworthy and safe. Moreover, what becomes clear is that natural aspects of the bioeconomy mainly were appreciated from a consumer perspective related to health and safe living rather than to a deeper concern for the sustainability of the (global/local) environment.

However, several interviewees also perceived certain bioeconomic solutions as unnatural, particularly novel foods. For example, in talking about cultivated meat, Lene (rural group in the southeast) said, 'I think this is sort of the wrong way to move. The other solutions seem to support 'the natural cycle', despite of some fumbling. But *this* appears as a detour'. At the same time as she confirmed her perception of the general naturalness of the bioeconomy as such, Lene pointed to cultivated meat as something deviant. In several instances our interviewees did not accept cultivated meat because it was considered unnatural, and several were sceptical towards gene-modified food as this was perceived as tampering with nature.

In light of the fact that some bioeconomic solutions were perceived as unnatural compared to traditional solutions, it was interesting to see how many interviewees redefined this perception by undertaking a *de-naturalisation* of existing and traditional practices and solutions. One example of this is from the discussion on GMO strawberries in a focus group in a rural area in central Norway:

> Brita: One should not tamper with nature.
> Birger: But that is done all the time nowadays. It is done both with chicken and cattle and so on.
> Beate: I was about to say the same. You know, we are tampering with nature today as well. I am thinking; You breed meat on animals for example, that is supposed to become so and so large and heavy, to be slaughtered so and so quickly. And, likewise, with the chicken and other animals. And these are things we eat today.

Lydia, from a rural group in southeastern Norway, argued similarly when another participant signalised scepticism towards cultured meat:

> But if I start to think of a common cow, if I know how this meat is produced nowadays: I do not know if that cow has been standing in its pen and had a bad time there, or how it has been treated afterwards […] How much antibiotics has the cow received before I eat it - what is on my plate?

As exemplified above, some interviewees made comparisons in which traditional practices did not make naturalness better than new bioeconomic solutions. Their quotes reflect that nature/naturalness is a concept that is symbolically constructed (Coyle and Fairweather, 2005) and subject to negotiation, which may benefit more controversial aspects of the bioeconomy.

Objections and reservations relevant to social acceptance
As already mentioned, especially when going further into the concrete examples of bioeconomic solutions and innovations in the interviews, we did not find an unconditional embrace of a bioeconomic future. The interviewees had several interests and values they wanted to safeguard.

Among other things, the 'Not In My Back Yard' (NIMBY) phenomenon became clear on certain occasions. The NIMBY concept has met heavy criticism in social science, for providing a simplistic explanation for resistance (Devine-Wright, 2012). However, NIMBY, in the way we use the concept here, it is simply a description that covers the phenomenon in which people often have low acceptance when changes in their local environment include perceived disadvantages. For example, NIMBYism was reflected when a rural group in

central Norway was asked if something related to the bioeconomy could potentially make them actively involved, whether for or against:

> Eva: I think I would react if there suddenly was introduced clear cutting right behind here, or if it came eight meters of weed right below here [as part of a potential biofuel production strategy].
> Edel: Yeah, in the local community. If it had happened somewhere else in the world, or another place in Norway, then I don't think that I would. … I doubt I would make myself involved in the same way then.

Another issue related to the NIMBY phenomenon was people's general desire for maintaining the perceived ideals connected to established solutions and practices, such as the existing cultivated landscape and traditional cooking and meals.

In addition, it was a repeating theme that national food production must endure. Many were aware that Norwegian arable land is a scarce resource, including Mats from an urban focus group in western Norway:

> For me, personally, it is important that the Norwegian agriculture will be maintained. I don't want to see willow coppice around here at the sacrifice of my 'pinnekjøtt' [a mutton-based, traditional Christmas dinner].

The interviewees, both from rural and urban areas, highly valued Norwegian food production over biofuel production. This aligns with research showing that domestically produced food is very important to Norwegians in general (Kvakkestad et al. 2011).

All in all, the interviewees highlighted that a bioeconomic transition, with its various innovations included, has to be performed in an orderly manner, neither headless nor heartless, but considerate and within the limits of reason, risk, and ethics.

Quite moderate engagement

The denaturalisation of established practices presented above could have indicated that the bioeconomy, with its potential utility value, appears so attractive that people want to legitimise it further by (consciously or unconsciously) ascribing it natural qualities that in any case are competitive with today's established practices. However, even though the interviewees appeared as quite enthusiastic about the various issues being discussed, almost no one, when asked directly about their willingness to engage actively in these subjects, said they would have chosen to demonstrate for (or against) any of the mentioned issues. Nor did they think that these subjects would influence their political party preferences. A few exceptions regarded potential changes with negative consequences at the local level. This may be illustrated by quotes from a discussion in the urban group in central Norway on the interviewees' potential engagement:

> Anders: It won't affect my political preferences.
> Arve: It depends on how much it will interfere with your everyday life, maybe?
> Anders: Yes, you're right.

However, the great efforts to realise a bioeconomic transition were unfamiliar to the interviewees prior to our focus group interviews. The interview discussions seemed in

general to raise the interest in the bioeconomy as a topic, and more information was demanded:

> We were not fully aware of this subject, or, we didn't know it very well. But of course, we have had some thoughts about some of the aspects, without labelling it the same way. But I think it's time to focus more on these things. Maybe in schools and in the media. (Elisabeth, rural group in central Norway)

In summary, even though we find positive perceptions both of bioeconomic elements and of a bioeconomic transition as such, the quite moderate engagement indicates the importance of not exaggerating the current attractiveness of the bioeconomy. However, more information may create higher enthusiasm among lay people in the longer term.

Discussion

Our results show that there are certain aspects of the bioeconomy that clearly attract lay people. In particular, valuation of potentially global collective benefits and perceived naturalness of various bioeconomic solutions have been shown to be important in this regard. However, there are also certain objections and reservations when it comes to development towards a bioeconomy, and we found lay commitment to such a transition to be quite moderate at the moment.

In accordance with Wüstenhagen et al.'s (2007) theory on social acceptance, we can see that lay people easily accept bioeconomic developments on a broader socio-political level, while community and market acceptance is somewhat more critical in this matter. We find high social acceptance at the socio-political level related to globally joint gains such as a new foundation of energy and resources when oil will not be an option anymore, more food and stronger food security, and reduced climatic and environmental threats. The appreciation of global, collective benefits corresponds to a civic logic or order of worth.

Further, the majority of interviewees anchor their positive valuation of bioeconomic development on perceived natural qualities, which points toward high market acceptance for some of the solutions. Interestingly, people appreciate this naturalness mainly with regard to their own consumption preferences rather than because of a deeper concern for the sustainability of the environment. As such, it is the classical consumer perspective rather than the citizen perspective that appreciates this quality. Naturalness is positively valuated mainly related to health issues, where it is perceived as a trustworthy factor among the potential risks related to various products. According to Ditlevsen et al. (2019), emphasising one's own health appears to be a legitimate logic and of legitimate worth in Western societies, as it corresponds to the privatised responsibility for one's own body.

What sizes of productions are needed? What levels of value are added? What remaining consequences can be expected within the frame of a well-established bioeconomy? These are questions that are still subject to research. Thus, there were limitations on the amount of information we were able to provide when interviewees asked for it, and unanswered questions should be recognised as significant to their bases of opinion. Another thing we want to underline is that the issues discussed largely apply further into the future rather than being matters the interviewees are confronted with at the present time. Our questions often dealt with 'what will you think and do' instead of 'what do you do'. The often-documented gap between attitudes and more concrete behavioural intentions and consumer behaviour (Ajzen, 2001; Westaby, 2005; Vermeir and Verbeke, 2006) may therefore, to a greater or

lesser extent, also apply in the current case. Since many of the participants became familiar with the bioeconomic framework for the first time at the beginning of our interviews, it is also possible that some may have changed their views after further consideration in the aftermath of the interviews.

We chose a diverse sampling strategy in order to capture a variety of perspectives that exist—or may come into being—on the bioeconomic transition. Notwithstanding, there may still be perspectives and inputs that we did not manage to gather in the current study. Nor have we tried to quantify the spread of acceptance. The qualitative approach allowed us to inform participants on what the bioeconomy aspires to do for society and nature, to make sure that they know the concept, and to lead people to substantiate what they find attractive and why they value things the way they do. In future, when the bioeconomy gradually becomes more well-known, it will be possible to carry out quantitative surveys and analyses to quantify the spread of acceptance and to undertake more systematic investigations of differences between various groups in the population when it comes to social acceptance.

Even though it cannot be proved as such in the current study, the results point to the conclusion that the overall presentation of a bioeconomic transition can have a positive effect on people's valuation of the separate innovations since the bioeconomic framework highlights the *aggregated* (collective and individual) gains of the various products, projects, and processes included in the bioeconomy. We suggest that the significance of the bioeconomic framework be examined more systematically in future studies.

Conclusion

In this study we have explored lay perceptions of bioeconomic developments' necessity, risks, and ethical trade-offs in various areas of Norway. Our results indicate that the prospects for lay people's acceptance of a bioeconomic transition are quite positive as long as the transition is carried through in an orderly, considerate manner. A range of significant global gains, together with perceived naturalness as an important individual gain, are aspects of the bioeconomy that attract lay people. In addition, more sustainable consumption and production are perceived both as more tempting and realistic than reduced consumption and production as an alternative way of meeting global challenges. Taking into consideration the massive media coverage of climate issues in the last three years, there is no reason to expect that people's thoughts around such a transition have changed in a negative direction since the interviews were carried out.

A sustainable bioeconomy is considered to be a promising contribution to meeting several of the United Nation's SDGs responding to a range of global challenges. However, successful realisation of a bioeconomic transition requires three-dimensional social acceptance. To establish social acceptance of the bioeconomy will obviously require more outward communication of the planned transition as such, and then not only of the strategy. Stronger emphasis on both global and individual gains seems crucial to the design of further bioeconomy-related policies.

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Table 1. Overview of topics addressed in the focus group interviews

Bioeconomic relevant theme	**Practical example**
New land use	Changed landscape (willow coppices, clear-cutting areas); feed vs fuel; localisation of bioeconomic plants
Extended use of waste	Sewage sludge; 'bird poop facials'
Gene-modified organisms (GMO) / biotechnology	Food (strawberries, 'golden rice') and medicine
New/alternative food	Cultured meat; insects; 3D-printed food
Bacteria-grown products	Clothing