3.4. Communicating Risks about Plant Biomass
The initiation of a Citizen Council in the Munsterland region

Julia-Lena Reinermann/Jan-Hendrik Kamlage/Nicole de Vries and Ute Goerke

1. Introduction

Green (agri)technologies, such as biogas plants, agri-photovoltaics, or biotechnical processes for energy crops, promise greater, more sustainable energy production.[1] These science-based innovations, and the real-world changes they both bring to and through policy, are mostly adopted by western societies without much public debate or controversy; the public is often not even aware of them. Such technology development is often characterized by uncertainty and a lack of knowledge about its manifold and unintended consequences, however, and involves not only opportunities, but also poses risks for societies. Particular members and groups of societies consistently refer critically to the possible negative effects of technology innovations, to profound ethical dilemmas, to power relations, and express fundamental concerns about acceptance. These concerns are often accompanied by the general question of whether new technologies will change society in the future for the better or for the worse (see Pidegeon et al. 2017). As a prime example, the longstanding debate around green biotechnology in Europe (e.g., for energy crops) can be used to illustrate how conflicts around (potential) risks can arise and how these debates are often accompanied by both a strong polarization of opinions and a social reinforcement of risk perceptions (EFS 2019; Bonfadelli 2012; Bauer/Gaskell 2002). The reasons for these controversies do not indicate a lack of formal knowledge about technologies (»deficit model«) that needs to be increased, as has long been assumed in science and risk communication research. Instead, most agree that a »multi-way« approach to risk communication is needed (Balog-Way et al. 2020), in which public participation in dialogue and deliberative processes is particularly important, such as in participatory technology assessment (pTA) procedures (see Pidgeon

1 The emergence and upscaling of such technologies are supported by political concepts, such as ›a sustainable bioeconomy for Europe‹ or by Germany's ›National Bioeconomy Strategy‹.

2021, for a discussion; Fiorino 1990). According to Webler and Tuler (2018: 5), the public's dialogic involvement will bring together different types of knowledge and experiences that also offer epistemological contributions. Furthermore, dialogue processes can improve people's ability to resolve conflicts constructively, thereby increasing the legitimacy of risk decisions and fostering greater trust in science, and the policymaking process, and promoting the democratic ideal of empowering diverse groups and subjects (Jardine/Driedger 2014). With this in mind, this article is dedicated to research on a participatory technology assessment (pTA) procedure; specifically, the Citizen Council on biomass production in the Munsterland, Germany 2018. To that end, the article is divided into four parts. First, we outline the relevance of a mutual understanding of risk assessment and the role played by pTA-procedures in the bioeconomy field. It is important to frame the specific relationships of issues, positions, and actors in order to derive conflicting patterns, and thus the existing potential risks and opportunities that can be deliberated with the citizens; this should take place prior to the initiation of a Citizen Council on biomass production. Therefore, we proceed by presenting some relevant patterns of conflict that we have identified throughout our analysis. Following this, we introduce the concept of Citizen Councils in greater detail and describe their concrete implementation. Finally, we draw conclusions from our experiences and provide recommendations.

2. Communicating Risks in a Participatory Manner

Biogas plants, agri-photovoltaics (Duttmann et al. 2020), and other technologies such as precision farming[2] and modified crops are both changing agricultural management and increasing the visibility of the technological artefacts of energy and product production. These changes are driven by political concepts in Germany, such as ›the National Bioeconomy Strategy‹ (BMEL/BMBF 2020).[3] The importance of these concepts has increased gradually in recent years at the political level, worldwide, nationally, and regionally (BMBF 2021a; BMBF 2021b). The hope is that we arrive at a more sustainable economy, through (bio-)technology-driven developments in particular, which at least partially replaces[4] existing fossil resources and materials while also ensuring food se-

2 Precision farming refers to a method of location-differentiated, and targeted management, of agricultural land. The term encompasses a subset of digital process technologies in the context of digitalization in agriculture.

3 A distinction must be drawn between national and regional mission statements, as well as between strategic concepts and their implementation. At best, mission statements provide an orientation and depict possible future developments, but not the concrete implementation thereof, including measures and responsibilities. Conflicts resulting from differing objectives repeatedly arise here, given that different interests and positions often clash.

4 Which agricultural biomass is ultimately used for which purpose has not yet been comprehensively researched scientifically, given that there are inconsistencies between individual data sources. The most illustrative example is still the silage corn and green plants in the categories of animal feed and energetic use. Here, it is already assumed that there will be a deficit, that more will be used than will be available (Szarka et al. 2021).

curity (cascade use principle).[5] Agriculture, and therefore farmers, play a crucial role, as do forestry and fisheries. Furthermore, both local residents and consumers alike are affected by such changes, and their involvement and acceptance are crucial for future realization. This is because such widespread changes can generate conflict and controversy about potential risks[6] or even outright resistance or rejection. Communication activities about these policies and technologies, which exclude critical perspectives or local experiences, can contribute to conflicts and rejection in this context. In this way, the communication does not address the relevant target groups or their arguments about the direction. Rather, information is often only provided in a one-sided manner when the technologies are ready to be implemented. The direction and management of activities taking place within the bioeconomy and biotechnological developments have also been discussed, primarily in scientific, economic, and political circles and less commonly in public, with civil society, or with those directly affected (Lehmann 2021; Hempel et al. 2019). However, focusing only on a few groups can lead to the exclusion of important bodies of knowledge, which are crucial to implementing an acceptable (Webler/Tuler 2018; Kamlage et al. 2020) and sustainably organized (Voorberg et al. 2014) bioeconomy in the future.[7] We will argue for a constitutive understanding (see Rickard 2019) in order to more broadly assess possible risks and potentials in contrast to a *top-down* approach, typified by a one-way and linear understanding of communication. Following such an understanding of communication, balanced (pros and cons) information and knowledge are developed in a target group-oriented way, which enables an argumentative weighing of chances and risks and creates a transparent and trustworthy knowledge transfer (»democratic model understanding of risk communication«, see Rowan 1994; Priest et al. 2003; Jovchelovitch 2007; Renn 2008). Several decades worth of experience have already been accrued about how participatory procedures can be implemented to identify the potential risks and conflicts surrounding technology as early as possible. Citizens, who do not represent any organized interests (Abels/Bora 2013), become involved through procedures of pTA (Böschen et al. 2021). These »lay citizens«[8] are brought

5 Cascading biomass from plants is used here; in addition to using biomass as food and animal feed, it is also used for oils and fats for the chemical industry, sugar for chemical-technical industries (e.g., for bio-plastic or plant fibres for textile production). Alternatively, residual and waste materials can be used, such as manure, for bio-energy or for bio-fuels (Iost et al. 2020).

6 Risk is defined here, after Dahinden/Schanne (2009: 70), »as the process of systematically weighing the advantages and disadvantages of different and in principle uncertain decision options«. Thus, the preoccupation with risk presupposes a minimum degree of ability to actually shape the future and, thus, to prevent undesirable events through precautionary action (Sellke/Renn 2019).

7 There is a public interest in and a desire for sustainable agriculture. An environmental awareness study in Germany showed that the respondents see clear deficits and, thus, a pressing need for action with regard to a stronger environmentally-compatible orientation. With regard to most of the goals surveyed, the prevailing assessment is that not enough is being done. This applies first and foremost to the goals of »reducing food waste« (89 percent), »halting the decline in biodiversity« (86 percent) and »ensuring the welfare of farm animals« (85 percent) (BMU/UBA 2020)

8 Non-organized citizens do not usually have the expert knowledge on the topic to be acted upon, but they do have life-world backgrounds and experiences as well as everyday morals, which only include fixed opinions and strategic interests to a limited extent (Dienel 2002).

together to ascertain the pros and cons, outlined by experts, and contribute their knowledge and perspectives, weigh in on possible risks, and to develop recommendations for either policy or science (e.g., Dryzek et al. 2019).[9] This has the potential to stimulate a mutual learning process and to spark a dialogue between experts and citizens. The goal is an assessment of the potential opportunities and risks involved in technical innovations and in the development of new ideas, as well as including an ›advisory effect‹ on political decision-making processes.[10] The focus is on discussing key questions about how a particular technology might develop in the future, who will benefit or be harmed by these developments, what values are at stake, and whether desirable or unintended consequences will result (e.g. Kurath/Gisler 2009). There is hope that key research and political decisions can still be influenced, while the polarization of opinions that often occurs with many controversial issues downstream could be avoided by giving an area to these questions through dialogue at an early stage. The condition for the creation of such a dialogical space is the analysis of existing risk (perceptions) and through an analysis of past and current conflict patterns; this also allows for the identification of actors and contents. This identification of origins, developments, arguments, and positions within the population, and among those potentially affected in particular, helps to better understand possible risks or reservations, but also resistance and protest, and dialogical content can be derived from this.[11] To this end, we have analysed literature and conducted research at the local level using ethnographic methods, such as participant observation. We focused on the already established use path of the bioenergy crop corn for the realization of the Citizen Council for plant biomass in Munsterland.[12] This pathway has stood for specific bioeconomic practices in both Munsterland and in Germany more generally for about 15 years, which already shows a high cultural diversity of conflict patterns and risk assessments. The findings serve as a starting point for initiating dialogue-oriented processes, such as the Citizen Council, in which ways of dealing with risks and opportunities can be found as a result of increasing (and more sustainable) bioeconomic activities.

9 The degree of influence that these recommendations have on political decision-makers has not been thoroughly researched to date, due to the low level of dialogue procedures in Germany (see Wagner 2019).

10 However, the various formats are an upstream consultative process that can, and should, be taken up by political institutions that have been legitimized through elections.

11 In this context, conflicts about possible risks posed by biotechnological developments are above all also ›value conflicts‹ (Dahrendorf 1962). These conflicts, as specific risk conflicts, are characterized by a high degree of unknowing, since they refer to an uncertain future that is shaped by normative presuppositions.

12 We selected the example of Munsterland because that region has a) a long farming tradition and b) a high proportion of biomass production that utilizes corn (including biogas facilities) for energy production. Therefore, we assume that a lot of people in the region have been affected by the negative, and sometimes unintended, consequences of large-scale biomass production. These peoples‹ direct concerns raise the chance of a high level of reflection on risks and negative aspects of the technology being examined.

3. Risk Patterns: Learning from Corn

It is worth examining already established utilization paths, such as corn as an energy source and with corn starch as a bio-based feedstock, in order to learn more about assessing potential risks for society, concerning the development of conflict in specific, in order to develop anticipatory strategies to deal with such conflict. We analysed the existent literature and spoke with local residents, farmers, civil society organizations, academics, and policymakers in order to acquire an understanding of existing patterns of conflicts around corn. For this purpose, we chose a region in which corn cultivation has been very important for a long time. Corn is an outstanding example whose utilization pathway in the existing bioeconomy has been well researched over the past 15 years and is widely cultivated in Germany's Munsterland region. As a true all-rounder, corn can meet the diverse needs of people and is also compatible with the existing ideas of bioeconomic processes. Corn is grown almost everywhere in the world today, due to its flexible location requirements.[13] While the cultivation of corn as food is predominant in countries in the global South, silage corn is mainly cultivated in industrialized nations. In Germany, this has been used as animal feed and as an energy source in the form of biofuels (bioethanol), silage corn for biogas plants (FNR 2018), and as a feedstock for bioplastics since 2004.[14] Different ways of utilizing corn were commonly the source of controversial and public debates in the past, especially since 2005, when monocultural cultivation was significantly expanded.[15] Complaints were made about the »yellow plague« or the »cornification of the landscape«, which intensified land-use competition because fallow or grassland areas were displaced for the cultivation of corn monocultures.[16] In addition, the nutrient-intensive cultivation (e.g., the pollution of groundwater with nitrates), the use of chemical pesticides, and the conspicuously high growth of corn as well as its utilization in biogas plants repeatedly led to local controversies between locals and stakeholders from the arenas of tourism, nature conservation, and agriculture (see Reinermann et al. 2020). Criticisms of corn cultivation and its utilization include the loss of biodiversity, the montane landscape, as well as health and economic impacts on local residents (Schleer et al. 2016; Huth et al. 2019; Glemnitz et al. 2010; Schuster et al. 2018). Another result of the growing demand for corn is demonstrated in the *tortilla crisis* that was triggered by stock market speculation in 2007 (Hübner/Kralisch 2011).

13 In 2017, the global area found beneath corn was about 180 million hectares, which represents an increase of 50 percent compared to the year 2000. Of this, 2.5 million hectares were located in Germany alone.

14 This represents the largest share of German corn production with 2.1 million hectares under cultivation and 99 million tons of silage corn as livestock feed and substrate for biogas production. Grain corn for direct human consumption, conversely, yields only 4.5 million metric tons (DMK 2019).

15 Three cultivated areas corresponded to approx. 78,800 hectares for grain corn and approx. 216,000 hectares for silage corn in North-Rhine-Westphalia (NRW) (Information und Technik NRW 2021).

16 In Germany, this corn is used as animal feed and, since the EEG amendment in 2004, for energy use in the form of bio-fuels (bio-ethanol), as corn silage for bio-gas plants (FNR 2018), and as a feedstock for bio-plastics.

Furthermore, as a result of the »tank-or-plate debate«, ethical concerns have repeatedly been raised as to whether the use of food corn for the production of bioenergy is permissible at all (Zichy et al. 2014), given that it competes with the claimed land, which is a prerequisite for price increases for agricultural products (Banse et al. 2011). In Germany, both politicians and scientists alike have responded to parts of these criticisms and have developed political measures to limit the cultivation of corn (»Maisdeckel«), as well as technological processes, in order to be able to use more waste and residual materials for energy production (Herbes et al. 2014). Some of these conflicting goals remain present, and the current debates about bioeconomy are once again bringing them to the fore at the global and local levels. For example, whether sufficient land is available for exploitation remains an open question (Spangenberg/Kuhlmann 2020; Börner 2019). Furthermore, there is the risk of higher biomass imports from countries in the global South, which may be accompanied by an increased externalization of environmental and social costs. Critics see further potential risks in indirect land use, by converting green land to cropland or by using fertile soils for other consumer goods instead of food. In addition, new technological processes will lead to conflicting goals, such as with the use of energy corn in biogas plants for example. Schuster et al. (2018) identified 26 citizens' initiatives in Germany that opposed the construction and expansion of biomass utilization plants. The arguments behind the initiatives mainly referred to health and nature conservation aspects (noise and odour pollution, increased traffic, groundwater pollution, loss of species), in addition to economic reasons (loss of property values and rising lease prices; see also Fettke 2019: 284ff.). Another example concerns (new) genome editing methods which are associated with the hopes of producing modified organisms with higher crop yields or better climate resistance. Critics point out that, on the one hand, the corn plants were bred much too high and one gets lost in »corn tubes« (Reinermann et al. 2020: 20); on the other hand, critics have mentioned that it is not currently known whether the metabolism of genetically modified plants, for example, changes in the long term or what effects these will have on existing ecosystems (Guttenberger 2021).[17] Overall, and by using corn as an example (Tab. 1), some of the prevailing patterns can be broadly categorized into areas of conflicts, conflict issues, and conflict participants.

17 In surveys, respondents in Germany were in favour of a precise risk assessment measure, expressed their support for a detailed labelling requirement for old and new genetic modifications, and a large proportion were opposed to new genetic technologies (Guttenberger 2021).

Table 1: Overview of conflict fields, topics, and their actors

Conflict fields	Conflict subjects	Conflict parties
Seeds and Cultivation	monocultural cultivation intensified land-use competition chemical pesticides loss of biodiversity competition for land modified crops tank-plate debate food speculation	Farmers Nature Conservancy Tourism associations Local residents Politicians Scientists
Processing technologies	health and nature conservation aspects of biogas plants promotion of mass livestock	

Following this analysis, we designed the Citizen Council to discuss the current conflict issues and to explore the question of: *What a sustainable plant-based biomass production could and should look like in the future*? Thus, the council's aim was not just to discuss scientific and technical risks and their concepts, but also to discuss the impact of certain technical and scientific options among those affected and the parenthetical normative issues, as well as to communicate these as recommendations to policymakers.

4. The Citizen Council

Citizen Councils follow the general concept of micro-deliberation (Chambers 2009) which basically includes the institutionalization of forums designed for a small-scale, face-to-face communication, and deliberation. Citizen Councils, however, fall under a subdomain of micro-deliberation often referred to as »mini publics« (for an overview see Smith/Setälä 2018). Other examples are Planning Cells (Dienel 2002), Citizen Juries (Crosby 1995), and Consensus Conferences (Joss/Durant 1995), which has garnered a great deal of academic attention in recent years. The Citizen Council was initiated and developed first by the »Center for Wise Democracy« in Seattle in order to »find solutions to urgent social problems« (Nanz/Fritsche 2012: 50; Rough 2002). The original procedure was transposed from Seattle to Vorarlberg in Austria (Strele et al. 2012). As part of Voralberg's federal government, the ›Office of Future-related Issues Austria‹ has been experimenting and gaining experience with the method in a wide variety of both local and state-wide occasions for more than a decade now.[18] As a consequence, they have further developed and adapted the concept to the region's needs and conditions. Today, Citizen Councils are organized according to different organizational principles: they typically consist of twelve to fifteen citizens who are selected at random in order to

18 More information about Citizen Councils can be found at the following address: https://www.buergerrat.net/english-version/[Accessed 10.06.2022].

obtain a heterogeneous group of participants.[19] These lay citizens deliberate together for a day and a half. The Councils have a clearly defined aim and topic, starting point and end point, they work with the support of competent facilitators, and integrate experts as well as stakeholders when necessary. Thus, these processes rest upon the idea of a reasoned exchange of information, ideas, and arguments among participants who, ideally, consider each other as equals. Joint recommendations are formulated at the end which are then received and commented upon by the political representatives or by the administration and are discussed and supplemented by the interested public. A strong focus on trust-building and an open, respectful atmosphere among the participants is enabled because of its relatively small size. These processes are organized and structured by – ideally impartial and competent – facilitators in order to further ensure that the reasoned exchange and weighting of arguments takes place on the basis of equality and non-domination. These intermediaries both introduce and enforce rules of communication, apply techniques for collaboration, ensure inclusive deliberation, and structure the results of the dialogue (Landwehr 2014). By using a specific facilitation method, referred to as ›dynamic facilitation‹, the participants' arguments and comments are grouped into four basic categories: problems, solutions, concerns, facts and figures. The design and implementation of these dialogue-oriented participation processes are guided by the principles of the ›Art of Hosting‹. A community of international practitioners stand behind this approach and share a common, normatively grounded understanding of the ethics of participation, as well as a canon of methods and techniques such as practical design frameworks of ambitious collaboration and co-creation. In a nutshell, the ›Art of Hosting‹ offers »a methodology focused on engaging diverse groups of stakeholders to make progress on shared challenges« (Sandfort/Sarode 2021: 412). All in all, the Council's organizational principles both stimulate and foster an informed opinion and will-formation within the groups, and this increases the chances that a consensus will be reached, or at least for an acceptable amount of dissent. The Citizen Council has a consultative function and is meant to complement representative democracy while pursuing the following overarching goals:

- offer a designed communication space for informed and ambitious opinion- and will-formation about relevant issues being examined;
- promote a culture of cooperation among participants as well as a constructive handling of conflicts on the basis of trust, mutual understanding, and exchange; and
- develop jointly supported, common good-oriented perspectives and acceptable solutions.

As mentioned previously, we have adopted and applied the concept of the Citizen Council in order to pose specific questions about a sustainable plant-based biomass produc-

19 Random selection is intended to guarantee a cross-section of the population in order to increase the legitimacy of the deliberation's results and the recommendations for action (for which a representative cross-section of the population is required).

tion; Councils have not yet been implemented with this specific purpose in mind.[20] In the past, other methods have attracted academic attention in the area and have been considered to be more appropriate for participative technology assessment. Consensus Conferences (Joss/Durant 1995) or Planning Cells (Dienel 2002), for instance, offer timely spaces with extended expert consultation and informed deliberation. Our analysis of these pioneering methods showed that lay citizens were able to democratically engage in discussions about advanced technologies, and their potential consequences, but that both the time-consuming element of participation and the topic at stake raise significant barriers for engagement (Kleinman et al. 2009). In contrast to the aforementioned approaches, the Citizen Council involves experts only on a limited basis and takes only one and a half days. Thus, it represents an easily accessible approach that incurs comparatively small costs, involves a lower degree of organization, and requires less individual effort on the participants' part. However, this poses the question of whether or not the Council provides solid outcomes. To answer this, among other questions, we initiated a Citizen Council about the production of plant biomass in the Munsterland region and in other areas of North Rhine-Westphalia (NRW) (Kamlage et al. 2019) in the winter of 2018. We selected twelve citizens at random[21] to discuss the opportunities and risks associated with the cultivation and use of plant biomass. The participants were asked to take a close look at corn's already established utilization path and were asked to discuss sustainable alternatives to biomass production. The process was supported by contributions from civil society, business, and academia, which were processed using graphic recording, supplemented by an exhibition of biobased products, different methods like ›World Café‹ or the ›Fishbowl-Method‹ were employed for discussion and reflection, and participants evaluated the Council using a questionnaire. We also designed a specific structure and divided the Council into four phases.

20 Against the background of new technological developments in agriculture, which are supposed to enable more sustainable management, only two processes in Germany could be identified that deal with the future of technology and agriculture and include the perspective of citizens at an early stage: The German Federal Institute for Risk Assessments‹ (BfR) Consumer Conference on Genome Editing 2019 and »Ecologically sustainable: How do we want to live, do business and work in 2030?«, an Integrated environmental program by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (2016). More procedures can be found in the context of the ›Energiewende‹, and the changing landscape, but here the procedures are rarely used at an early stage, instead only when the conflicts have already arisen (Radtke et al. 2020).

21 The Institute for Democracy and Participation Research (IDPF) selected 396 citizens in the city of Münster and the surrounding districts of Coesfeld, Steinfurt, and Warendorf for our Citizen Council. All 396 citizens were personally invited by letter and an expense allowance was offered. The basis for the selection was the population registration data provided by the municipalities to the IDPF. Of the 48 people who responded, a group of 15 participants was selected based on the criteria of age, gender, and place of residence, of which 12 people ultimately took part. The composition was only conditionally balanced: 2/3 of the participants were male and half were over 50 years old. The age structure was balanced, although there was a focus on those aged 50 to 63. While the occupation was still somewhat average (17 % retired, 17 % student/trainee, 17 % self-employed, 34 % employed, and 8.5 % not specified), the highest level of education attained was above average (34 % university degree diploma and 17 % university of applied sciences degree).

Welcome and Get in touch

This phase forms the basis for the rest of the process. It lays the foundation for a trusting, creative, and constructive working atmosphere. Participants are welcomed individually and get to know each other in person. The aim is to create a space in which everyone feels comfortable and ready to participate. This can be facilitated by designing the room in an appealing way, facilitating informal conversations, offering food and drinks, as well as small games and other interactions that may also facilitate access to the topic at hand.

Information and Consulting

Various opportunities and risks involved in the cultivation of renewable raw materials were highlighted by experts in order to balance out an expertise gap among the participants and to allow practical and scientific expertise to flow into the information and consultation phase. Following the discussion of existing conflict issues, and the risk perspectives articulated therein, we invited three experts who:

1) addressed the ecological aspects in plant biomass cultivation, as well as global and local interdependencies, from a civil society point of view;
2) addressed the political framework and strategies for sustainable production; and
3) highlighted scientific options, such as alternative plants and their cultivation.

Since the experts only have an advisory function, and the focus is on the discussion that takes place among the participants, the experts should not present their knowledge by means of a formal lecture, if possible, but rather in a sitting circle, for example, and more in the form of a discussion.

Evaluation and preparation of recommendations

A Citizen Café took place in the third phase, in which the participants discussed and developed policy recommendations. This adaptation of the *World Café* method (Brown/Isaac 2005) was applied to promote exchange, and to bring together knowledge and experience in order to develop new creative ideas within a short period of time. The most important results were written down and were presented in a plenary session held later that same day. The three questions that the participants were asked to address were:

- What are the opportunities and challenges involved in the current cultivation of biomass?
- How should plant cultivation be designed in the future, in view of these opportunities and challenges?
- What measures are needed for this and who should implement them?

Tab. 2 summarizes the main results of the discussion, regarding risks and opportunities, as well as the recommendations for action that were identified. The participants agreed that a bioeconomy can only be sustainable if it is both economically and ecologically viable. The desire for model regions in which sustainable production practices, in particular, can be tested was emphasized.

Table 2: Overview of the discussion's results (Kamlage et al. 2018)

Risks from the perspective of the Citizen Council:	**Recommendations for Action to mitigate risks and to seize the opportunities**
Monocultural cultivation; The loss of biodiversity; The danger of increasing crop failures as a result of climate change; and The increasing land use and the growing competition for land	A more efficient and innovative land use; Develop new plant species that are resistant to the impacts of climate change; Link existing scientific, economic, and political expertise along the value cycle; Implement model regions for sustainable biomass production and for the trial cultivation of genetically modified, low-input crops in a regulatory framework
Opportunities from the perspective of the Citizen Council:	
Marginal land for energy crops: marginal land that cannot be used for agricultural production, can be used for innovations, such as the cultivation of energy crops; and Urban gardening/agriculture for green cities.	

Reflection and Outlook

In the last phase, we applied the ›Fishbowl-Method‹[22] in order to enable all of the participants to share their experiences. The appreciative communication and the possibility to take different perspectives were perceived by the participants as very valuable. Concerns were expressed as to whether the recommendations would be taken seriously or whether or not they would be implemented by decision-makers. In any case, the recommendations were expected to flow into further scientific work and will be fed back into politics and administration, with a subsequent additional request for comments.

5. Conclusion and Recommendations

The analysis of the Citizen Council showed that lay citizens, as a group of people from diverse backgrounds and with different perspectives and voices are able to deliberate and to discuss complex issues in a well-arranged setting (Dryzek et al. 2019: 1145), even if they mostly had no explicit (expert) knowledge about the issues under examination. All in all, the participants revealed a rather optimistic and opportunity-based view of

22 An inner and an outer circle of chairs were formed. The participants take turns sitting in the inner circle and expressing their opinions and positions in order to discuss them with others.

the issue of bioeconomy and biomass production. During the course of the participation process, the perspective altered from a sceptical perspective, emphasizing risks and negative consequences, towards a more optimistic view. The topic, however, placed high demands upon the Council's participants. It can be assumed that the sophisticated and highly technological topic led to the fact that some people took a step back and did not respond to the invitation to participate in the process. An informed debate within the Council was also slightly hampered by the fact that the participants felt unable to deliberate on the issue in the beginning, due to a lack of real-world experiences or due to a lack of connection to the topic. As a consequence, a lot of time and attention had to be spent to inform the participants (with support from experts) about the multidimensional issues of bioeconomy, biomass production, and related risks and consequences. This left far too little time at the end of the process and made it difficult to carefully formulate recommendations. Spending more time introducing the topic to, and reflecting upon it with the participants would have yielded added value. Unfortunately, Citizen Councils provide only a limited time frame, which posed a limiting factor for better outcomes in terms of informed and reflected recommendations in our case. Alternative design choices and the framing of the topic at stake could potentially remedy the problem of having insufficient time for the information phase. Widely unknown terms and concepts are not very suitable for communication and deliberation with lay citizens. It would have been better to break the topic down in terms of specific issues and reframe terms in a manner that is easier to approach and that is more related to the participants' everyday experiences. Other thematic areas that require further attention are, for example, the powerful relationship between speakers and non-speakers: how can less-speaking people also be included in the deliberation? The selection criteria and the experts employed, as well as the adequate and helpful criteria by which to weigh the argumentative pros and cons, must also be conducted as neutrally as possible. The feedback from the participants, however, showed that they learned and improved their knowledge and even improved their ability to assess potential risks. It is precisely the experts' diverse perspectives that made it easier for them to assess advantages and disadvantages. The debate in the small groups was also perceived as enriching, in that they were able to learn about and to train their deliberative skills. Finally, they perceived the process to be appreciative, in that they were able to contribute their perspectives. All in all, the bioeconomy involves not only opportunities, but also new risks that cannot be solved by experts from the domains of science, politics, and industry alone. Transparent risk communication is crucial for the successful implementation and transformation in the future. Participative technology assessments (pTA-)procedures (like Citizen Councils, Planning Cells, or others) represent appropriate measures by which to not only identify risks and societal consequences of different technologies, but also to provide informed recommendations for the policy process in a more democratic and reciprocal way. These processes open up the political agenda and add societal concerns, which might otherwise be missing, and might even inform and involve citizens to a greater degree. Deliberative processes offer initial opportunities for an exchange of ideas and, at the same time, for the acquisition of new knowledge. There was some room for improvement in terms of the design, implementation, and execution of the Citizen Council. Other big questions that remained unanswered relate to the content of a transforma-

tion of agriculture for a more sustainable bioeconomy itself. Some of these are aimed at formulating a vision and concern the possible path to realizing this vision, like if energetic and material biomass really can sustain the existing consumption demands, or if we instead need alternative ideas of prosperity which take a look at other concepts of growth and consumption? From a sustainable science perspective, such questions always include a normative dimension that can only be answered by society as a whole.

Bibliography

Abels, Gabriele/Bora, Alfons (2013): »Partizipative Technikfolgenabschätzung und -bewertung«, in: G. Simonis (Ed.), Konzepte und Verfahren der Technikfolgenabschätzung, Wiesbaden: VS Verlag, pp. 109-128. https://doi.org/10.1007/978-3-658-02035-4_7.

Balog-Way, Dominic/McComas, Katherine/Besley, John (2020): »The Evolving Field of Risk Communication«, in: Risk analysis: an official publication of the Society for Risk Analysis 40.S1, pp. 2240-2262. https://doi.org/10.1111/risa.13615.

Banse, Martin/van Meijl, Hans/Tabeau, Andrzeji/Woltjer/Geert/Hellmann, Fritz/Verburg, Peter V. (2011): »Impact of EU biofuel policies on world agricultural production and land use«, in: Biomass and Bioenergy 35.6. doi.org/10.1016/j.biombioe.2010.09.001.

Bauer, Martin W./Gaskell, George (Eds.) (2002): Biotechnology: the making of a global controversy, New York, USA: Cambridge University Press.

Bonfadelli, Heinz (2012): »Fokus Grüne Gentechnik: Analyse des Medienvermittelten Diskurses«, in: Marc-Denis Weitze/Alfred Pühler/Wolfgang M. Heckl et al. (Eds.), Biotechnologie-Kommunikation. Kontroversen, Analysen, Aktivitäten. acatech DISKUSSION, Berlin, Heidelberg: Springer Vieweg, https://doi.org/10.1007/978-3-642-33994-3_7.

Börner, J. (2019): Nationale Bioökonomie Strategien und Herausforderungen für eine globale Nachhaltigkeits-Governance. Vortrag auf der Tagung »Bioökonomie und Gesellschaft« am 10./11.03.2019, Tutzing. Unpublished.

Böschen, Stefan/Grunwald, Armin/Krings, Bettina-Johana/Rösch, Christine (Eds.) (2021): Technikfolgenabschätzung. Handbuch für Wissenschaft und Praxi, Baden-Baden: NOMOS. doi.org/10.5771/9783748901990.

Brown, Juanita/Isaacs, David. (2005): The World Café. Shaping Our Futures Through Conversations That Matter, New York: McGraw-Hill Professional.

Bundesministerium für Bildung und Forschung (BMBF) (2021a): Bioökonomie in den Bundesländern. https://biooekonomie.de/themen/biooekonomie-in-den-bundeslaendern [Accessed 28.10.2021].

Bundesministerium für Bildung und Forschung (BMBF) (2021b): Bioökonomie weltweit. https://biooekonomie.de/en/topics/in-depth-reports-worldwide [Accessed 28.10.2021].

Bundesministerium für Ernährung und Landwirtschaft (BMEL)/Bundesministerium für Bildung und Forschung (BMBF) (2020): Nationale Bioökonomiestrate-

gie. https://www.bmel.de/DE/themen/landwirtschaft/bioeokonomie-nachwachsende-rohstoffe/nationale-biooekonomiestrategie.html [Accessed 13.09.2022].

Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (BMU) & Umweltbundesamt (UBA) (2021): Umweltbewusstsein in Deutschland 2020. https://www.umweltbundesamt.de/publikationen/umweltbewusstsein-in-deutschland-2020 [Accessed 30.03.2022].

Chambers, S. (2009): »Rhetoric and the public sphere: Has deliberative democracy abandoned mass democracy?«, in: Political Theory 37.3. DOI: doi.org/10.1177/0090591709332336.

Crosby, N. (1995): »Citizens juries: One solution for difficult environmental questions«, in: Ortwin Renn/Thomas Webler/Peter Wiedemann (Eds.), Fairness and Competence in Citizen Participation Evaluating Models for Environmental Discourse, Dordrecht: VS Verlag, pp. 157-174.

Dahinden, Urs/Schanne, Michael (2009): »Wissenschafts- und Risikokommunikation«, in: Urs Dahinden/Daniel Suess (Eds.) Medienrealitäten, Konstanz: UVK Verlagsgesellschaft, pp. 69-88.

Dahrendorf, Ralf (1962): Gesellschaft und Freiheit. Zur soziologischen Analyse der Gegenwart, München: Piper.

Dienel, Peter C. (2002): Die Planungszelle. Der Burger als Chance. 5. Auflage, mit Status report 2002, Wiesbaden: Westdeutscher Verlag GmbH. DOl: 10.1007/978-3-322-80842-4.

DMK (2019): Fakten zum Maisanbau in Deutschland. http://www.maiskomitee.de/Fakten/Statistik/Deutschland [Accessed 28.10.2021]

Dryzek, John S./Bächtiger, André/Chambers, Simone/Cohen, Joshua/Druckman, James N./Felicetti, Andrea/… & Warren, M. E. (2019). The crisis of democracy and the science of deliberation, in: Science 363.6432, pp. 1144-1146.

Duttmann, Rainer/Kühne, Olaf/Weber, Florian (2020): Landschaft als Prozess: Raum-Fragen: Stadt – Region – Landschaft, Wiesbaden: VS Verlag.

European Food Safety Authority (EFS) (2019): Food safety in the EU. https://data.europa.eu/doi/10.2805/661752.

Fachagentur Nachwachsende Rohstoffe (FNR) (2018): Bioenergie: Energiepflanzen. https://bioenergie.fnr.de/bioenergie/energiepflanzen/ [Accessed 29.03.2021].

Fettke, Ulrike (2019): »Kommunale Energieprojekte als Lokalpolitikum«, in: Radtke, Jörg/Canzler, Weert/Schreurs, Miranda A./Wurster, Stefan (Eds.), Energiewende in Zeiten des Populismus, Energietransformation, Wiesbaden: VS Verlag, pp. 263-293.

Fiorino, Daniel J. (1990): »Citizen participation and environmental risk: A survey of institutional mechanisms«, in: Science, Technology, & Human Values 15, pp. 226-243. http://www.jstor.org/stable/689860 [Accessed 23.05.2022].

Glemnitz, Michael/Platen, Ralph/Hufnagel, Johannes (2010): »Auswirkungen des landwirtschaftlichen Anbaus von Energiepflanzen auf die Biodiversität – Optionen in der Anbaugestaltung«, in: Michael Reich/Stefan Rüter (Eds.), Energiepflanzenanbau und Naturschutz. Umwelt und Raum. Vol. 1, Göttingen: Schriftenreihe Institut für Umweltplanung, Leibniz Universität Hannover, pp. 77-90.

Guttenberger, Sophia (2021): Neue Umfrage zeigt: Mehrheit der Deutschen will strikte Regeln für neue Gentechnik. http://www.umweltinstitut.org/aktuelle-meldungen/

meldungen/2021/gentechnik/umfrage-mehrheit-der-deutschen-will-strikte-regeln-fuer-neue-gentechnik.html [Accessed 28.10.2021].

Hempel, Corinna/Will, Sabine/Zander, Katrin (2019): Bioökonomie aus Sicht der Bevölkerung. Thünen Working Paper 115, Braunschweig, April 2019. https://literatur.thuenen.de/digbib_extern/dn060609.pdf [Accessed 24.05.2022].

Herbes, Carsten/Jirka, Eva/Braun, Jan/Pukall, Klaus (2014): »Der gesellschaftliche Diskurs um den ›Maisdeckel‹ vor und nach der Novelle des Erneuerbare-Energien-Gesetzes (EEG) 2012«, in: GAIA – Ecological Perspectives for Science and Society 23.2, pp. 100-108.

Hübner, Rico/Stefanie Kralisch (2011): »Ein Rückblick auf die ›Tortilla Krise‹«, in: VWU Mitteilungen 111, pp. 15-17. https://www.vwu.wzw.tum.de/fileadmin/user_upload/Mitteilungen/VWUHeft111.pdf [Accessed 28.10.2021].

Huth, Eva/Paltrinieria, Sabine/Thiele, Jan (2019): »Bioenergy and its effects on landscape aesthetics – A survey contrasting conventional and wild crop biomass production«, in: Biomass and Bioenergy 122, pp. 313-321.

Information und Technik NRW (2021): Vorläufige Ergebnisse der repräsentativen Bodennutzungshaupterhebung in Nordrhein-Westfalen 2020 und 2021. Ackerland der landwirtschaftlichen Betriebe nach Kulturarten sowie nach Regierungsbezirken. https://www.it.nrw/sites/default/files/atoms/files/239_20.pdf [Accessed 04.04.2022]

Jardine, Cynthia G./Driedger, Michelle S. (2014): »Risk communication for empowerment: An ultimate or elusive goal?«, in: J. Árvai/L. Rivers III (Eds.), Effective Risk Communication, New York: Earthscan Publications from Routledge, pp. 258-276.

Iost, Susanne/Geng, Natalia/Schweinle, Jörg/Banse, Martin/Brüning, Simone/Jochem, Dominik/Machmüller, Andrea/Weimar, Holger (2020): Setting up a bioeconomy monitoring: Resource base and sustainability. Thünen Working Paper 149, Braunschweig: Johann Heinrich von Thünen-Institut. DOI:10.3220/WP1593762669000.

Joss, Simon/Durant, John (1995): »The UK national consensus conference on plant biotechnology«, in: Public Understanding of Science 4.2, pp. 195-204.

Jovchelovitch, Sandra (2007): Knowledge in context: representations, community and culture, London: Routledge. DOI:10.4324/9780203968895.

Kamlage, Jan-Hendrik/Warode Jan/Reinermann Julia Lena/de Vries, Nicole/Trost, Esther (2020): »Von Konflikt und Dialog: Manifestationen der Energiewende in den Transformationsfeldern Netzausbau, Biogas und Windkraft«, in: Rainer Duttmann/Olaf Kühne/Frank Weber (Eds.), Landschaft als Prozess. RaumFragen: Stadt – Region – Landschaft, Wiesbaden: Springer VS, pp. 603-633.

Kamlage, Jan-Hendrik/Reinermann, Julia-Lena/Stengel, Oliver/Nicole de Vries (2019): Bürger*innenrat »Biobasierte Wirtschaft?! Welche Folgen hat das für meine Region?«: Ergebnisbericht (2018). https://dialogbiooekonomie.de/wp-content/uploads/KWI_BioDisKo_Broschu%CC%88re_Buergerrat_final.pdf [Accessed 14.10.2021].

Kleinman, Daniel Lee/Delborne/Jason A./Anderson, Ashley A. (2009): »Engaging citizens: The high cost of citizen participation in high technology«, in: Public Understanding of Science 20.2, pp. 221-240. DOI: 10.1177/0963662509347137.

Kurath, Monika/Gisler, Priska 2009: Informing, involving or engaging? Science communication, in the ages of atom-, bio- and nanotechnology. DOI: 10.1177/0963662509104723.

Landwehr, Claudia (2014): »Facilitating deliberation: The role of impartial intermediaries in deliberative mini-publics«, in: Deliberative mini-publics: Involving citizens in the democratic process, pp. 77-92.

Lehmann, Rosa (2021): »Knowledge, Research, and Germany's Bioeconomy: Inclusion and Exclusion in Bioenergy Funding Policies«, in: M. Backhouse et al. (Eds.), Bioeconomy and Global Inequalities, New York: Palgrave Macmillan, pp. 107-129.

Lokko, Yvonne/Heijde, Marc/Schebesta, Karl/Scholtes, Philippe, Montagu, Marc Van/Giacca, Mauro (2018): »Biotechnology and the bioeconomy – Towards inclusive and sustainable industrial development«, in: New Biotechnology 40.25A, pp. 5-10. DOI: 10.1016/j.nbt.2017.06.005.

Nanz, Patrizia/Fritsche, Miriam (2012): Handbuch Bürgerbeteiligung. Verfahren und Akteure, Chancen und Grenzen, Bonn: Bundeszentrale für politische Bildung, Schriftenreihe (Vol. 1200).

Pedegeon, Nick/Harthorn, Barbara H./Satterfield, Terre/Demski, Christina (2017): »Cross-National Comparative Communication and Deliberation. About the Risks of Nanotechnologies«, in: Jamieson, Kathleen H./Kahan, Dan/Scheufele, Dietram A. (Eds.), The Oxford Handbook of the Science of Science Communication, Oxford: Oxford University Press 2017, pp. 141-155.

Pidgeon, Nick (2021): »Engaging publics about environ-mental and technology risks: frames, values and deliberation«, in: Journal of Risk Research, 24.1, pp. 28-46. DOI: 10.1080/13669877.2020.1749118.

Priest, Susanna Hornig/Bonfadelli, Heinz/Rusanen, Maria (2003): »The ›Trust Gap‹ Hypothesis: Predicting Support for Biotechnology Across National Cultures as a Function of Trust in Actors«, in: Risk Anal 23.4: pp. 751-66. DOI: 10.1111/1539-6924.00353.

Radtke, Jörg/Drewing, Emelie/Eichenauer, Eva/Holstenkamp, Lars/Kamlage, Jan-Hendrik/Mey, Franziska/Warode, Jan/Wegener, Jana (2020). »Energy transition and civic engagement«, in: Ortwin Renn/Frank Ulmer/Anna Deckert (Eds.), The role of public participation in energy transitions, London: Academic Press Inc., pp. 81-91.

Reinermann, Julia-Lena/de Vries, Nicole/Jan-Hendrik Kamlage (2020): Mais. Eine ethnografische Studie im Münsterland, Deutschland von 2018-2019. Unpublished.

Renn, Ortwin (2008): »Concepts of Risk: An Interdisciplinary Review – Part 2«, in: GAIA 17.2, pp. 196-204.

Rickard, Laura N. (2019): »Pragmatic and (or) constitutive? On the foundations of contemporary risk communication research«, in: Risk Analysis 41, pp. 466-479. https://doi.org/10.1111/risa.13415.

Rough, Jim (2002): Society's Breakthrough: Releasing essential wisdom and virtue in all the people, Bloomington, Ind.: 1st Books.

Rowan, Katherine E. (1994): »The technical and democratic approaches to risk situations: Their appeal, limitations, and rhetorical alternative«, in: Argumentation 8, pp. 391-409.

Sandfort, Jodi/Sarode, Trupti (2021): »Art of Hosting Frameworks and Methods as Participatory Research«, in: Danny Burns, Jo Howard, Sonia M. Ospina (Eds.), The SAGE Handbook of Participatory Research and Inquiry, Los Angeles/London, p. 412.

Schleer, Christoph/Reusswig, Fritz/Calmbach, Marc/Hipp, Tamina (2016): Naturbewusstsein 2015. Bevölkerungsumfrage zu Natur und biologischer Vielfalt.

Berlin, Bonn. https://www.researchgate.net/publication/311700078_Naturbewusstsein_2015_Bevolkerungsumfrage_zu_Natur_und_biologischer_Vielfalt [Accessed 13.09.2022].

Schuster, Lena/Hage, Gottfried/Hoppenstedt, Adrian (2018): »Fokus: Bürgerinitiativen gegen Biomasseverwertungsanlagen«, in: Catrin Schmidt/Maxim von Gagern/Martin Lachor/Hage Gottfried/Adrian Hoppenstedt/Lena Schuster/Olaf Kühne/Florian Weber/Albert Rossmeier/Diedrich Bruns/Daniel Münderlein/Franziska Bernstein (Eds.), Landschaftsbild & Energiewende. Vol. 1: Grundlagen. Ergebnisse des gleichnamigen Forschungsvorhabens im Auftrag des Bundesamtes für Naturschutz, Bonn – Bad Godesberg: Bundesamt für Naturschutz. http://www.bfn.de/fileadmin/BfN/erneuerbareenergien/Dokumente/LandschaftsbildundEnergiewende_Band1.pdf [Accessed 28.10.2021].

Sellke, Piet/Renn, Ortwin (2019): »Risiko-Governance«, in: Jochen Mayerl/Thomas Krause/Andreas Wahl/Marius Wuketich (Eds.) Einstellungen und Verhalten in der empirischen Sozialforschung, Wiesbaden: Springer VS, pp. 97-125.

Smith, Graham/Setälä, Maija (2018): »Mini-Publics and Deliberative Democracy«, in: Andre Bächtiger/John S. Dryzek/Jane Mansbridge/Mark Warren (Eds.), The Oxford Handbook of Deliberative Democracy. Oxford: Oxford University Press, pp. 300-314.

Spangenberg, Joachim H./Kuhlmann, Wolfgang (2020): Bioökonomie im Lichte der planetaren Grenzen und des Schutzes der biologischen Vielfalt. Eine Studie für den BUND und das denkhaus Bremen. https://denkhausbremen.de/wp-content/uploads/2021/03/Studie-Biooekonomie-final.pdf [Accessed 10.06.2022].

Strele, Martin/Lüdeman, Martin/Nanz, Patrizia (2012): BürgerInnen-Räte in Österreich: Gemeinsames Forschungsprojekt des Lebensministeriums und des Büros für Zukunftsfragen. Ergebnisbericht zur begleitenden Evaluation, Bregenz/Wien. https://www.yumpu.com/de/document/view/19782022/burgerinnen-rate-in-osterreich-vorarlberg [Accessed 10.06.2022].

Szarka, Nora/Haufe, Henryk/Lange, Nora/Schier, Franziska/Weimar, Holger/Banse, Martin/Sturm, Viktoriya/Dammer, Lara/Piotrowski, Stephan/Thrän, Daniela (2021): »Biomass flow in bioeconomy: Overview for Germany«, in: Renewable & Sustainable Energy Reviews 150. https://doi.org/10.1016/j.rser.2021.111449.

Voorberg, William H./Bekkers, Victor J. J. M./Tummers, Lars G. (2014): »A Systematic Review of Co-Creation and Co-Production: Embarking on the Social Innovation Journey«, in: Public Management Review 17.9, pp. 1333-1357. DOI: 10.1080/14719037.2014.930505.

Wagner, Sabine (2019): Lokales Demokratie-Update. Wirkung dialogorientierter und direktdemokratischer Bürgerbeteiligung, Wiesbaden: Springer VS.

Webler, Thomas/Tuler, Seth (2018): »Four decades of public participation in risk decision making«, in: Risk Analysis 41, pp. 503-518. https://doi.org/10.1111/risa.13250.

Zichy, Michael/Dürnberger, Christian/Formowitz, Beate/Uhl, Anne (2014): Energie aus Biomasse – ein ethisches Diskussionsmodell. Wiesbaden: Springer VS.