Indicator Politics: Modelling Societal Problems Under Real-World Conditions

Stefan Böschen

1 Introduction: Societal Problem-Solving as Modelling

Societal problem-solving as an overarching term links different social spheres such as politics, culture, economics and the public sphere with epistemic and technical questions in experimental processes. Such processes open up opportunities for the organization of collective order, whether as confirmation or change, in order not only to grasp the world adequately in terms of reality, but also to identify design possibilities for improving interaction opportunities with the world. Models play a key role in this.[1] Models bundle specific states of aspects of the social or natural world in order to enable learning processes in this way. "[Via] these models we reconstruct our world as an external world of means under our ends." But at the same time, "we give the world a chance for us to change (and our models) in the course of the change we make in the world for experimentation. After the experiment as 'event,' not merely

[1] On the concept of models, see Tondl (2003, pp. 122ff.) and Hubig (2006, pp. 198ff.).

S. Böschen (✉)
Käte Hamburger Kolleg "Cultures of Research", RWTH Aachen University, Aachen, Germany
e-mail: stefan.boeschen@humtec.rwth-aachen.de

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nature but we ourselves are 'transformed'."[2] A further specification can be made by looking at models as scenarios.[3] Prototype scenarios play a formative role here.[4] In contrast to narrative scenarios, which capture socio-technical settings as a narrative, prototype scenarios form a material arrangement. The FabLab movement[5] ultimately opens up real labs for the development of very different prototype scenarios, making them accessible to experimental testing.

Now, it is fair to argue that the modelling of societal problems is by no means identical to the formulation of prototype scenarios. This brings into play an important idea, namely the question of the structure of societal problems. Here we can identify different forms.[6] A simple case are well-structured problems like those where the knowledge and value bases are more or less consensual and where there are, if any, only challenges to more effective modellings of the problem. Here, the focus on outstanding factual issues is functional. The situation is different, though, for partially structured problems like those where knowledge bases are not yet consensual and where the normative standards of evaluation diverge. Finally, we are dealing with unstructured problems when knowledge bases as well as normative standards differ.[7] The debate on sustainable development represents the paradigmatic case of a discourse in which the construction of the problem involves a mixture of social, economic, political and epidemic issues. At the same time, this case is challenging in contrast to well-known well-structured problems, such as the regulation of industrial chemicals. There are no simple, clear standards for the construction of such a problem, as the forms of implementing sustainability are simply too multifaceted. For this reason, it is the construction of societal problems, their concrete modelling as well as their institutional framework conditions that are essential in order to arrive at adequate problem descriptions and means of problem-solving that are as effective as they are legitimate. Societal problems do not simply exist.

[2] Hubig (2006, p. 199); translation S. B.

[3] Schulz-Schaeffer and Meister (2017).

[4] Dickel (2019).

[5] Schneider (2018).

[6] Hurlbert and Gupta (2015).

[7] Cf. Hurlbert and Gupta (2015, p. 102).

Against this background, the following line of argumentation will be pursued in this paper. First, the interplay of epistemic-technical and societal processes will be reconstructed as an emergence of civic epistemologies. Here, the dynamics of contextual references play a decisive role (Sect. 2). Secondly, the knowledge relations of societal problems are analytically separated as an interplay of indicators, criteria and observables. The argument will be made that there are basically two ways of dealing with indicators: Indicator work and indicator politics (Sect. 3). This difference is further outlined by an analysis of political discourses distinguishing between political ability ("politisches Können"), political will ("politisches Wollen") and political obligation ("politisches Sollen"). Indicator politics, in contrast to indicator work, which focuses on political ability, places political will and obligation above political ability (Sect. 4). Thus equipped, we take a look at a selected site for defining and solving societal problems: Real-world laboratories (Sect. 5). A summary and outlook conclude these reflections (Sect. 6).

2 Civic Epistemologies: Processing Context-Neutrality and Context-Openness

In societal problem-solving, the structure of institutionalized spaces in which the development of problem descriptions as well as problem solutions can be addressed plays a decisive role. The effectiveness and legitimacy of this procedure depends on whether the problem construction takes place in a way that is perceived as relevant and appropriate by the participants. For the institutional framing of processes of risk regulation, Sheila Jasanoff proposed the concept of "civic epistemologies," which generally can be applied to considerations such as those developed here. As Jasanoff wrote in her seminal book *Designs on Nature*: "Civic epistemology […] refers to the institutionalized practices by which members of a given society test and deploy knowledge claims used as a basis for making collective choices."[8] In this definition, the focus is on the institutional aspects of knowledge processing. Clark Miller emphasizes another aspect of civic epistemology, namely "practices, methods, and institutional processes by which the community identifies new policy issues, generates knowledge relevant to their resolution, and puts that

[8] Jasanoff (2005, p. 255).

knowledge to use in making decisions."[9] Miller mainly addresses the openness of the situation with respect to practices. The social, cognitive and temporal dynamics in civic epistemologies enable processes that open black boxes. Thus, the heterogeneity resulting from different knowledge resources can be ordered and institutional environments for processing different forms of expertise can be created.

Conceptually, the formation of civic epistemologies can be contoured even more precisely if one looks more specifically into strategies of structuring the problem situations. Basically, we are dealing with fundamentally different strategies of problem construction. Rather simplifying, yet in an instructive way, it has been claimed that such a difference in strategies can be described by a distinction between context-neutralizing and context-open forms of risk communication.[10] Although originating from a different debate, this distinction nevertheless represents a form-theoretical argument that can be made fruitful for other problems, including strategies for analyzing complex problems.

According to Giegel, the first form of risk communication is characterized by the fact that it follows a mode of operation similar to that of differentiated subsystems: context-neutralizing operations "are characterized by the fact that they establish a strict boundary between an inner area, in which complexity is drastically reduced, and an outer area, which in its over-complexity cannot be understood and certainly not practically mastered."[11] However, this gain in rationalization in the inner area demands stability of social and natural factors in the then separated outer area. For it is quite obvious that operations such as those initiated in large power plants cannot themselves produce the socio-material environment they require (i.e. for example: the necessary standards, infrastructures, human capital, legal basis for operation and much more). Context-neutralizing operations work while they somehow ignore environmental complexity.

In contrast, with context-open operations, "the attempt to draw a strict boundary between system-internally regulated and system-external communication of the lifeworld […] remains inherently contradictory."[12]

[9] Miller (2005, p. 406).

[10] Giegel (1993).

[11] Giegel (1993, p. 107); translation S. B.

[12] Giegel (1993, p. 108); translation S. B.

We encounter this form of operations especially in those areas where the integration of environmental complexity is of great importance and narrow system boundaries are to be broken down, for example in medicine, nursing, education or even in pastoral care. Therefore, "in context-open operations, it can no longer be a matter of carrying out an internal system operation alone and leaving everything else to the environment; rather, the processing of the environment itself must still be included in the internal operation."[13] What is crucial here is that despite the creation of an internal area capable of being processed, which allows complexity to be reduced, "the established boundaries between the inside and the outside of the system under consideration are repeatedly breached."[14] Thus, the difference between these two modes of operation is not found in the creation of internal areas that are relieved of complexity, but in the sensitive handling of the boundaries that are created at the same time. Ultimately, the difference between context neutrality and context-openness can be found in different variations in the literature. Of particular importance is the argument of how the dynamics of participatory opening and closing can and should be dealt with.[15]

In the societal construction of problems, both forms of operation are typically present. Context-neutralizing operations are obvious in cases where there is already a clear system definition for the problem to be addressed. Context-open operations are helpful when the contours of the problem are not conclusively defined and the exploration of the problem is part of the discussion. In principle, a selection of analytical strategies appropriate to the subject matter is a challenge for any type of formation of civic epistemologies, yet a tendency towards context-neutralizing analysis strategies can be observed. The sheer complexity of societal problems can be mirrored in the difficulties of meaningfully configuring context-neutralizing and context-opening analysis strategies via institutionalized procedures of problem-solving.

[13] Giegel (1993, p. 108); translation S. B.

[14] Giegel (1993, p. 108); translation S. B.

[15] Stirling (2008).

3 Social-Epistemical Construction of Problems by Indicators

While looking at emerging civic epistemologies, it is important to take into account a wide variety of features. One aspect focuses on orders and standards for epistemic quality as well as on positions of epistemic authority during problem-solving processes. This can be observed, for example, in the field of chemicals or genetic engineering technologies, but also during transformation processes like the energy or mobility transition. In all these cases, societies are not only taking problem-solving actions, but, at the same time, these actions are changing the existing collective and the epistemic order. Some aspects that are strongly influencing the structure of such civic epistemologies are the complexity of the infrastructures related to these solutions, the multifaceted history of problem-solving, the possibility of multiple futures and development pathways,[16] the landscapes of multiple knowledges and non-knowledges[17] and the specific social challenges like building trust or confidence. Within such processes of emerging civic epistemologies, the standards for the form and relevance of knowledge and the hierarchy of epistemic agents are (more or less explicitly) formulated and fixed. Thus, the boundary conditions as well as the objects of problem-solving are constituted within civic epistemologies, understood as regimes of specifying and ignoring problem-solving while processing problems. Roughly speaking, there are three heuristically distinguishable dynamics of articulating, selecting and solving problems. They are typically co-present and related to different actor groups.

The first dynamic is the articulation of a problem; it might be termed 'problem setting.' The dynamics of emerging civic epistemologies are fueled by the introduction of a problem and the processes emanating from the 'affordance' that lies in the simple fact of presenting a problem. There are numerous examples for these processes; but without the here suggested conceptualisation of such phenomena these processes used to be analyzed within the so-called agnotology studies.[18] The example of the regulation-avoiding strategies of the tobacco industry illustrates that

[16] Lösch and Schneider (2016).

[17] Gross and McGoey (2015).

[18] Oreskes and Conway (2010).

they did not make the claim that cigarettes had no effects on health. The strategy was far more subtle. It claimed that if there were connections between cigarettes and cancer, they would represent a severe health hazard that needed to be regulated. Therefore, these conjectures should be thoroughly studied. And if strict evidence of this causality should be proven then smoking and the purchase of cigarettes should be regulated. The point here is to demand unambiguousness, which seems quasi-impossible. And indeed, it took about fifty years of research to get to this point. So, with the introduction of the problem ('cancerogeneity of tobacco'), also standards for epistemic quality were articulated to frame the problem more specifically. As the tobacco industry succeeded with its epistemic tactic to call for the highest standards of evidence, this problem articulation heavily influenced the dynamic within this epistemic regime.

The second dynamic concerns the choice between different options to articulate a problem. Problem descriptions are changing over time within epistemic regimes. In any case, emerging civic epistemologies regulate which problem descriptions are feasible and legitimate and which ones are not—and which other problems and aspects will therefore be put aside or ignored. The problem dynamic is a story of choosing problems, more specifically, to expect non-knowledge in the context of these problems, and to reduce it. A case in point is the change from damage indicators to hazard indicators in the regulation of chemicals within the EU.[19] The paradigm shift is hidden in the abstract formula 'PBT equals CMR'. PBT represents the indicators "persistency", "bioaccumulation potential" and "toxicity". CMR represents the indicators "carcinogenicity", "mutagenicity" and "reproductive toxicity" of a chemical substance. Equating PBT with CMR substances represents a focus shift from the level of damage to the level of hazard: PBT indicators are indicators of possible harm ("hazard"), whereas CMR indicators are indicators of concrete damages ("risk"). This shift must be seen as a revolution. For many decades, the evidence of a real danger had to be proven to allow regulation. Now, regulation can be implemented when a possible harm is indicated. That way, standards for epistemic quality were redefined as the sources of expertise and their disciplinary background changed. CMR indicators were used by toxicologists and physicians, PBT indicators by environmental chemists.

[19] Cf. Böschen (2014).

The third dynamic is connected to solving or processing a problem. One case in point is how the European Union regulated GMO (genetically modified organisms). A so-called post-release monitoring was established, instituting a time span of ten years to observe possible negative effects of the authorized organism. After this time span, a new approval of the GMO is required. Thus, the permission can be given on the basis of up-to-date knowledge and findings, or it can be denied. Moreover, procedures for testing hypotheses as well as for detecting unforeseen environmental effects were established. The overall strategy of temporalization is highly important to solve problems of non-knowledge. Nevertheless, this strategy depends on whether non-knowledge is seen to be resolvable over time. If the non-knowledge related to the main problems of a regime turns out to be irreducible then the social balance within that regime will become fragile. Against this background, the institutional order of processing the problem of detecting and reducing possible ecological effects of GMO is an advanced mechanism within an epistemic regime. This is why, within this order, standards for epistemic quality were redefined and EFSA (European Food Safety Authority) became the key player for processing epistemic quality.

This brief depiction of the articulation, selection and solving of socio-technical and socio-epistemic problems respectively also points to some specific challenges for societal problem-solving. First, the description of complex problems and the strategies to solve them are heavily influenced by the use of indicators. For example, the use of the indicator 'security of livelihood' in a sustainability problem introduces a specific description of a certain problem which is thus positioned as a key problem, with very clear and specific strategies for its solution.[20] In another example, using the indicator of toxicity as a central problem concerning the regulation of chemicals introduces both a specific description of the problem and a strategy to deal with it.[21] The use of indicators to provide a description and the classification of safety or precautionary strategies are interlinked. In many debates, the availability of specific problem-solving strategies organizes the problem context that is addressed through indicators.[22]

[20] Cf. with regard to climate science: Gramelsberger (2018).

[21] Cf. Böschen (2014).

[22] E.g. Garrelts and Flitner (2011).

Second, indicators cannot be seen as normatively neutral instruments for analyzing problems. Although indicators are tools for describing and analyzing a problem methodically, their selection is everything but normatively neutral. It makes an important difference whether we look at the CO_2 footprint of a product or at the whole chain of different risk factors associated with a technology. Thus, any study of a complex problem has to be inherently selective. Claiming comprehensiveness is therefore a form of implicit politics. Moreover, the selection of indicators is not normatively neutral but driven by specific criteria chosen by certain actors to propose a focused description of a problem. Therefore, with regard to the analysis of societal problem-solving, one has to be aware of both the epistemic quality of problem descriptions and its own selectivities.

What seems to be required is a specific knowledge analytics, allowing a more reflective and transparent perspective and offering insights into the normative as well as the empirical dimension of knowledge claims. Thus, it seems to be useful to build an analytical framework to classify the different aspects of knowledge used for the description of problems. A trias of indicators and their empirical and normative qualifiers seems to be helpful.[23] I suggest differentiating knowledge sources and their politicalness by three aspects: criteria, indicators and observables.[24] Criteria evaluate indicators against the background of general cultural values or interests (e.g. 'precautionary principle,' 'low-carbon society' or 'economic welfare'). Indicators represent an effect-related aspect of a problem, which should be considered or solved (e.g. 'toxicity,' 'cancerogenity' or 'CO2 footprint'). Finally, observables apply indicators by providing specified methods for empirical observations or test strategies (e.g. 'LC50 test' for acute toxicity or measurement routines related to industry norms).

Typically, in public-political discourses, statements only address the level of criteria and indicators. This is the level of general classification and normative orientation. The more technical level of observables is rarely addressed. One could argue that the observables are the most implicit part of 'indicator politics.' Let us return to the example of the tobacco industry analyzed within the framework of the agnotology studies. Expressed in terms of the knowledge analytics suggested here, this process can be

[23] Cf. Hubig (2016).

[24] Böschen (2014, pp. 40–41).

reconstructed. Although there was a consensus about the criteria ('protecting humans against health hazards') and indicators ('cancerogenity'), the problem was transformed onto the level of observables. Tests had to be constructed to meet the highest level of evidence. And, as there was a call for 'high evidence,' not only concrete methods for observation had to be constructed (and were contested), but a vast amount of data had to be observed. And that needed time.

We can see that the use of indicators harbours an inherent tension, if not a paradox. On the one hand, the use of indicators is necessary to analyze real-world problems and reduce their complexity to a manageable form. On the other hand, using indicators promotes a political statement as well; their use is in any case related to certain norms and values fueling the relevance of a single indicator or a specific set of indicators. By applying a certain indicator, attention is drawn to a selected aspect of the problem while others are ignored. Whereas in (emerging) civic epistemologies the debate is structured by an ongoing struggle between different knowledge providers claiming to know the 'true' problem description and aiming at maintaining or changing the rules of the civic epistemology. Against this background, we can introduce a distinction between indicator work and indicator politics. Conceptually, indicator work can be understood as the selection and configuration activity of indicators in the area of tension between two strategies of analysis: 'context neutralization' and 'context openness.' In contrast to indicator work, indicator politics tries to reduce the complexity of societal problems by highlighting specific aspects of societal problems while implicitly carrying out a context-neutralizing strategy. This could be observed very well in the debate on the use of nuclear energy. Under the impression of the climate issue, power plants could be presented as climate neutral. The other contexts (risks of the power plants, risks of uranium mining, etc.) then simply no longer carried any weight.

4 Political Discourses: Tensions Between Indicator Work and Indicator Politics

In order to work out the difference between indicator work and indicator politics more precisely, I will resort to a heuristic that comes from political theory. In addition to questions of competent governance based on (technical) expertise, the fundamental democratic concerns of collective decision-making and moral self-understanding are also negotiated.

These basic concerns correspond to three distinguishable semantics of public speaking. Thus, a heuristic should address three layers of political discourse which distinguishes between political ability ('politisches Können'), political will ('politisches Wollen') and political obligation ('politisches Sollen'). To clarify this, I will briefly characterize the three semantics below.

Firstly, democratic discourses have an implementation function according to which democratic politics is primarily about enabling efficient political decision-making and overall societal control,[25] i.e. generating and successfully applying effective forms of governance as a means of realizing the political self-determination of society (political ability). Democratic discourses unfold a specific semantics of political ability primarily in the medium of constituted power, i.e. in the institutionalized forms of democratic politics. In addition to the classic representative, governmental and social mediating institutions, political ability also includes diverse hybrid forms of governance in which networks of non-governmental organizations, business enterprises and individual citizens are also involved as actors. The implementation capacities of democratic discourses generated on this basis encompass the most diverse forms of knowledge,[26] ranging from factual information and technical expertise to the ability to understand the functioning of political processes and institutions as well as to assess which goals are politically feasible and what costs and non-intended side effects their implementation implies. The semantics of political ability thus concentrates on factual problems, which may always include norms, but address them primarily in the sense of coordination rules in processes of problem-solving. Normatively, the orientation towards the "values" of neutrality and objectivity in the context of "good governance"[27] is therefore inscribed in the semantics of political ability. This is about the capacity to determine, understand and handle those objective problems that arise as political tasks independently of the normative targets of collective will formation and moral convictions in the sense of competent and responsible problem-solving.

However, agreement on such normative guidelines is also an essential component of democratic discourse. Therefore, secondly, they represent

[25] Mayntz and Scharpf (1995).

[26] Nullmeier (1993) and Schuppert (2008).

[27] Czada (2010).

the attempt to enable a process of collective will formation through exchange, conflict, but also by bringing together different opinions, interests and ideas about the goals of political shaping (political will). The semantics of political will normatively express the basic democratic idea of collective self-determination and with it an understanding of political power not only as "constituted" but also as "constituting."[28] The power of the public sphere is thus to be understood here as a bottom-up phenomenon, i.e. as the power of a collective body of free and equal citizens.[29] In reality, this 'collective body' or the public as a whole always consists of a multitude of often contradictory positions, and processes of collective will formation take place primarily in the form of ongoing and not completely resolvable conflicts between them. But understood in such a pluralistic-agonal sense, the semantics of political will is nevertheless a real element of democratic politics, articulated in concrete forms of "practical enactment in public life"[30] and having real effects on the agenda of democratic processes. The political will of the public in this sense is factually articulated, for example, in fundamental readjustments of public debates on self-understanding, which can take the form of both fundamental 'additions' and (at least partial) 'interruptions' of previous public debates and corresponding development trends.[31]

However, democratic discourse on the normative basic coordinates of the political process is not exclusively about organizing collective will-forming processes, but—thirdly—also about the attempt to generate categories of moral orientation and to articulate basic principles of public-political morality, which determine, for example, basic rights worthy of protection as indispensable preconditions for the legitimate application of political formative power (political obligation). This moral character of public discourses is expressed above all through the fact that here the question of the fundamental restrictions to which political action should be subject is always a question of negotiation.[32] The corresponding semantics of political speech follow a logic that is objective and universal in its claim, but primarily negative, of determining the moral

[28] Kalyvas (2005, pp. 227ff.).

[29] Rawls (2003, p. 222).

[30] White and Ypi (2017, p. 444).

[31] Wenman (2013).

[32] Rawls (2002, pp. 27f.).

limits not only of what is politically "feasible," but also of the legitimate "arbitrariness" of the democratic sovereign.[33]

Against this background, it can be argued that it is crucial how indicators (as an expression of political skill) are embedded and used. This is because they represent selected aspects of reality that are considered relevant and should be addressed through political action. In situations where there are well-structured problems, the indicators used to describe the social problem are usually indisputable. At most, the question of the most effective observables then plays an important role. Not so, however, with unstructured or highly unstructured problems. For here, in addition to the characterization of sections of reality, the aspects of societal problems that are considered essential are emphasized. These are mostly acts of political will or political obligation. They serve to characterize the problem in a way that corresponds to the respective convictions and problem-solving strategies of the expressing actors. Depending on the institutional structure of civic epistemology, this 'doing problems' leads to a more or less far-reaching selectivity or blockade. In this sense, indicator politics can be understood as the tactical use of indicators to mobilize support for a selective description of problems and a one-sided interpretation and development of rules in civic epistemologies.

5 Real-World Labs: Playing Fields for Indicator Politics

These general considerations regarding the social construction and processing of problems can be further specified very well in the case of the real-world laboratories. In terms of knowledge policy, the establishment of real-world laboratories (living labs) represents the most ambitious form of societal experimentation practices to date. Such practices of experimentation not only display an astonishing diversity, but are also even more ubiquitous in contemporary societies. Under the auspices of a 'Great Transformation' the establishment of real-world labs is accorded special significance. While transformative processes represent highly experimental processes, real-world labs can provide transformative research spaces with a quasi-stable framework. In "real-world labs"[34] actors from

[33] Rawls (2002, p. 31).

[34] E.g. Wanner et al. (2018) and Engels et al. (2019).

different stakeholder groups, in particular from science and civil society, but also from politics and business, should cooperate[35] in order to experimentally produce new approaches to sustainable action and thus shape transformation processes.

Ultimately, a variety of different forms of local experimentation follow this concept. These include living labs, urban labs, transition experiments, social innovation labs and many others.[36] Although there is no lack of attempt to analytically separate the various forms and position them in relation to one another, this conceptual jungle has not yet been truly penetrated, if only because the diversity of the social and cultural contexts of real-world labs is very high. Nevertheless, a defining characteristic of real-world labs that transcends all these activities is that they are intended to experimentally address problems that are positioned as socially relevant and to develop (knowledge) solutions by means of collaborative action. Roughly speaking, three groups of real-world labs can be classified.

Firstly, there is the group of real-world labs that are grouped around individual products, services or otherwise clearly definable objects.[37] Such real-world labs are characterized by a high degree of condensation of the concrete research situation allowing to balance context-neutralization and context-openness and to specify research questions accordingly. It is probably no coincidence that an abundance of real-world labs of this type has been established in the field of digital technologies. Alavi et al. have proposed an instructive grouping of this real-world lab type.[38] These real-world labs differ according to the degree of control over the experimental situation exerted by the participating scientists, and they range from 'Visited Places' with the highest degree of control to 'Innovation Spaces' with a perspective of shared control through co-production processes.

The second group of real-world labs focuses on activities in the field of spatially bound developments. Here, the focus is particularly on neighbourhoods or cities. This type of lab, which is also referred to as Urban Transition Labs, Urban Labs or City Labs,[39] is of particular importance because the associated experimental practices are not only spatially

[35] Cf. e.g. Compagnucci et al. (2021).

[36] Schäpke et al. (2018).

[37] E.g. Hyysalo and Hakkarainen (2014).

[38] Alavi et al. (2020).

[39] Scholl and de Kraker (2021).

assigned, but at the same time the hierarchical coordination of action is facilitated by planning staffs in administrations, and new options can be brought into play via specific milieus of civil society actors.[40] In its 2011 transformation report, the WBGU encouraged municipalities to provide such experiments: "Municipalities should generally show more courage for ambitious experiments with a signal effect."[41] In a more recent annual report, the WBGU even advocates the idea of "50 global urban real laboratories over 50 years"[42] to provide a stable framework for transformative research. In real-world labs, actors from science, civil society, politics and business should cooperate to experimentally produce new approaches to sustainable action and thus make contributions to the transformation on the ground.

The third group deals with questions of sustainability transformation in different facets. Even if the moment of close spatial coordination (e.g. in neighbourhoods) is often significant here, these activities are not characterized by a specific innovative motivation, but rather attempt to open up a space for diverse experimental testing.[43] At the same time, a rich discourse of reflection has established itself in this field of sustainability and transformation research. For example, Schäpke et al. distinguish real-world labs by five relevant dimensions, which they define as (1) the contribution to transformation processes, (2) the use of experimental methods, (3) the orientation towards a transdisciplinary research mode, (4) the scalability and transferability of results and (5) learning and reflexivity.[44] In other works, specific normative values are accentuated even more, such as the "normative orientation towards sustainability" or "civil society orientation."[45] In essence, it is about the co-production of model-capable design knowledge, which is elaborated by means of transdisciplinary transformation or sustainability research in a fixed location, in order to solve concrete, hitherto poorly defined or poorly definable societal problems. Nevertheless, such basic characteristics of transformation

[40] WBGU (2016), Evans and Karvonen (2014), and Voytenko et al. (2016).

[41] WBGU (2011, p. 316).

[42] WGBU (2016, p. 36).

[43] E.g. Quartier Zukunft (2020).

[44] Schäpke et al. (2018).

[45] Beecroft and Parodi (2016, p. 7).

real-world labs remain too unspecific to be able to describe their characteristics adequately and at the same time distinguish them from other activities.

Obviously, these three forms of real-world labs correspond in a certain way with the strategies for constructing problems. In the first group of real-world labs, context-neutralizing strategies predominate. The aim is to increase technical functionality. And, with regard to the quest of construction, one can state that constructing is making a functional simplification that continuously transforms inputs into outputs in a stabilizing way. Luhmann defined technology accordingly as a "functioning simplification in the medium of causality."[46] Technology structures specific sections of reality in a simplifying way. It functions by stabilizing pragmatic expectations into reproducible routines. The goals and functionalization desires vary, which is why technology is not used to depict reality, but rather to open it up in a way that is bound to action practice. The second group already has to deal with greater challenges here, because context-opening strategies play a role in the processes of designing on site. They must therefore also be reflected in civic epistemologies. If these demands are ignored, public-political conflicts are unavoidable. Rather, one can generally say that the balance between context neutrality (in order to increase political ability) and context-openness (in order to provide an arena for political will and obligation at the same time) is particularly difficult to achieve here. The third group, on the other hand, is easier to manage, because an open experimental space is actually set up for trying out new problem articulations. During this process, new options for linking political ability, will and obligation can be explored. Moreover, this experimental openness eases the possible sharpness of public-political discourse.

6 Conclusion

Real-world labs as infrastructures for real experimental practices provide a structured space of experience to explore and stabilize innovation or transformation options. Since real-world labs extend expansively into the lifeworlds of many citizens, the institutional design of such real-world labs is all the more important, and the more fundamental questions of order

[46] Luhmann (1991, p. 97).

in the respective lifeworlds are touched upon. Against this background, it is important to examine the democratic implications of participation in such socio-techno-ecological innovations in good time and to determine what kind of real-world laboratory is involved. If one sums up the considerations of this article, then two indications in particular can be derived with regard to the question of modelling social problems in real-world labs.

Firstly, it is important to take into account the sometimes intricate connection between the problems to be constructed and the innovations as well as the dimensions of political discourse expressed in them. Depending on the structuredness of the problem, the specific significance of the dimensions of political ability, political will and political obligation occurs. It should be clear that even if a problem initially presents itself as a purely factual problem, options for opening up to the other two dimensions should also be provided for. As things have politics, they can always become the object of politicization. In the case of poorly structured or even poorly structurable problems, special attention must even be paid to the political will and obligation in order to sensibly delineate the problem-solving space in which the factual questions can be dealt with.

Secondly, it seems essential to understand real-world labs as an emergent civic epistemology, in which questions of an appropriate institutionalization of problem-solving processes are dealt with in addition to epistemic-technical questions. In this way, the interplay of the three political discourses can be disentangled and the real-world labs work as a place for the construction of epistemic-technical solutions to societal problems. The litmus test is the extent to which indicator work can be carried out—or indicator politics dominate.

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