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Aneliya Paneva[1*]

CHALLENGES OF SCIENCE-SOCIETY INTERACTIONS IN THE FRAME OF SUSTAINABLE DEVELOPMENT: A CASE-STUDY OF CONTEMPORARY BULGARIA

Abstract: Effectively tackling problems of sustainable development such as climate change, poverty, and biodiversity loss requires a different perspective on the role of science in society. Building on the understanding that knowledge production processes shall go hand in hand with governance processes, sustainability science and ecological economics promote transdisciplinarity and participatory procedures as a key requirement for scientific work on nature-society interactions. Involving non-academic actors such as local lay persons, civil society representatives, businesses, and decision makers in the research process promises the discovery of practical solutions to related problems and empowerment of communities. While this novel research approach has been increasingly applied in Western societies, its adoption by scientific actors in the context of Central and Eastern Europe, however, remains relatively low. Employing Bulgaria as a case study, this investigation examined the inter-actions between academia and practice through a series of expert interviews and a review of policy documents, thus offering insights into the specific conditions of implementing science for sustainable development. It emerges that knowledge transfer and experience exchange in the field are needed. Promoting social learning in this domain requires clarification of the roles of actors and institutions for sustainable development. Finally, recommendations for science related policies and scientific work are given.

Key words: sustainable development, scientific knowledge production, transdisciplinarity, social learning, Central and Eastern Europe, Bulgaria

[1]aneliya.paneva@uol.de (corresponding author)
[*]Carl von Ossietzky University, School of Computing Science, Business Administration, Economics and Law, Department of Ecological Economics, Oldenburg, Germany

Introduction

Environmental concerns caused by adverse anthropogenic impact on the Earth-system processes urge societies to re-consider destructive development paths (Rockström et al., 2009; Steffen et al., 2015). The roles of science[2] and research in this context have been increasingly recognized and debated. A more recent understanding of how to deal with cross-cutting issues, such as regional environmental change and transition towards sustainability, is that a transdisciplinary approach beyond interdisciplinarity is required for scientific work (ICSU, 2010; Future Earth, 2014). As defined in the Global Sustainable Development Report, transdisciplinarity is a novel paradigm of science for sustainable development that "combines interdisciplinarity and participatory approaches and requires reaching out to various communities..., e.g. from local and indigenous communities, user groups, the general public, [and] non-governmental organizations" (UN, 2015). The recognition that existing scientific models, (e.g., static and reductionist ones) are ill-prepared to cope with emerging problems, has inevitably led to the search for new, more appropriate research approaches. While multidisciplinarity fails both to develop a common language for different academic disciplines and to enable communication among researchers, interdisciplinarity, which brings researchers together to work on a common problem, falls short in that it remains relevant predominantly in a university context (Daly & Farley, 2011). What is called for is a complex-systemic approach that allows for viewing a certain system (e.g., a society) from a bird's eye, and for understanding its complexity and main properties that arise from interactions and relationships among its parts (Gallopin et al., 2001). Building on this, transdisciplinary research that goes beyond disciplinary boundaries has become an imperative for addressing problems of sustainable development (Scholz & Marks, 2001; Lang et al., 2012; Mauser et al., 2013). Luks and Siebenhüner (2007) draw particular attention to the adequate roles of actors and institutions for sustainability governance because it is not only the role of science that is challenged, but of politics as well. In this sense, transdisciplinarity is related to social learning, which represents the close interaction between science, policy, and society to establish a knowledge base, rules, and regulations in the frame of sustainable development, described as a process of change on a society level that is based on newly acquired knowledge, a change in predominant value structures, or of social norms which results in practical outcomes. Its relevance is particularly pronounced for management regimes in which new organization of social practices is necessary to deal with uncertainty and complexity, such as the fields of water resources management and climate adaptation (Pahl-Wostl et al., 2008; Collins & Ison, 2009; Pahl-Wostl et al., 2011; Ensor & Harvey, 2015). Practical insights from the Swiss and German experience are contained among others, in the "Mountland" project related to sustainable land-use practices in European mountain regions and awarded as a best practice in transdisciplinary research by the td-net of the Swiss Academies of Arts and Sciences, the Social-Ecological Research Program implemented as part of the Germany's Research Program for Sustainable Development (FONA), and the GLOWA-Danube project for sustainable use of water in the Upper Danube basin (Huber et al., 2013; Ruppert-Winkel et al., 2015; Mauser & Prasch, 2016). Jahn et al. (2012 a) provide a general definition that represents the common understanding among scholars in the field, describing transdisciplinarity as "a reflexive research approach that addresses societal

[2] For the purposes of this paper, science is referred to both natural and social sciences.

problems by means of interdisciplinary collaboration as well as the collaboration between researchers and extra-scientific actors; its aim is to enable mutual learning processes between science and society; integration is the main cognitive challenge of the research process." Linking societal to scientific problems, the scholars develop further a conceptual model to be used as practical guidance for implementing an ideal trans-disciplinary research process consisting of three main phases – problem transformation, in which cooperation between different stakeholders involved in an issue is established; production of new knowledge, during which different bodies of knowledge are included; and transdisciplinary integration, where insights gained and potential contribution to real-world problems and scientific progress are elaborated.

Central fields of study and concepts underlying the debate over the changing roles of science in the context of sustainable development include sustainability science, ecological economics, and post-normal science, which developed as a reaction to an increased awareness of environmental problems since the 1960s. Fundamental documents in this area include the World Conservation Strategy and the National Research Council's report 'Our Common Journey: A Transition Toward Sustainability.' Sustainability science developed as a unifying field of various disciplines from the social and Earth sciences and engineering, which "deals with the interactions between natural and social systems, and with how those interactions affect the challenge of sustainability: meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems" (PNAS, 2016). For delivering the required understanding of these interactions, involvement of different bodies of knowledge is adopted as a central approach to research: "In a world put at risk by the unintended consequences of scientific progress, participatory procedures involving scientists, stakeholders, advocates, active citizens, and users of knowledge are critically needed" (Kates et al., 2001). It is precisely this strand of thought that the concept of stakeholder participation evolves from and that is further regarded as a way to promote education, empowerment of local communities, and a higher legitimacy of scientific research (Siebenhüner, 2004). In a parallel process, ecological economics emerged in the late 1980s as a transdisciplinary field of study that seeks to address the relationship between ecosystems and economic systems. It rests on the assumption that an ever-increasing economic growth cannot be sustainable on a finite planet (Costanza et al., 1991). In this changing context, where human activities are associated with industrial risk and, in general, adverse environmental and social impacts, the concept of 'post-normal science' layed the foundation of a new problem-solving practice, reaching beyond applied science and professional consultancy to ensure quality of science by an "extension of the peer-community" that allows for taking into consideration all legitimate perspectives and forms of knowledge of an issue (Funtowicz & Ravetz 1992, 1993, 1994). Accordingly, challenges for conducting scientific research have been identified to serve as criteria for research programs and to support the organization of open knowledge systems in the frame of sustainability (Luks & Siebenhüner, 2007; Jahn et al., 2012b; Cornell et al., 2013). A more recent view on the responsibility of science for integration of ecological, societal, and ethical concerns in scientific work is conveyed in the Manifesto for a Responsible Scientific Research presented at the 5th Degrowth International Conference in Budapest, 2016 that calls on researchers and their institutions to admit co-responsibility in techno-industrial development and to participate in the process of

rebuilding confidence between science and society (Fondation Sciences Citoyennes, 2016).

Problem statement and aims

While the changing role of science in the frame of sustainable development and its implications for scientific inquiry is predominantly debated in pro-democratic societies, this issue has barely been referred to post-communist societies. However, the relevancy of sustainability science and the need for exploiting the potential of the transdisciplinary approach for solving pressing problems particulary in the region of Central and Eastern Europe (CEE) is increasing. This draws on the closing document of the regional consultation for implementing the UN 2030 Agenda for Sustainable Development in Central and Eastern Europe, in which irreversible environmental damage is pointed to as an urgent priority to address (REC, 2016). Further, it is related to the on-going process initiated by the UNESCO National Commissions of Germany, Austria, Slovakia, and Poland for promoting Sustainability Science in CEE. More than 40 representatives from governmental and academic institutions came together in a workshop held in Bratislava June 15-17, 2014 to discuss the conceptualization of sustainability science in the context of the region. A major outcome was a joint agreement on some aspects of what science for sustainable development in this domain should be about: "Sustainability Science entails an opening of science towards society and its legitimate needs and demands. This requires more transparency [...] and interactive dialogue, including participation of society in setting scientific priorities [...] and inter- and transdisciplinary approach to research. " (UNESCO, 2014) However, some of these concepts may not be well familiar in all national contexts – as is, for example, the case of Bulgaria. In the scholary debate, transdisciplinarity has been related only to fields, such as education and the development of cross-curricular skills (Yancheva, 1996), public relations and the association with the concept of crisis (Pacheva, 2005), and the development of sociolinguistic theory (Pachev, 2007), but not yet to sustainable development. This indicates a need for developing a conceptual understanding of the problem. Against this background, it is the purpose of this paper to raise awareness of the related concepts first; and, second, to deliver empirical evidence for the key challenges to implement science for sustainable development. The case study of Bulgaria is employed, as it represents a strong example of the region. Major factors addressed include policy framework, processes of scientific knowledge production, societal expectations regarding the function of science and the needs of academia to take on a new role in the frame of sustainable development. Finally, practical implications from this analysis are drawn for theory, practice, and future research.

Data and Methods

For addressing these questions, a qualitative research approach is adopted. This allows for an in-depth understanding of the particular setting by capturing the perspectives of people (Yin, 2011). The main methods employed are a review of policy documents and expert interviews. The actual strategic documents related to science and research were analyzed and include the "National Research Development Strategy 2020", the new strategic vision for a research policy in support of society and economy "Better Science for a Better Bulgaria 2025", and the "National Innovation Strategy for Smart Specialization

(2014-2020)". The wording of these documents was reviewed according to prioritization of main areas for research and inclusion of sustainability science or transdisciplinarity. Moreover, personal communication with officials from the National Ministry of Science and Education was established based on the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters to discuss the existiing policy framework related to science for sustainable development. The investigation further draws on 10 expert interviews conducted between December 2014 and August 2015 with academic and non-academic actors (such as lecturers and researchers), journalists, and representatives from the government, civil society, and business organizations. For the purposes of this work, experts are regarded as individuals with professional background in the field of sustainable development and operating at the national level. The main topic discussed refers to the contribution of science for sustainable development in the domestic context, emphasizing personal perceptions regarding the obstacles and needs for strenghtening its role. All interviews were recorded and fully transcribed. Central patterns and categories have been identified through an inductive approach to data analysis, using the software programme for qualitative data analysis MAX QDA (Kuckartz, 2014).

Findings and Discussion

A long period of academic isolation during the communist period and a difficult transition to market economy and democracy, characterized by political instability, failure to establish trust among key actors, and a lack of recognition, are among the major reasons for science to pull back from political processes and social practice. Current statistics show that conditions for publication productivity and technical inventions remain unfavorable in the CEE region (Abbott & Schiermeier, 2014; Eurostat, 2016). Necessary and indispensable structural reforms have been slow to take place in Bulgaria. A lack of human capacities, ineffective management, and low expenditure on research and development are some of the general problems facing academia. The challenges of implementing science for sustainable development particulary relate to three main aspects: policy conditions, mode of scientific knowledge production, expectations and requirements for strengthening the role of science.

National science, research, and innovation policy framework

Promoting sustainability in research and policy development, which is one of the general recommendations in the position paper from the Regional Environmental Center for Central and Eastern Europe (REC, 2016) fails to be adequately addressed in the present national documents. The new strategic vision for a research policy in support of society and economy, "Better Science for a Better Bulgaria 2025", has been elaborated to reform the present system and to enhance capacities for fostering technology-based innovation, employment, and economic growth. Aligned with the National Innovation Strategy for Smart Specialization (2014-2020), the main priorities for scientific research include green technologies, environmental protection and monitoring, nanotechnology, information and communication technologies, national identity and anthropology, socio-economic development and governance (Ministry of Economy, 2015; Ministry of Science and Education, 2016a). Although the interdisciplinary approach has been integrated to serve as a foundation for innovations and as an instrument to improve the

communication among scientists and between academia and industry, the science-policy interface or transdisciplinarity as an instrument to improve the relationship between science and society have not been sufficiently elaborated on. The major barrier interviewees raised for implementing science for sustainable development under present conditions mainly relate to the lack of prioritization as one political representative claims: "a systemic approach to science for sustainable development fails to be adopted by the government yet" (Participant B2).

Scientific knowledge production

Producing problem-oriented knowledge in the domestic context remains problematic. On the one hand, behavior and negative attitudes of actors can have an unfavorable effect on the dialogue and cooperation among the different societal groups. On the other hand, the lack of awareness of an adequate methodology for scientific work (such as transdisciplinarity) prevents the possibility for science to act as an initiator for designing novel research projects that aim to include a wide range of stakeholders for addressing a certain problem. More recently, Radev (2013) has highlighted the contribution of Vernadski's work for the present times and its implication for the investigation of complex problems resulting from modern development, which, in turn, needs to build on pluridisciplinary and interdisciplinary approaches, but has not raised the need to include forms of knowledge found outside academic constructs. A far-reaching consequence of this lack of a tradition in doing research with society is that knowledge generated from academic research fails to be effectively used in practical applications, while the possibility to resolve socially relevant problems is not really being explored. This can also serve as an explanation for the negative patterns of expenditure on research and the effectiveness to bring about a real change to social or economy related problems observed in the analysis of the National Research Development Strategy 2014-2020 (Ministry of Science and Education, 2014).

National research programs in the frame of sustainable development

According to information from the National Ministry of Education and Science, actual research programs with a focus on sustainable development are the Bulgarian-Swiss Research Programme (2011-2016) financed by the Enlargement Contribution of the Swiss Confederation to enable Bulgarian researchers to network internationally and allow for the transfer of knowledge in ecology, the social sciences, medicine, and engineering. However, the program is not likely to be extended. At present, only the National Program for Young Researchers at the Bulgarian Academy of Sciences is in operation, which aims to provide additional financial support for PhD students and research assistants within the institution (Ministry of Science and Education, 2016b). Meanwhile, the low public awareness of the relevancy of the topic as well as corruptive practices within the national research funding body, make it difficult to obtain grants for sustainability-related research activities. As to educational programs, limited opportunities for professional development and the lack of academic experts are regarded as major obstacles for the establishment of degree courses in the field of sustainable development. Furthermore, study disciplines suited to explain and to deal with the relationship between nature and economic activity, are largely missing (Participants B3, B4, B7). As to educational programs dealing with the issue of climate change, the master program "Climate Change

and Water Management" was adapted and established at the Sofia University in the fall of 2014, in response to the increasing need for scientific expertise in the field. However, main problems that have been encountered relate to a lack of financing for procurement of specialized equipment, limited access to meteorological data due to a near-monopoly situation of the National Institute of Meteorology and Hydrology, and the low participation of scientists in decision-making processes because of the public administration's preference to cooperate rather with consulting companies and NGOs (Participant B10).

Societal expectations and requirements for strengthening the role of science

Against this background, then, science for sustainable development does not rank high in the national political agenda, nor have the necessary preconditions for available scientific expertise been created. In general, science is perceived by interviewees to have a weak and passive role for sustainable development in the domestic reality as it develops isolated from the realm of practice. However, rising expectations about "what it ought to be", relating specifically to the role of the national universities and the Bulgarian Academy of Sciences, center around three main facets: delivering a better understanding of the global and local problems of sustainable development, opening up to society and communicating scientific discoveries more effectively, and participating proactively in decision-making processes. This can be very well illustrated in the following quote stated by an actor from the civil society sector: "As academic institutions, it ought to be like a nest of wasps that generate creative ideas for the development of this nation, and even acting proactively, especially in the fields of ecology and sustainable development" (Participant B7). Moreover, the public administration has expressed a need for support from academic institutions with regard to identification and definition of emerging society-relevant problems (Council of Ministries, 2014). Thus, dissatisfaction with the performance of academic institutions concerning their contribution to matters of public interest can be observed, but while these expectations are just the one side of the coin, the perceived need for overcoming obstacles to implementing science for sustainable development voiced by scientific actors represents the other side of the coin. The establishment of an enabling environment for science is referred to as a prime priority. This includes, first, a requirement for clarification of the State's role in sustainable development within the EU multi-level system and the elaboration of a long-term vision for development building on regional approaches and geographical analysis. This, in turn, will enable other societal group actors to understand their role and functions in the whole system (Participants B3, B4, B5, B7, B8). Second, scientific capacities need to be developed and the knowledge base be broadened. Transferring foreign experience and knowledge has been recognized as focal for building expertise and for introducing innovative educational and research programs. Finally, measures for raising public awareness, such as the capacity development of media representatives, including managers, editors, and journalists, as well as ensuring access to high-quality information in academic and public libraries are emphasized for enhancing the understanding of the issue of sustainable development and for increasing the recognition of science "as a factor of decisive importance for getting out of this swamp…" (Participant B5).

Conclusion

Advancing a problem-and-solution-oriented science in the frame of sustainable development becomes increasingly important - not only in the international arena, but also in the region of CEE. However, creating appropriate conditions for implementing science for sustainable development in some of these countries can turn to be a daunting task. Failing to introduce sustainability science and transdisciplinarity in the theory, policy, and practice lowers the potential for addressing adequately regional and local problems of sustainable development. Based on the example of Bulgaria, it emerges that a raising of public awareness, knowledge transfer, and experience exchange in the field are needed. While, promoting social learning in this context as a key governance process for enabling a transition towards sustainable development would firstly require clarification of the roles of actors and institutions in this frame.

The need for re-defining the role of the state and institutions for sustainable development in the context of transition economies such as Bulgaria has also been identified by Atanasov (2009). The scholar suggests that the government should play a more active role in initiating sustainable development policies, however, the role of science, the way it is performed, and the use of scientific findings for resolving practical problems in this domain have barely been addressed. Nevertheless, the need for a new role of science in the society has been percieved among both academic and non-academic actors. Although a strong political will and support for strengthening science and research for sustainable development has not yet been observed, the findings reveal namely the increasing expectations of societal groups, such as media, civil society, and government on scientific institutions to participate proactively in policy-making and to act as central drivers of development.

Hanger et al. (2013), investigating the problem of adaptation governance across Europe, conclude that effective decision-making for adaptation depends on a well-functioning science-policy interface and show that the inclusion of lower levels of the administration remain problematic in CEE due to a lack of tradition in multi-level governance. Referring to processes of knowledge generation and policy-making at the local and national levels, it can be said that here, the yet untapped potential of transdisciplinarity could help establishing this tradition, while at the same time supporting on-going processes of decentralization and emerging patterns of governance based on participation. However, bringing this into reality, will require an effort to design and develop adequate research programs in the frame of sustainable development that explicitly aim to include stakeholders from science, policy, and society. But since such collaborative programs in general and on climate adaptation in particular are largely missing in Eastern European countries, as Massey (2009) finds out, it emerges as a key area of intervention. Practical applications that can be derived from this apply to national and international research funding organizations and refer to the necessity to address the specific needs for capacity development and scientific research, and to reconsider the provision of financial support for implementing novel research projects.

In view of this situation, it would be instructive to generate empirical data on the state of knowledge and the practice of sustainability science from other countries in the region. As to the national context of Bulgaria, policy makers need to integrate sustainability science and its implications for scientific research into higher education

and science policies; while, scientists are required to employ novel research approaches (as appropriate) and take responsibility for involving in policy-making. Furthermore, it is to underline the need for creating room for interaction and creative dialogue between science and society, in order to enable processes of learning that allow for introducing changes in social practices, roles, and responsibilities and ultimately collective action. How this can work, which participatory methods and institutions are required, as well as which best practices can be found, is surely a worthwhile focus for future research.

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Aneliya Paneva[3*]

ИЗАЗОВИ У ИНТЕРАКЦИЈАМА НАУКА – ДРУШТВО У КОНТЕКСТУ ОДРЖИВОГ РАЗВОЈА – СТУДИЈА СЛУЧАЈА: САВРЕМЕНА БУГАРСКА

Резиме: Ефикасно решавање проблема одрживог развоја, као што су климатске промене, сиромаштво и уништавање биодиверзитета, захтева посматрање различитих улога науке у друштву. Ослањајући се на схватање да се процес продукције знања развија упоредо са процесима управљања, наука о одрживости и еколошка економија промовишу трандисциплинарне и партиципаторне процедуре, као кључне за научни рад на интеракцијама природа – друштво. Укључивање и других актера (локалних и домаћих заједница, предузећа, доносиоца одлука и невладиних организација) у истраживачки процес помаже откривању практичних решења. Док се поменути приступ више примењује у западним друштвима, његово усвајање од стране истраживача у Централној и Источној Европи је остало на релативно ниском нивоу. На примеру Бугарске ово истраживање ће испитати међусобне активности између теорије и праксе кроз низ стручних разговора и прегледа стратешких докумената, пружајући увид у специфичне услове за примену науке у проучавању одрживог развоја. Из истраживања произилази да је потребно подизање јавне свести, трансфер знања и размене искуства у овој области. Потребно је да креатори политика интегришу одрживи развој и научна истраживања у високом образовању и научним политикама; док су научници у обавези да прихвате нове истраживачке приступе (по потреби).

[3] aneliya.paneva@uol.de (аутор за кореспонденцију)
*Карл фон Осиецки Универзитет, Школа за компјутерске науке, бизнис администрацију, економију и право, Департман за еколошку економију, Олденбург, Немачка