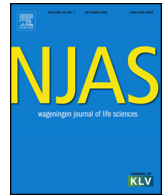




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Editorial

Social science perspectives on the bio-economy

1. Introduction

Both at the national and at the EU level, there is increased interest in the realisation of a bio-economy as a comprehensive approach to address the challenges concerning energy, food supply and natural resources which Europe and the world are facing [8,10]. Definitions of the bio-economy are derived mainly from strategic publications provided by public organisations [12]. The European Commission defines the bio-economy as an economy which “encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bio-energy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries” [9], p. 5). The Federal Ministry of Food and Agriculture in Germany defines the bio-economy as “the knowledge-based production and use of renewable resources to provide products, processes and services in all economic sectors, within the framework of an economic system which is viable for the future” [11], p.77). Other sources have used a narrower definition and focus on specific technical dimensions of the bio-economy, for instance limiting the bio-economy to biotechnology (e.g., [19], biofuels [21], or biological innovations [25].

Addressing global challenges such as climate change, population growth and an increasing demand for food in the bio-economy requires an improved knowledge of agricultural technologies that increase efficiency and environmental sustainability in food production, provide alternative sources for energy supply and offer biological solutions to improve health outcomes. However, such technical solutions cannot arise in a vacuum and will be influenced by public policies, regulations, consumer attitudes and societal responses. Therefore, research that investigates not only the biological and technical challenges of the bio-economy but also the social science dimension of the development of the bio-economy is required. Addressing the social dimension of the bio-economy is the specific aim of this Special Issue.

A review of the existing social science research on the bio-economy in Scopus, provides a number of interesting insights. First, out of a total number of more than 6500 publications registered in Scopus (up to March 2016) that relate to aspects of the bio-economy, only about 200 publications belong to the subject

area of the social sciences. This seems to suggest that social science research on the bio-economy is lagging behind other fields of research. Second, Fig. 1 shows that social science research on the bio-economy has only taken off in the last decade and especially after 2008. This confirms the relatively recent interest of social scientists in research on the bio-economy. Third, looking at the geographic distribution, almost 50% of the social science research on the bio-economy is contributed by Anglo-Saxon authors from the UK (53 publications) or the USA (41 publications).¹ Fourth, scrutinizing subject areas reveals that most social science publications focus on the interplay with the environmental science domain (60 publications), engineering (32 publications), arts and humanities (24 publications) and economics (21 publications). Finally, apart from ‘bioeconomy’ (44 publications) or ‘bio-economy’ (12 publications), the most frequently used keywords in social science research on the bio-economy are: ‘biotechnology’ (27 publications); ‘biomass’ (22 publications); ‘sustainability’ (21 publications); ‘sustainable development’ (19 publications) and ‘biofuel’ (17 publications). This seems to suggest that much of the existing social science research on the bio-economy focuses on the narrow definition of the bio-economy, namely the biotechnology and biofuels sectors. The Special Issue will contribute to the existing literature by (1) adding to the still limited share of articles on the bio-economy that use a social science perspective; (2) using a broad scope on the definition of the bio-economy that goes beyond specific sub-sectors such as biofuels and biotechnology.

This Special Issue gathers problem-oriented contributions that add empirical or theoretical insights about the bio-economy and specifically adds a social sciences perspective to the vast amount of research that currently exists on the bio-economy in the natural sciences domain. It draws on contributions of participants of the International Conference “Food in the Bio-based Economy: Sustainable Access and Provision”, that was held in Wageningen on May 27–29, 2015. The main contributions of the Special Issue are: (i) its relevance for informing policy; (ii) the strong empirical focus using a diversity of methodologies to address different aspects of the bio-economy; (iii) the identification of cross-cutting themes that help to outline a future research agenda on the bio-economy.

¹ Note that this does not necessarily mean that the geographic focus of the research is also limited to these countries.

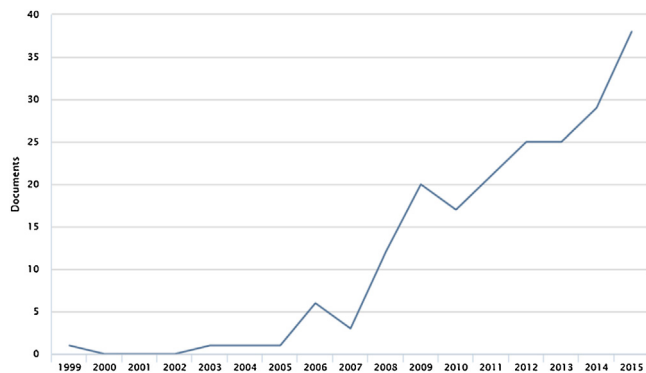


Fig. 1. Social science research on the bio-economy, 1999–2015.²

²Fig. 1 was produced using the following search string in Scopus: “TITLE-ABS-KEY (bio-economy OR biobased OR bioeconomy OR bio-based) AND SUBJAREA (mult OR arts OR busi OR deci OR econ OR psyc OR soci) AND (LIMIT-TO (SUBJAREA, ŠOCI))”.

Source: Scopus

2. Contributions of the special issue

2.1. Policy relevance

All contributions to the Special Issue provide input to an evidence-based policy discussion about the bio-economy. The relevance of such contributions is emphasized by Golembiewski et al. [12] who note that “*the necessity of a transition from a fossil- to a bio-based economy has been emphasized; nevertheless, existing publications mainly originate from governmental institutions and are primarily concerned with strategic agendas than with the identification of challenges and measures to implement the bioeconomy*”. Moreover, several studies highlight the potentially perverse effects that regulatory actions concerning the bio-economy may have if they are not guided by adequate theoretical and empirical evidence (see e.g., de Gorter et al. [5,6] for the case of biofuels policies).

The contributions gathered in the Special Issue provide policy-relevant insights in different aspects of the bio-economy: (i) the importance and measurement of the bio-economy; (ii) the impact of policies on adaptation and structural change in the bio-economy; (iii) the development of tools to guide the regulatory process; (iv) insights in the role of contextual drivers with respect to the bio-economy.

An important issue for policy makers is to have insight in the actual size of the bio-economy. Two studies in this Special Issue contribute to this goal by **estimating the size of the bio-economy** for respectively the Netherlands [14] and Germany [7]. Both studies point out that the bio-economy contributes between 6 and 7 per cent of gross national production and that this share is increasing over time. Moreover, the studies also provide insights in the effects of external conditions – such as the international market situation – on the development of the bio-economy. For instance, the bio-economy has grown in recent years because of increased globalization of the food sector, while the economic slump after the 2008 financial crisis hampered the growth of the bio-economy. Detailed evidence of the importance and the drivers of the bio-economy is interesting for policymakers that wish to stimulate or otherwise interfere in this sector.

A number of papers in the Special Issue investigate **the role of the regulatory environment in driving (or hampering) adaptation processes and structural change in the bio-economy**. Wesseler and Drabik [27] present a conceptual framework to enrich the debate around production and consumption decisions of land-based biofuels in the EU. The authors claim that arguments made in the food versus fuel discussion are often misleading in the EU context because many of the negative environmental externalities, to

which opponents in the debate refer, have already been addressed in existing environmental regulations. Therefore, an alternative method is proposed to ‘fuel’ the debate based on the comparison of production costs across products and countries to determine actual resource efficiency. The results of the exercise point to the benefits of the lowering of EU import tariffs for biofuels and biofuel feedstock coming from countries exhibiting low biofuel production costs such as developing African countries. Groeneveld et al. [13] investigate policy effects at the micro-level. They focus on the implications of changes in the regulatory framework in the dairy sector (milk quota abolishment in conjunction with stricter environmental policies) for adaptation and structural change. Results show that especially larger farms are likely to grow even larger and adopt more intensive production systems. Both studies provide relevant background information to policymakers about the intended and unintended impact of different policy measures.

Two papers included in the Special Issue develop **analytical tools that can help to guide regulatory processes in the bio-economy**. The paper by Smeets Kristkova et al. [24] explicitly models R&D-driven technical change in agriculture to improve projections of food security, a distinct feature that is lacking in other global impact assessment models. A state-of-the-art model is developed that allows the derivation of policy-oriented insights, by exploring the possible directions of R&D investments worldwide and their impacts on agricultural productivity and consequently on food security. The study reaches a number of novel insights. First, results show that R&D growth rates are waning; both in developing countries such as China and high income countries such as the EU and the US. Second, the model outcomes show that public R&D investments are unable to stimulate agricultural production to the levels that are generally expected in other impact studies. Similarly, Benjamin and Wesseler [4] develop an improved economic evaluation tool for the introduction of integrated pest management strategies. As opposed to conventional cost-benefit analysis techniques, the model developed in this paper include the uncertainty that exists over benefits and costs; the irreversibility of investment decisions and their effects; and externalities (both positive and negative). Both contributions highlight the importance of choosing an appropriate analytical tool when providing evidence-based policy advice.

Finally, two contributions in the Special Issue focus on **contextual drivers that can affect the bio-economy and the regulatory initiatives that target the sector**. One such factor entails the role of consumer perspectives and attitudes. The study by Sijtsema et al. [22] explores consumers’ perceptions regarding the concept of ‘bio-based’ and for specific bio-based products. Results from the study show that ‘bio-based’ is most often associated with positive environmental perceptions such as naturalness and environmental friendliness but also with negative environmental associations such as environmental pressure and to a lesser extent with technological and health aspects. The study illustrates the importance for policy-makers and stakeholders in general of being aware of consumer attitudes regarding novel concepts and products. Finally, the paper by Ochieng et al. [18] focuses on the effects of climate change on crop revenues in the case of smallholders in Kenya. Successful adaptation of smallholder production systems in the bio-economy is possible only if the effects of climate change are correctly estimated and disentangled from other potential sources of revenue variability. The authors find that climate change effects are not homogeneous across sectors. For instance, revenues in the tea sector (a major export product for Kenya) are affected more than those in the maize sector (a major food crop). These results indicate that while the bio-economy encompasses a wide range of sectors, policy-makers should be aware of sub-sectoral differences in adaptation and response to regulatory as well as contextual drivers.

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