Embedding sustainability of bioclusters into a multiscalar framework

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The transition to bioeconomy is often practiced in bioeconomy clusters, which are used by the governments to strengthen the collaboration between different bioeconomy actors and ultimately to contribute to active learning and enhance the innovative activity in bioeconomy.

Building upon the definition of Porter (1998), bioeconomy clusters (hereafter 'bioclusters') are specific types of sustainability-oriented clusters that constitute geographically proximate and interconnected firms and organizations specializing in various fields of bioeconomy.

On the one hand, bioclusters appropriate the benefits of geographic proximity and facilitate networking and innovation. On the other hand, bioclusters embrace sustainability and the pursuit of sustainable interaction between ecology and economy (Bosman & Rotmans, 2016) by, potentially, localizing production, conversion and consumption within the same region, thereby closing material flows and working on principles of industrial ecology (Deutz & Gibbs, 2008; Ehrenfeld, 1997). However, it is clear that bioclusters will have sustainability effects way beyond their regional borders and that a successful transition towards a bioeconomy can have both positive and negative effects on different Sustainable Development Goals (Biber-Freudenberger, Basukala, Bruckner, & Börner, 2018; Dietz, Börner, Förster, & von Braun, 2018). Therefore, it is important to include different sustainability measures in the research of bioclusters by taking a multiscalar perspective.

The concept of scales and levels

Scales and levels are applied in a variety of disciplines and in different contexts. We conceptualize them based on Gibson, Ostrom, and Ahn (2000) who defined scales as measures for different spatial, temporal, quantitative or analytical dimensions, and levels as specific positions on those scales. An example of two scales with different numbers of levels is shown on Figure 1.

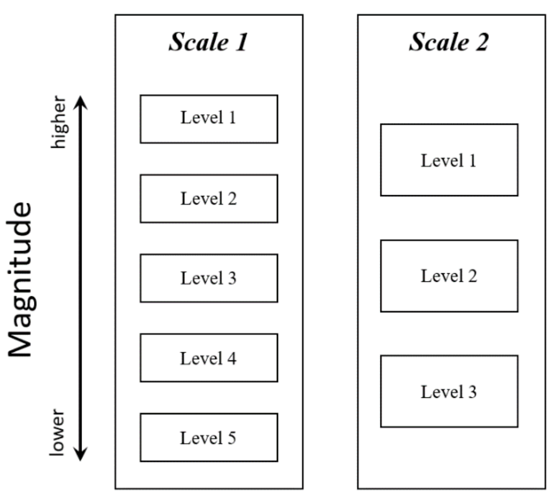

Figure 1. Illustration of scales and levels.
Source: based on Cash et al. (2006)

The lower levels on a scale correspond to the lower magnitude of the scale. Accordingly, the higher levels stand for the higher magnitude.

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In our contribution to the SFER Symposium, we aim to make a first step towards integrating the sustainability issues of bioclusters into a broader framework constructed from scales regarded to be important for bioclusters.

Our main research question is: *What are the scales and their interrelations in different types of bioclusters?*

Methodology

We used the method of quantitative meta-analysis to identify the scales of different case-study bioclusters. The meta-analysis was based on the data from 35 articles indexed in the Scopus database (https://www.scopus.com). An initial coding framework was based on some of the existing literature on socio-ecological systems (Cash et al., 2006), sustainability transitions (Hermans, Roep, & Klerkx, 2016) and clusters (Menzel & Fornahl, 2010). However, we followed an iterative coding process that allowed this coding framework to be extended with new scales during the analysis of the case studies.

The articles were analyzed by between one and three persons for better reliability. The process of data extraction implied finding references to different scales and levels in the articles. With this regard, an important assumption of the current methodology is that any scale-reference made by the author(s) implied a certain degree of significance of that scale for the particular case study. In other words, we assumed that the author(s) did not refer to any scale arbitrarily, but instead based on the significance of that scale.

Preliminary results and conclusions

In the end, our framework included 13 scales (see Figure 2). Scales like Knowledge accumulation & learning, Administration and Geography were most common in the case studies. On the contrary, scales like Employment, Production and Trust were emphasized less often by the authors.

The bioeconomy sectors covered by the case studies were mainly forestry, agriculture, aquaculture, winery and horticulture. The transformation pathways were different across sectors. For instance, forestry, agriculture and aquaculture based mostly on boosting primary sector productivity, whereas the sectors of winery and horticulture associated markedly with low-bulk & high-value applications.

The case-study bioclusters started to reveal interesting features when they were grouped according to the number of transformation pathways they pursued. We compared the number of transformation pathways in the bioclusters with the number of references to the scales of administration and sustainability. It turned out that as the number of transformation pathways increased, the extent of government engagement at different levels grew as well. But most interestingly, those case studies which counted both more transformation pathways and more references to administration scale, were also more likely to contribute to environmental sustainability.

Our data provided important insights regarding the different levels of sustainability. It turned out that in almost all the case studies where social and/or economic sustainability contributions were stressed, the level of environmental sustainability was emphasized as well.

Finally, our results suggest that sustaining economic advantages in bioclusters might be possible when social and environmental domains are structured in ways that allow for economic success. If environmental and social issues accrue, they are likely to hinder economic development in the long term. Therefore, when environmental and social conditions are favorable, economic sustainability is often likely to follow.

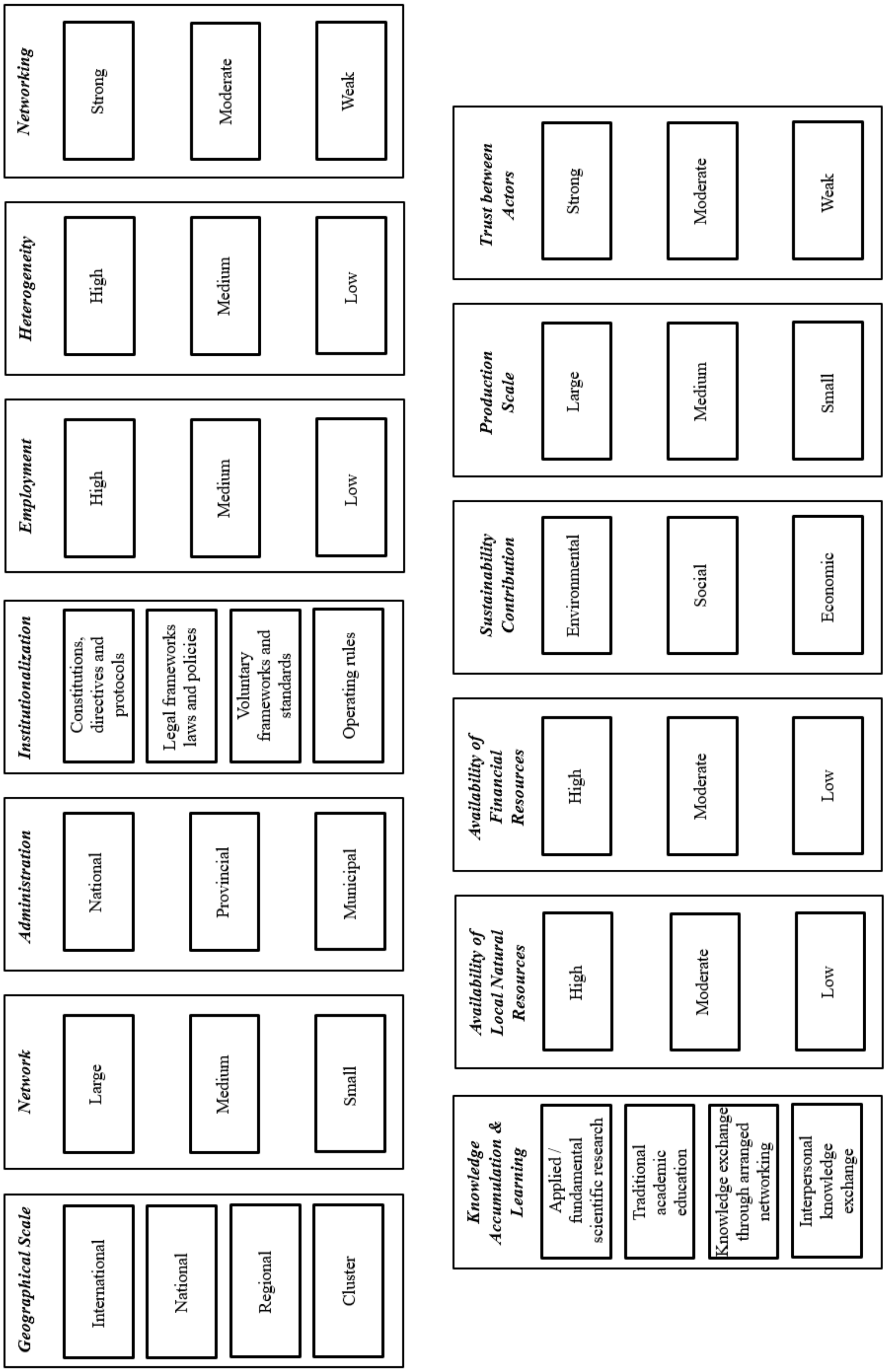

Figure 2. The scale framework

Source: based on Cash et al. (2006), Hermans et al. (2016), Menzel and Fornahl (2010) and the content of case studies

References

Biber-Freudenberger, L., Basukala, A. K., Bruckner, M., & Börner, J. (2018). Sustainability Performance of National Bio-Economies. *Sustainability, 10*(8), 2705.

Bosman, R., & Rotmans, J. (2016). Transition Governance towards a Bioeconomy: A Comparison of Finland and The Netherlands. *Sustainability, 8*(1017).

Cash, D. W., Adger, W., Berkes, F., Garden, P., Lebel, L., Olsson, P., . . . Young, O. (2006). Scale and cross-scale dynamics: governance and information in a multilevel world. *Ecology and Society, 11*(2).

Deutz, P., & Gibbs, D. (2008). Industrial Ecology and Regional Development: Eco-Industrial Development as Cluster Policy. *Regional Studies, 42*(10), 1313-1328. doi:10.1080/00343400802195121

Dietz, T., Börner, J., Förster, J., & von Braun, J. (2018). Governance of the bioeconomy: A global comparative study of national bioeconomy strategies. *Sustainability, 10*(9), 3190.

Ehrenfeld, J. R. (1997). Industrial Ecology: A framework for product and process design. *Journal of Cleaner Production, 5*, 87-95.

Gibson, C. C., Ostrom, E., & Ahn, T. K. (2000). The concept of scale and the human dimensions of global change: a survey. *Ecological Economics, 32*(2), 217-239.

Hermans, F., Roep, D., & Klerkx, L. (2016). Scale dynamics of grassroots innovations through parallel pathways of transformative change. *Ecological Economics, 130*, 285-295. doi:http://dx.doi.org/10.1016/j.ecolecon.2016.07.011

Menzel, M.-P., & Fornahl, D. (2010). Cluster life cycles—dimensions and rationales of cluster evolution. *Industrial and Corporate Change, 19*(1), 205-238. doi:10.1093/icc/dtp036

Porter, M. E. (1998). *Clusters and the new economics of competition* (Vol. 76): Harvard Business School Press Boston, MA.

Regional Biotechnology. (2011). Establishing a methodology and performance indicators for assessing bioclusters and bioregions relevant to the KBBE area. The Final Report. In.