Transition towards Bio-economy?
Evaluating different definitions in Styria

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***Abstract* - The term bio-economy, bio-based economy and other associated terms are getting increasingly popular. However, different definitions reach from narrow biotechnology focused to wide bio-based interpretations. With the increasing relevance of the term in political discussions a growing number of industries and research areas are expected to claim bio-economy as a concept. At the same time the question may be raised whether there is anything new at all regarding bio-based economies? In the light of this discussion this research paper investigates a large sample consisting of the largest and most relevant companies' active in Styria. Information about their business activities, visions, research activities, raw material and sustainability was taken from company webpages. The data was analysed in context of different definitions of bio-economy. As a main result the study indicates to differentiate not just between bio-economy and bio-based economy by also considering for example indirect or potential contributors ("new entrants"). Furthermore, the analysis reveals a currently low awareness of the bio-economy vision in the industry.**

Introduction

Boehlje and Bröring (2011) described three dilemmas for innovation and adoption in context of the increasing multi-functionality of renewable raw materials: the competing goals, the incumbent versus new entrant competition and the industry boundaries dilemma. Bio-economy (BE) and associated terms (e.g. bio-based economy, circular bio-economy, post-carbon economy, green economy) have been increasingly used and discussed (Staffas et al., 2013). Agriculture, as well as forestry, are both frequently mentioned as important sectors to be included in a vision of a future BE (Langeveld et al., 2010). According to OECD (2006) the concept of BE can be defined as "transforming life science knowledge into new, sustainable, eco-efficient and competitive products". Therefore innovation plays a crucial role when realizing the vision of a BE (Stern, 2014). Bio-economic innovations in this context aim at replacing fossil resources for energy, chemicals and materials with renewable and bio-based feed stocks.

Although the issue of BE development and transition is of actual relevance and received several research contributions recently (e.g. Piotrowski et al., 2016; Ehrenfeld and Kropfhäußer, 2016), empirical studies addressing industrial activities that indicate how a possible transition may affect competing goals, new entrant competition and the industry boundaries dilemma are scare.

Methods

The study is based on a comprehensive sample of industrial companies in Styria considering the 100 biggest companies (excluding trade and service companies thereof) as well as companies active in highly relevant fields like environmental technologies, wood processing, food, pharmaceuticals or fuels. Therefore, companies were identified through a top 100 businesses list as well as clusters and industry associations. In total 70 companies with a total annual turnover of more than 20 billion euros and over 85,000 employees were considered.

Information about their e.g. business activities, their visions, research activities, raw material consumption and sustainability was taken from the companies webpages and reports (e.g. business, sustainability or corporate social responsibility reports). The study therefore considers only data which is freely available and basically provided by the company itself. It is therefore focusing on the self-expression of the companies. Although of generally limited nature, this sort of data sourcing provides advantages in context of the research goal. Firstly it avoids biasing the results by asking questions (e.g. strategic bias, convenience bias) especially by not using any BE related terminology. Secondly this approach uses the same information base which is available to stakeholder groups (e.g. general public, consumers and employees) and can be therefore considered to represent the current publicly perceived status.

In order to develop a comparable data set across all considered companies a procedure for data collection including a data entry form and a manual had to be developed. As some relevant information is not just hard to find, but also may leave considerable room for different interpretations, validation procedures are highly relevant. For validation purposes the data gathering was done by a research team of ten persons in a multiple step approach. During the first step some companies were analysed during a group session of all involved researchers. This session was used to derive a checklist of relevant information based on literature (e.g. Boehlje and Bröring, 2011; Staffas et al., 2013) and the availability at company webpages. In the second step always two researchers had to analyse the same companies

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based on the checklist independently. The outcomes were subject to another group session in which differences were reviewed. This included for example the use of reference units for figures (turnover, employees) or the categorization of information (implicitly or explicitly communicated). Uncertainties and misunderstandings were clarified and cleared up. The data was analysed in context of different definitions and aspects of BE. According to Langeveld et al. (2010) the term BE is predominantly used when referring to the biotechnological and life science part of an existing economy, whereas the term bio-based economy (BBE) is used for describing an economy which is predominantly based on biomass for food, feed, energy and other purposes, rather than fossil-based resources (page 2765). Referring to Boehlje and Bröring (2011) we included potential new entrants as companies who are currently not (or only to minor degree) utilizing biomass but may be able to switch to a predominantly bio-based production (e.g. bioplastics, bio-energy, bio-chemicals) in the future.

Results

Obviously large differences of various company´s representation and self-expression can be stated. Only two out of 70 companies referred to BE in their communication, both of which can be allocated to the bio-based economy (BBE) definition. Overall one third of the companies (and a little more in terms of employees and turnover) in the sample can be allocated to BBE which can be considered as "traditional" BE. This includes companies in pulp and paper, saw milling, beer brewing, diary, meat processing but also leather production and processing. In contrast the BE definition referring to biotechnology and life sciences was only applicable to two companies which were both SMEs and therefore did not account for a larger share in terms of employees or turnover. About 10% of the companies in the sample was classified as having the potential to turn into BE or BBE, including also a few big companies (e.g. energy, building materials). Finally, 28% of the companies in the sample showed at least a potential indirect contribution to BBE or BE by producing technologies or machinery (figure 1).

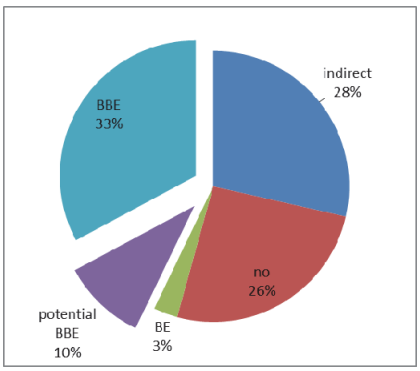

Figure 1. Percentage of companies (n=70) associated to the different bio economy (BE) definitions. Note: BBE (bio-based economy).

In total about 75% of the companies in the sample refer to sustainability in their business objectives. However, the occurrence of sustainability in this context is not dependent on the company's relation to BE-definitions. In case of the sample investigated it is, as other issues (e.g. defined sustainability management), significantly associated with company size. Interestingly, this picture changes when considering the quality of the goal setting. Companies associated with the BBE-definition show significantly more frequently the definition of measureable and quantified sustainability goals. In contrast, companies associated with the BBE definition communicate significantly less research and development activities.

Conclusion

As a main result the data indicates to differentiate not just between "new" BE and "traditional" BBE by also considering for example indirect or potential contributors. Furthermore, the analysis reveals a currently low awareness of the BE vision in the industry. It must be considered that this study used only information provided by the company itself without asking specific questions to representatives. The results are therefore limited to the self-expression of these companies without a critical review of their activities.

However, there is a need to further develop the existing data set by for example including additional companies and variables. A consistent classification system based on empirical evidence could be developed in the future.

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