

# Tackling Uncertainty in the Bio-Based Economy

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## ABSTRACT

There is a clear overall consensus among international institutions and governments on the need to scale down the reliance of the global economy on fossil fuels. Yet, a sustainable transition from a long-established regime based on rooted production and consumption models, requires tackling a wide array of challenges. Indeed, the transition towards a bio-based economy is still characterized by a high degree of complexity and uncertainty. Managing complexity and accounting for uncertainty entails appropriate and multidisciplinary tools. In this regard, sustainability certifications, standards and labels can play a pivotal role in navigating this transition, creating the conditions to ensure a level playing field between bio-based and conventional products.

## KEYWORDS

Bio-Based Economy, Standards, Uncertainty

## 1. INTRODUCTION

There is a broad consensus among international institutions and governments of industrialized countries for the need to scale down the reliance of the global economy on fossil fuels, paving the way to a more responsible and resource efficient society (Dubois & Gomez San Juan, 2016). This has increasingly led policy makers to pay greater attention to the bio-based economy (Staffas, Gustavsson, & McCormick, 2013), representing one reliable way for transitioning to equitable, sustainable, post fossil-carbon societies (Ingrao et al., 2018). Though biomass has been consistently used as a raw material throughout history, it is only recently that, thanks to the development of new technologies (e.g. biorefineries), biomass deriving for instance from forestry and wood residues, biowaste, algae (Ben-Iwo, Manovic, & Longhurst, 2016) or more traditional raw material such as agricultural biomass, has started to be exploited for obtaining a range of value-added products (Imbert, 2017), although at varying stages of technical maturity, with some of them being commercially available and others still at the demonstration stage.

Many industries are thereby involved (e.g. agriculture and food, textile, wood and paper, chemical and pharmaceutical), together with an ever-increasing number of actors. These include farmers, waste management companies, converters, innovative startups and medium sized specialist producers as well as global brands (e.g., IKEA, Tetra Pak and Toyota) (Pöyry 2016).

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In addition to having a lower impact on the environment, the transition towards a bio-based economy, and more specifically to a circular bio-based economy, is also seen as a great opportunity to revive productivity and employment growth (European Commission, 2018b). Specifically, by improving the competitiveness of domestic industries through new technologies as well as by reducing dependence on imported feedstocks, also through the rehabilitation of marginalized lands and the exploitation of a wide variety of locally sourced wastes and residues that will be maximized by fully employing a cascading approach (Corrado & Sala, 2018).

Several combined and interconnected issues, however, negatively affects the market entry of bio-based products. In this context, the implementation of a coherent yet, at the same time, flexible regulatory framework becomes a key factor in ensuring the sustainability of bio-based products (including impacts on health and safety and the environment), as well as improving the functioning of markets (European Commission, 2018a). Throughout this process, the development of standards would help to overcome the high degree of complexity and uncertainty that still surrounds the bio-based economy and that will be discussed in this paper.

## **2. TRANSITIONING TOWARDS A CIRCULAR BIO-BASED ECONOMY**

A sustainable transition from a long-established regime based on rooted production and consumption models, requires tackling a wide array of challenges. As stated by Priefer et al. (2017), despite the bio-based economy being viewed as a “comprehensive societal transition,” a number of issues have not yet been fully addressed. In particular, besides rather well-known concerns surrounding the debate on the sustainability of the bioeconomy, including food security, land grabbing, direct and indirect land use changes (LUC and iLUC) and loss of biodiversity, additional issues highlighted by the literature must be taken into account. These include no level playing field with fossil based products, but also within the bio-based economy itself due to the incentives created by the EU’s Renewable Energy Directives (RED I and II) and several member countries energy policies, intended for the use of biomass for energy production rather than for material purposes (Carus et al., 2016; Meyer, 2017). Moreover, there are only few product categories, such as bio-based lubricants, to have already benefited from regulatory measures at EU or Member State level (Spekreijse, Lammens, Parisi, Ronzon, & Vis, 2019).

Another aspect that deserves particular attention is represented by demand-side developments, which include consumer willingness to pay for bio-based products and new consumer behavior towards sustainability and related changes in lifestyle. Notably, a major theme strongly interlinked with the bio-based economy is whether society can reach sustainability solely through the development of green innovative processes and products, or whether more far-reaching approaches, including lower consumption levels, should be implemented (Zsóka, Szerényi, Széchy, & Kocsis, 2013). In recent years, several consumption and ownership models are indeed fast being developed (Priefer et al., 2017). These approaches include the extension of a product’s life cycle by enabling recovery for repair or reuse and sharing model approaches (Martin, 2016) for example applied to cars (Mounce & Nelson, 2019) and food (Falcone & Imbert, 2017; Morone, Falcone, Imbert, & Morone, 2018). Remarkably, there are several issues debated in the literature such as whether the shift from a fossil-based economy will result in decreased productivity and whether a transition towards regenerative pathways inevitably leads to post-capitalist societies (Bosch & Schmidt, 2019). This debate is also strongly related to the degrowth approach that views a voluntary reduction of overall consumption and production as the main target for societies in order to reach sustainability (Muradian, 2019).

## **3. DEALING WITH RISK AND UNCERTAINTY IN BIO-BASED ECONOMY**

The notions of complexity and uncertainty are not consistent in literature and this produces confusion even among specialists (de Assis et al., 2017). Several definitions have been proposed to show how

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