

Communication

# Bioeconomy Transformation Strategies Worldwide Require Stronger Focus on Entrepreneurship

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**Abstract:** The number of governments worldwide embracing the vision of a sustainable bioeconomy is constantly rising. One factor facilitating the transformation of economies to such sustainable bioeconomies will be entrepreneurial activity. Hence, I analyze how available bioeconomy strategies account for the role of entrepreneurship in driving the bioeconomy transformation. That analysis indicates that the majority of existing bioeconomy strategies account for the transformative potential of entrepreneurship but remain ineffective with respect to achieving their goals. I consequently suggest devising entrepreneurship substrategies of bioeconomy strategies that are holistic, dedicated, and based on a clear causal rationale.

**Keywords:** bioeconomy; biobased economy; entrepreneurship; sustainability; transformation

## 1. Introduction

Entrepreneurship is widely understood as the pursuit of primarily business opportunities [1–3]. Exploiting such opportunities often involves innovation, such as technological or business model innovation, which introduces the potential to change how business is done, how value is created, and how markets behave [4,5]. In other words, entrepreneurship is a driving force that contributes to the transformation of economies and societies. One important area requiring transformation is the so-called bioeconomy, which focuses on changing the modus operandi from one based on fossil resources to one employing biological resources [6,7].

A transformation toward the bioeconomy seems desirable [8–11], because it would at least partially align with the goal of carbon neutrality and the attainment of the UN Sustainable Development Goals [12]. Ever more policymakers worldwide acknowledge this necessity and are developing dedicated bioeconomy strategies [13]. In Germany, the Federal Ministry of Education and Research has even declared 2020 to be the Bioeconomy Science Year, a nationwide initiative intended to educate the wider public about the potential of the bioeconomy and following such eminent topics as “The Working Life of the Future” in 2018 and “Artificial Intelligence” in 2019.

Given the great importance attached to the bioeconomy transformation by policymakers and researchers, the question arises of how the transformation envisioned could actually materialize and be actioned. Innovation will be part of the solution [14] and the entrepreneurship literature suggests that entrepreneurs can contribute to the transformation by commercializing innovative technologies through startups and new business models [11,15,16]. In particular, entrepreneurs that manage the triple bottom line and aim to achieve social and ecological goals extending beyond pure monetary ones can contribute: a phenomenon termed sustainable entrepreneurship [11,17]. The bioeconomy transformation literature acknowledges this fact [18–20]. Many entrepreneurial opportunities for entrepreneurs result from a transition to a bioeconomy, which allows entrepreneurs to introduce new products and establish new ventures [21]. These are realized through so-called “entrepreneurial experimentation” [22–24]. Support

from investors [25] as well as universities and research institutions [26,27] will be essential in this regard and policy can intervene to help maximize the potential resulting from entrepreneurial activity.

If entrepreneurs are the agents that put political vision into action [28], bioeconomy policies should acknowledge this fact and include measures and initiatives that help sustainable bioeconomy entrepreneurs to fulfill this vision. Hence, in the subsequent paragraphs, I will determine how national bioeconomy strategies worldwide take account of the transformative role of entrepreneurship. In doing so, I contribute to the emerging discourse on the bioeconomy transformation and provide explicit suggestions on how to develop existing strategies going forward.

## 2. The Status Quo: Entrepreneurship in Bioeconomy Strategies

Identifying the entrepreneurial elements of bioeconomy strategies makes it possible to pinpoint gaps and weaknesses in existing strategies, to outline a metastrategy for entrepreneurship in the bioeconomy combining those elements, and to suggest ways to develop those strategies. The current research relies on the overview of available bioeconomy strategies continuously maintained by the German Bioeconomy Council (GBC) [13,29,30]. All policy documents classified by the GBC as holistic strategies were collected in their most recent edition. The collection thus comprises 15 national strategies from all over the world plus the European Union's bioeconomy strategy. Nearly all the documents are available in English; those only available in other languages were analyzed with the help of a native-speaking researcher.

To understand how bioeconomy strategies account for entrepreneurship, a data extraction sheet was developed. This data extraction sheet contained six dimensions utilized by the OECD in its Entrepreneurship Indicators Programme (EIP) to assess the determinants of entrepreneurial activity on the national level [31]. Careful reading of the bioeconomy strategies allowed to assign components of the bioeconomy strategies referring to entrepreneurship to the categories of the data extraction sheet. To minimize subjectivity in this process and to establish intrarater reliability [32], all strategies were reread after completing this process; conducting the exercise a second time did not result in any necessary changes, suggesting the reliability of this procedure.

Table 1 plots the contents of these holistic bioeconomy strategies regarding aspects of entrepreneurship. These are the regulatory framework of an economy, market conditions, access to finance, knowledge creation and diffusion, entrepreneurial capabilities, and culture, which together are considered to determine the entrepreneurial performance of a given economy. With the exception of Japan, all bioeconomy strategies at least acknowledge the importance of entrepreneurial activity in facilitating the bioeconomy transformation.

However, the degree of specificity of measures varies widely. Whereas some strategies (e.g., that of Argentina) reduce proposed measures simply to the availability of venture capital that would allow bioeconomy entrepreneurs to realize their projects, only the US and Latvian strategies could be considered (almost) complete in addressing the EIP dimensions. Most strategies, however, exhibit a clear tendency to focus only on access to finance, knowledge creation and diffusion, and the building of entrepreneurial capabilities. A further characteristic is that nearly all strategies avoid introducing measures to monitor their success, with only the South African strategy incorporating concrete key performance indicators (KPIs) with which to evaluate its success.

**Table 1.** Determinants of entrepreneurship in holistic bioeconomy strategies.

Country	Accounts for Entrepreneurship	Regulatory Framework	Market Conditions	Access to Finance	Knowledge Creation and Diffusion	Entrepreneurial Capabilities	Culture
Argentina [33]	Yes	-/-	-/-	- Support provision of venture capital for startups	-/-	-/-	-/-
Finland [34]	Yes	-/-	-/-	-/-	-/-	-/-	-/-
France [35]	Yes	-/-	-/-	-/-	- Hubs and ecosystems connect entrepreneurs with important actors	-/-	-/-
Germany [36,37]	Yes	-/-	-/-	- Support provision of venture capital for startups and SMEs	-/-	-/-	-/-
Ireland [38]	Yes	-/-	-/-	-/-	- Concrete investment in bioeconomy innovation facility as the nucleus of an innovation hub/entrepreneurial ecosystem	- Entrepreneurship education to foster bioeconomy entrepreneurship in rural areas	-/-
Italy [39]	Yes	-/-	-/-	- Direct investments in spin offs/startups	- Development of a platform connecting entrepreneurs and key stakeholders	-/-	-/-
Japan [40]	No	-/-	-/-	-/-	-/-	-/-	-/-
Latvia [41]	Yes	- Addressing the problem of unfair competition in the bioeconomy - Involvement of local authorities to foster regional bioeconomy entrepreneurship	- Utilize public procurement to speed up market adoption	- Generally creating an investment-friendly environment	- Supporting the exchange of entrepreneurs and research associations in the bioeconomy	- Entrepreneurship education at the higher education level	-/-
Malaysia [42]	Yes	-/-	-/-	- Connecting venture capitalists, crowd funders, and financial institutions	-/-	-/-	-/-
Norway [43]	Yes	-/-	-/-	- Strengthening innovation loans	-/-	-/-	-/-
South Africa [44]	Yes	- Build an enabling environment with proper tax incentives - Support exchange of intellectual property	-/-	- Stimulate venture capital funding - Establishment of a co-investing Bio-Innovation Venture Capital Fund	- Foster interaction of academics and entrepreneurs	- Bioeconomy transformation requires entrepreneurial skills	-/-
Country	Accounts for Entrepreneurship	Regulatory Framework	Market Conditions	Access to Finance	Knowledge Creation and Diffusion	Entrepreneurial Capabilities	Culture

Table 1. Cont.

Country	Accounts for Entrepreneurship	Regulatory Framework	Market Conditions	Access to Finance	Knowledge Creation and Diffusion	Entrepreneurial Capabilities	Culture
Spain [45]	Yes	-/-	-/-	-/-	-/-	-/-	- Successful role models should attract entrepreneurial initiative
Thailand [46]	Yes	-/-	-/-	- Need to establish a fund providing capital for entrepreneurs	-/-	-/-	-/-
USA [47]	Yes	- Creation of tax reliefs - Reduction of regulatory barriers - Assist entrepreneurs in obtaining and defending patents	- Utilize public procurement to speed up market adoption	- Support the provision of venture capital for startups	- Educate entrepreneurs about regulation - Connect mentors and entrepreneurs - Support the development of entrepreneurial ecosystems - Educate agencies about entrepreneurship with the help of an entrepreneur-in-residence program	- Enhance university entrepreneurship	- Creation of an overview of available prizes/awards - National entrepreneurship month
Western Nordic Countries (Greenland, Iceland, Faroe Islands) [48]	Yes	-/-	- Enable access to infrastructure for startups	-/-	-/-	- General enhancement of entrepreneurial skills	-/-
European Union [49]	Yes	-/-	- Entrepreneurship in the bioeconomy helps to develop rural areas	-/-	- Hubs/ecosystems help to connect entrepreneurs with important actors	- Entrepreneurship education at the vocational, higher education, and researcher level - Utilization of role models	- Fostering an entrepreneurial mindset and culture in the bioeconomy

### 3. Moving Forward: Dedicated and Holistic Entrepreneurship Strategies for the Bioeconomy

The analysis of bioeconomy strategies suggests that these initiatives are only effective on first sight. The vague and incomplete treatment of an important transformative power—entrepreneurship—necessarily leads to the conclusion that nearly all strategies are ineffective in enabling transformation in a convincing way. Admittedly, for many bioeconomy strategies it would already be a huge step forward to consider the measures included in Table 1 and then to utilize that overview to inspire construction of a metastrategy with regard to supporting bioeconomy entrepreneurship by combining all the elements available in different bioeconomy strategies. However, such an eclectic approach could only be an initial step.

Based on the assumption that entrepreneurs are important actors helping to achieve the bioeconomy transformation and thus warrant a maximum of attention, I suggest the following three adjustments to any bioeconomy strategy.

First, it would be preferable to devise strategies that are holistic, dedicated, and based on a clear causal rationale. That is, while the bioeconomy strategies assessed here can be considered holistic as such, even the most complete strategies are incomplete with respect to entrepreneurship and omit many potentially interesting options. Just as the overall strategies are intended to be holistic, their entrepreneurial substrategies have to be holistically conceptualized too. For instance, research suggests the nucleus of entrepreneurial transformation to be universities and research institutions [50,51]: knowledge that could serve as a starting point. Any strategy needs to support the entrepreneurial transfer of basic research out of research institutions and the OECD's EIP dimensions can then serve to roll out initiatives supporting the commercialization of bioeconomy knowledge with the help of entrepreneurship education, dedicated innovation systems and entrepreneurial ecosystems [9,50,52,53], and a legal framework and culture that is generally positive toward bioeconomy entrepreneurship.

Second, many bioeconomy strategies seem to be torn over whether they see entrepreneurial potential in small, rural entrepreneurs or with innovative, technology-based bioeconomy startups. Either type of entrepreneurial activity can contribute to the bioeconomy transformation; policymakers, however, have to tailor their initiatives to the specific needs of these very different types of entrepreneurial activity (e.g., funding for technology-oriented bioeconomy startups to scale up vs. tax incentives or education for rural entrepreneurs). Whatever the decision, specific measures aligned with concrete KPIs seem to be essential.

Third, while some strategies acknowledge that bioeconomy entrepreneurs will require public funding to realize their entrepreneurial projects (e.g., the German and the US bioeconomy strategy), such strategies always refer to available general programs to support innovation in their respective economies. To assume such innovation programs would be as receptive as necessary to bioeconomy innovations and startups as well is however unwise. Decision makers in such general programs will not necessarily account for the goals of the bioeconomy transformation (e.g., sustainability, circularity, or perhaps even degrowth), and instead employ traditional, growth- and profit-oriented decision-making criteria when evaluating initiatives. Bioeconomy entrepreneurs thus risk failing to meet these standard criteria. Consequently, dedicated innovation programs accounting for the specifics of bioeconomic innovation will be required in order to recognize the potential of many promising and possibly game-changing entrepreneurial initiatives.

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