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A MULTI-STAKEHOLDER PERSPECTIVE ON FACTORS AFFECTING TECHNOLOGY TRANSFER FROM ACADEMIA TO INDUSTRY IN THE BIOECONOMY

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The challenges humankind is currently facing are steering the transformation of our economic system. In this regard, the bioeconomy is presented as an alternative towards a sustainable future. If successful, the bioeconomy offers many opportunities to improve economic productivity and supports sustainable development at the same time (OECD, 2009). The bioeconomy is defined as “*the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food and feed, bio-based products and bioenergy*” (EUROPEAN COMMISSION, 2012: 3). For the successful implementation of the bioeconomy, it is crucial that bioeconomic inventions, which result from extensive research at universities and research institutions, are transformed into successful innovations and finally end up as products on the respective markets. As MCMILLAN ET AL. (2000) point out, the biotechnology sector, which is one of the innovation drivers of the development of the bioeconomy and accordingly an important part of the bioeconomy, strongly relies on academic research. In this regard, technology transfer from academia to industry comes into sharp focus to exploit its strong innovation and commercial potential and thus, to make its way to market oriented applications. However, technology transfer from academia to industry is not a random process, but needs to be actively carried out (ROGERS, 2002). In addition, there is a wide variety of factors (e.g. organizational designs of universities, intellectual property policies, technology transfer offices, individual characteristics of researchers) that challenge the technology transfer process. Against this background, we aim at investigating the factors influencing the technology transfer process and finally the commercialization of academic research in this new emerging and interdisciplinary area of knowledge.

To this end, this paper draws upon a mixed-method approach of concept mapping following KANE and TROCHIM (2007). This aims at responding to the challenge of guiding a group of diverse stakeholders in the objective representation of ideas, thoughts or abstract concepts based on a topic of interest. This approach is particularly appropriate to meet the aim of our research objective because firstly, it integrates input from multiple actors with different expertise and interests (technology developers, technology facilitators and technology recipients), and secondly, it blends the best of qualitative and quantitative approaches. Data collection and analysis was performed following KANE and TROCHIM (2007).

The first step included the selection of participants for a focus group discussion and the development of the focus prompt for conceptualization. In our case, the aim of this step was to compile a heterogeneous group representing the diverse actors involved in the technology transfer process in the bioeconomy. As such, our participants ranged from technology developers (researchers), technology recipients (industry), and technology facilitators (e.g. technology transfer offices or venture capital firms). In light of our research objective, our focus prompt for conceptualization was defined as follows: "Factors that influence technology transfer in the bioeconomy are...". In the second step, the selected 13 participants¹ were invited to participate in a focus group discussion to generate ideas around our focus prompt for conceptualization. The

¹ These 13 participants were selected from different (bioeconomy and/or technology transfer) networks for their wide experience in transferring technologies in the bioeconomy.

analysis of the group discussion by two independent researchers led to a list of 55 consolidated statements representing the outcome of the discussion. Thirdly, selected experts active in technology transfer either in general or in particular in the bioeconomy were asked to individually perform two tasks: sorting and rating of the extracted statements via a web-based survey. Firstly, the participants sorted the developed statements into piles based on how they perceived the statements to be related to each other. Secondly, the statements were rated based on a 5-point Likert scale according to two value qualifiers (importance and impact). The responses from participants completing both the sorting and rating formed the input for the generation of the concept maps. In the fourth step, the maps were computed using multidimensional scaling of the sorted data and cluster analysis of the output of the multidimensional scaling. These maps were used to identify the most relevant factors in terms of highest importance and impact for the different groups of stakeholders respectively and ultimately, to propose recommendations on the topic of interest.

In conclusion, we identified different relevant factors (e.g. availability of public funding, consumer demand for biotechnological applications, communication among different disciplines, and missing proof of successful (market) applications in biotechnology) that affect technology transfer in the bioeconomy. Here, both the interconnectedness and the perceived impact and importance of the individual factors varied across the different stakeholders involved. Moreover, although empirical research on factors that affect the process of transfer have been conducted in academic literature in the past, to the best of our knowledge, technology transfer in an emerging and at the same time highly interdisciplinary field, like the bioeconomy, has not yet been extensively analyzed. Given the importance of technology transfer for a successful implementation of the bioeconomy, understanding the factors that influence this process is of key relevance.

Finally and based on our findings, we discuss practical implications both for the involved stakeholders and particularly for policy makers on how to achieve effective technology transfer in the bioeconomy (e.g. continuing spin-off and commercialization grants, supporting and establishing educational training on entrepreneurship).

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