Editorial: Digital Innovations in the Bioeconomy

Iivari Kunttu, Guest Editor

Welcome to the February issue of the *Technology Innovation Management Review*. As guest editor, it is my pleasure to introduce this month's editorial theme covering a variety of topics on actual theme of digital innovations in bioeconomy.

Climate change caused by increased carbon emissions into the Earth's atmosphere is leading to huge challenges for several areas of everyday life. Building a climate-smart bioeconomy in response to this is a key goal that considerable amounts of efforts, both among research community and practitioners, have been dedicated towards in recent years (Campbell et al., 2014; Rose & Chilvers, 2018). Developing sustainable solutions and research-based innovations to minimize the environmental impacts of food production has been a focal area in the field, particularly about minimizing carbon emissions in the production process. Along with new technologies, systematic monitoring, analysis, and simulation of climate change impact, comes the need for a deeper understanding of sustainable processes to utilize natural resources. This plays a central role in finding answers to the huge environmental challenges (Arulnathan, 2020).

The topic of digitalization in the bioeconomy and agriculture was selected as one of the main themes in the first *Open Bioeconomy Conference* held in Hämeenlinna, Finland, in September 2020. This conference was meant to be the beginning of an annual meeting that brings together bioeconomy researchers and practitioners (https://openbioeconomyweek.org/). Two of the papers presented in this special issue are based on presentations from that conference.

The focus of this special issue is to highlight current research, innovations, trends, and future directions of the bioeconomy through the lens of digitalization and data utilization (Kunttu, 2020). Our aim is to highlight and underline some of the significant improvements that digitalization can bring to the bioeconomy field. In this manner, the issue is built around themes involving digitalization in the development of bioeconomy research, innovations, and business, particularly in the areas of climate-smart food and biomass production. This area is often referred as "smart agriculture" (Campbell et al., 2014), to which two of the papers are directly related.

In the opening paper, **Olli Niemitalo et al.** provide a report on the utilization of drone imaging in agriculture, forestry, and the green areas of cities. The paper describes how digital imaging and image analysis provide a wide variety of opportunities to support, manage, and monitor plant production based on data collected from the field, and thus support practices of farming and forestry. The authors also publish a remarkable set of drone image data for experimental use.

In the second paper, **Ilpo Pölönen et al.** present a practical use case that utilizes an Internet-of-Things (IoT) approach to smart agriculture. The paper introduces an automatic digital tracking and monitoring system for round feed bales on farms that utilizes a wide variety of field data obtained during the baling and delivery process.

The third paper, authored by **Essi Ryymin**, studies digitalization in the bioeconomy from the viewpoint of education and lifelong learning. The paper conducts research on perceptions of bioeconomy teachers at an Applied Sciences University in Finland regarding digitalization in the rapidly developing and disruptive area of smart bioeconomy.

The final paper by **Olli Koskela et al.** shows how computational simulation can be used to plan and optimize the logistics related to producing renewable fuels from waste in local biorefinery units. The simulation tool presented was developed to allow users to explore the effectiveness and impact of a local biorefinery in waste management. The paper reports on the results of testing this tool with multiple delivery options and waste locations.

The contributions included in this special issue of the TIM Review provide insights into the rapid digitalization and data-driven development currently taking place in the area of bioeconomy and food production. My hope is that the content of this special issue will be of interest to the TIM Review audience, as well as scholars and practitioners contributing to these areas. The importance of pursuing a climate-smart bioeconomy with digitized agricultural production and delivery has become even greater as we look to move forward out of a global pandemic with more sustainable use of natural resources.

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References

Arulnathan, V. 2020. Farm-level decision support tools: A review of methodological choices and their consistency with principles of sustainability assessment. *Journal of Cleaner Production*, 256.

Campbell, Bruce M., Thornton, P., Zougmoré, R., van Asten, P., Lipper, L. 2014. Sustainable intensification: What is its role in climate smart agriculture? *Current Opinion in Environmental Sustainability*, Volume 8: 39-43. https://doi.org/10.1016/j.cosust.2014.07.002

Kunttu, I. 2020. Collaboration Network Creation and Utilization in a Digital Bioeconomy Ecosystem. In: Kantola J., Nazir S., Salminen V. (eds) *Advances in Human Factors, Business Management and Leadership*. AHFE 2020. Advances in Intelligent Systems and Computing, vol 1209. Springer, Cham. https://doi.org/10.1007/978-3-030-50791-6_7

Rose, D.C., Chilvers, J. 2018. Agriculture 4.0: Broadening Responsible Innovation in an Era of Smart Farming. *Frontiers in Sustainable Food Systems*, Vol. 2. https://www.frontiersin.org/article/10.3389/fsufs.2018.00087

The TIM Review currently has a Call for Papers on the website for a special edition on "Distributed Ledger Technologies and Smart Digital Economies" (June 2021). For future issues, we invite general submissions of articles on technology entrepreneurship, innovation management, and other topics relevant to launching and scaling technology companies, and for solving practical business problems in emerging domains such as artificial intelligence and blockchain applications in business. Please contact us with potential article ideas and submissions, or proposals for future special issues.

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