

prof. D.Sc., PhD., M. Eng. Mariusz Jerzy Stolarski
Department of Plant Breeding and Bioresource Engineering
Faculty of Agriculture and Forestry
Centre for Bioeconomy and Renewable Energies
University of Warmia and Mazury in Olsztyn

Olsztyn, 29.06.2026

Review of doctoral thesis

Adhitya Rahmana

**titled „The Transition of Forest-Based Bioeconomy in Indonesia's Rural Area: Key
Factors and Policy Implications”**

prepared under the supervision of
Dr. hab. Nina Drejerska, prof. SGGW

Centre for Climate Research
Warsaw University of Life Sciences

and

second supervisor

Dr. hab. Marcin Zbieć

Institute of Wood Sciences,
Department of Technology and Entrepreneurship in the Wood Industry
Warsaw University of Life Sciences

The bioeconomy is an important sector encompassing food, feed, and other agricultural, forestry (generally biological) products, as well as bioenergy. In recent years, the development of the bioeconomy has been increasingly dynamic. The first strategy, Innovating for Sustainable Growth – A Bioeconomy for Europe, emphasized the efficient use of biomass and the need to develop knowledge and innovation in this area. A Sustainable Bioeconomy for Europe: Strengthening the Connection between Economy, Society, and the Environment: Updated Bioeconomy Strategy, highlighted the specific role of the bioeconomy in regional development, as well as special attention to the ecological limits of resource production and use. In developing countries, too, the transition to the bioeconomy is increasingly being recognized as a strategy for linking economic growth with environmental sustainability.

Indonesia, with the world's third-largest tropical forest area, has a unique comparative advantage in pioneering the development of a highly competitive forest-based bioeconomy.

However, translating this macro-level potential into rural forestry sectors often reveals a distinct disconnect between national policies and local realities. Instead of generating high added value, many rural regions remain rooted in traditional resource extraction. Furthermore, weak governance and linear value chains often marginalize small-scale entrepreneurs at the local level, hindering an inclusive bioeconomy transformation.

Therefore, Adhitya Rahman's research, "The Transition of Forest-Based Bioeconomy in Indonesia's Rural Area: Key Factors and Policy Implications" should be considered to address the aforementioned challenges and needs, and is therefore timely and interesting. Therefore, it should be stated that the issues presented in the reviewed doctoral dissertation are very important for both research and practical reasons.

The doctoral dissertation submitted for evaluation is logically organized and comprises a total of 200 typewritten pages, including 31 tables and 25 figures. From a formal and methodological perspective, the dissertation is well-edited and contains all the chapters typically found in this type of work. Six first-order chapters are identified: 1. Research methodology; 2. Theoretical foundations and conceptual framework of forest-based bioeconomy transition; 3. Current condition of forest-based bioeconomy in Indonesia; 4. Divergent pathways in Indonesia's bioeconomy: A comparison of bamboo and teak industries; 5. (No main title?); 6. Conclusions. Additionally, 23 second-order chapters and 27 third-order chapters are distinguished. Furthermore, summaries in Polish and English, introduction, appendices, and references including 258 items.

After a brief and logical introduction, the research methodology chapter presents four specific research questions: RQ1: What are the main drivers of the bioeconomy transition in the rural forestry sector?; RQ2: How does entrepreneurial behavior shape the readiness of local actors to adopt bioeconomy practices?; RQ3: What cause-and-effect relationships within the local entrepreneurial ecosystem determine the success of bioeconomy initiatives?; RQ4: What governance strategies can effectively close the gap between macro-level policies and local realities? The author further concluded that teak and bamboo represent two opposite sides of Indonesia's forest bioeconomy. Teak is part of a highly regulated and capital-intensive industry. In contrast, bamboo is a flexible, community-driven sector. Therefore, the main goal of the study was to find ways to balance rural profits with environmental protection. To achieve this, four specific objectives were formulated and seven research hypotheses were formulated. The research approach, consisting of three stages, was then presented, along with data collection,

analysis, and research quality. Next, the theoretical foundations and conceptual framework of forest-based bioeconomy transition are presented. Next, the current condition of forest-based bioeconomy in Indonesia is presented, emphasizing that the forest area in Indonesia including conservation areas, covers 120,27 million ha (64% of Indonesia's total land area). Functionally, these forest areas consist of conservation forests (27,54 million ha), protected forests (29,66 million ha), and production forests (63,07 million ha). The next chapter presents divergent pathways in Indonesia's bioeconomy: A comparison of bamboo and teak industries. The basis for conducting these analyzes was the Quantitative Survey for PLS-SEM (phase 1) targeted micro and small enterprise (MSE) owners operating in the rural forestry sector. Specifically, the study compared the capital-intensive teak furniture industry with the community-based bamboo craft sector. A purposive sampling strategy was employed. To ensure data validity, respondents had to meet strict inclusion criteria: they must be active business owners or managers with a minimum of three years of operational experience. As a result of this work, 150 valid responses were obtained, distributed evenly with 75 respondents from the teak sector and 75 from the bamboo sector. Then, a panel of system-level experts (phase 2) with deep, highly specialized knowledge used the Fuzzy-DEMATEL method to map out complex cause-and-effect relationships. The expert panel for the Fuzzy-DEMATEL analysis was deliberately restricted to 10 key grassroots representatives (association leaders and community group heads). Five experts were associated with Teak Wood Furniture and five with Bamboo Crafts.

As a result of the research and analysis of Indonesian entrepreneurial ecosystems in the teak furniture and bamboo handicraft sectors, the doctoral dissertation concludes with conclusions that reflect the research findings and content. This section is further divided into key findings, theoretical contributions, practical implications and limitations, and future research directions. Among the valuable achievements of the dissertation are the following:

1. The forest based bioeconomy transition does not proceed uniformly across different sectors. Instead, the physical characteristics of local forest resources dictate the specific transformation pathways for each industry.
2. For the legacy teak industry, the transition is driven predominantly by technocratic and necessity-induced pressures. These act as pragmatic survival mechanisms designed to cope with severe raw material shortages and outdated production capacities.
3. Within the bamboo clusters, the transition drivers are fundamentally sociological. The shift in this sector is fuelled by community reciprocity, ambitions for spatial market expansion, and the vital desire to transfer socio-emotional wealth across generations.

4. In capital-intensive networks like teak, entrepreneurial readiness to adopt bioeconomy practices is dictated almost exclusively by pragmatic technological mastery. Within this space, ecological ethics that fail to instantly improve operational efficiency are perceived strictly as a cost burden, reflecting a profound cognitive dissonance..
5. On the other hand, in labour-intensive bamboo networks, readiness is shaped through a deeply internalised socio-ecological mentality. For these grassroots actors, normative environmental values act as the absolute, non-negotiable filter for adopting new bio-based practices, demonstrating that behavioral readiness relies far more on cultural alignment than mere technological diffusion.
6. In the teak sector, external consumer trends and formal financial liquidity operate as the primary causal drivers determine the success of bioeconomy initiatives. Alternatively, the causal dynamics in the bamboo ecosystem are anchored centrally by the role of culture and behavioral norms.
7. At the macroeconomic policy level, state interventions may support the teak sector through hardware-oriented instruments. Conversely, policy designs for the bamboo sector require soft infrastructure development.
8. Teak furniture entrepreneurs frequently face severe capital constraints and technological obsolescence. Regional ecosystem stakeholders may support this sector by facilitating formal financial integration. Improved formal financial access allows teak entrepreneurs to upgrade their physical production technologies safely.
9. The bamboo handicraft sector faces fundamentally different practical operational challenges. Bamboo communities primarily struggle with digital isolation and generic product commoditization. Local institutions may support these communities through specialised capacity-building programs. These practical initiatives may focus strictly on digital literacy and cross-border marketing strategies. Enhancing digital capabilities allows bamboo entrepreneurs to bypass traditional supply chain intermediaries. This strategic disintermediation may significantly improve their operational profit margins.

Every review of a scientific dissertation should also highlight controversial issues, which are intended to draw the author's attention to the precision and importance of preparing, developing, interpreting, and discussing scientific research at every stage. Furthermore, these issues can be helpful in preparing scientific publications.

Comments:

1. The entire doctoral dissertation should be written in the past tense, even though there is a wide variety and variability in the forms used in this regard. For example, page 152: H1: "the impact is not" (it should be "the impact was not"); H2: "has", "is", "is"; etc.
2. The supervisor's surname is misspelled on page 1; it should be "Zbieć".
3. The page numbering in the dissertation is incorrect: If double-sided printing was used, the "Table of Contents" page should be numbered "7" instead of "5". However, if single-sided printing was used at the beginning, the "Table of Contents" page should be numbered "4" instead of "5".
4. The signatures of the supervisors and the author of the doctrinal thesis on the declarations are illegible, despite the inclusion of the "Legible signature".
5. The Introduction was not assigned as number "1" in the entire dissertation. On page 6, there's a separate chapter, "5," but it doesn't have a main title. The question is, is this "5" necessary? Shouldn't the following first- and second-order subchapters begin with "4" instead of "5"?
6. Pages 14-15. Repeating the same abbreviations, e.g., (EES, BOT), in multiple hypotheses or elsewhere in the manuscript is unnecessary. Each abbreviation should be explained upon first use, and then simply use the abbreviation without its full name.
7. The "Research Methodology" section should include a subsection devoted to statistical analyses of the obtained results.
8. The literature citation method is inconsistent; for example, page 46 has "O'Connor and Audretsch, 2022," while page 47 has "Adler & Kwon, 2002."
9. Pages 57-58. H1 and H2 have slightly different notations compared to page 14.
10. Page 68, Table 5. The first line is written "KBBI," and the caption below the table has "KBLI".
11. Pages 75-76. There are errors in the numbers between the values in the text and those recorded in Table 16, e.g., "while marketing barriers paralyze 149,970 entities" and "149,97" in Table 16. Furthermore, "affecting 65,900" and "65,9" in Table 16.
12. Pages 77-78. There are errors in the numbers between the values in the text and those recorded in Tables 18 and 19, e.g., "to 1,310 exporting units," while in Table 18 is "1,31." Furthermore, "supporting 248,770 entities in KBLI 16" while in Table 19 is "248,77".
13. Page 79. There are errors in the numbers between the values in the text and those recorded in Table 20, e.g., "Only 9,740 entities engaging units" while in Table 20 is "9,74".

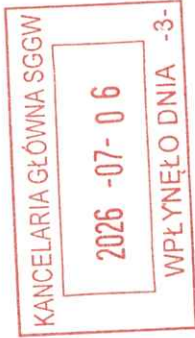
14. Pages 88-89. Literature cited (Disperindag Kabupaten Tasikmalaya, 2018; Zuriyah et al., 2023; Government of Tasikmalaya Regency, 2012) but not listed in References.
15. Page 91 and 96. Different formatting and caption under Figure 13 and 15 compared to most figures in the manuscript.
16. Pages 91-93. Literature cited (Woodfield & Husted, 2017; Blank et al., 2007; Zhu & Zhang, 2009) but not listed in References.
17. Pages 96-101. Literature cited (Malladi & Sowlati, 2018; Paul et al., 2017; Hojnik et al., 2017; Kahiya, 2018; Li et al., 2017; Frank et al., 2019; Oura et al., 2015; Hervás-Oliver et al., 2020; Malca et al., 2019; Laakkonen et al., 2023; Hinderer et al., 2021) but not listed in References.
18. Figures 17-20 are difficult to read, I suggest reformatting them before publishing the results.
19. Page 125, 132, 135. Literature cited (Spigel, 2022; Prasetyo et al., 2022; Overdevest & Zeitlin, 2018) but not listed in References.
20. There are other minor editorial errors in the paper that do not detract from its substantive value.
21. The "Conclusions" section cites literature in several places, which, in my opinion, is incorrect. The "Conclusions" section is a place for summarizing your own research results, not for a discussion of the literature. Comparisons and discussions of your own research results with the literature should be included in the discussion section.

In conclusion, I would like to state that the doctoral dissertation by Adhitya Rahman, titled "The Transition of Forest-Based Bioeconomy in Indonesia's Rural Area: Key Factors and Policy Implications," submitted for evaluation is complementary and constitutes an original solution to a scientific problem. It demonstrates the Candidate's general theoretical knowledge in the discipline of *economics and finance* and demonstrates the ability to conduct independent scientific research. Therefore, it meets the requirements for such dissertations in Article 187 of the Act of 20 July 2018, the Law on Higher Education and Science (Journal of Laws, 2024, item 1571, as amended) and qualifies the Candidate to apply for a doctoral degree in the scientific discipline of *economics and finance*. Therefore, I request the Disciplinary Council for Economics and Finance of the Warsaw University of Life Sciences to admit Adhitya Rahman to further stages of the doctoral process.

Maniusz Solarski

100 607

UNIwersytet WARMIŃSKO-MAZURSKI
w Olsztynie
Wydział Rolnictwa i Leśnictwa
Katedra Hodowli Roślin i Inżynierii Biosurowców
10-727 Olsztyn, Plac Łódzki 3
Tel. 89 523 48 80



OPŁATA POBRANA
TAXE PERÇUE - POLOGNE
Umowa z Poczta Polska S.A.
ID 518459/W



Biurow Obsługi Nauki
Szkół Główna Gospodarska
w Warszawie

(00)259007734981243235



(00)259007734981243235

(00)259007734981243235



Poczta Polska

Opłata pobrana _____ zł _____ gr

2026

R