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**Review of the doctoral dissertation of Anuphat Thirakulwanich, M.Sc.
titled: " Drivers of green innovation management adoption in SMEs:
Evidence from Poland and Thailand", written under the scientific
supervision of dr hab. Sebastian Kot, prof. PCz.**

The basis for this review was the notification dated 9.04.2025, dr hab. Katarzyna Szczepańska – Woszczyzna prof. AWSB the Dean of the Faculty of Applied Sciences, concerning the evaluation of the doctoral thesis of M.Sc. Anuphat Thirakulwanich. Bearing in mind the content of Article 187 paragraphs 1-3 of the Act of 20 July 2018, Law on Higher Education and Science („Prawo o szkolnictwie wyższym i nauce” Dz. U. z 2018 r. poz. 1668 with later changes). The verification of the dissertation in question was carried out through the formal requirements for doctoral theses in the field of social sciences in the discipline of management and quality, such as: the legitimacy of the subject matter undertaken, including the formulation of the title and originality of the research problem, the ability to conduct a scientific argument (including the ability to set objectives, formulate research hypotheses), the ability to conduct research, the layout and structure of the dissertation, the formal and editorial side.

1. Justification for the choice of topic, formulation of the title and originality of the research problem.

The dissertation addresses a highly relevant and timely issue—the implementation of green innovation management in small and medium-sized enterprises (SMEs). In this context, it is important to recognize that the ongoing transformation of the global economy, including industrial modernization, compels businesses to adopt green innovation management practices. On the one hand, these practices facilitate the emergence of green industries by transforming traditional sectors and fostering the growth of the green economy. More it's contribute to raising consumer awareness around sustainable consumption—specifically, environmentally conscious purchasing behaviors. The development of green business practices offers particular

advantages for small, emerging, and innovative enterprises. For such firms, eco-innovation serves as a demand-stimulating factor and opens opportunities to establish market niches. Another significant aspect is the role green innovation plays in shaping organizational green management systems. This is evidenced in the design and optimization of business processes aimed at minimizing environmental pollution and mitigating related risks. A key element of effective green management is the incorporation of clean, environmentally friendly technological innovations across production and service domains. These innovations are intended to prevent and reduce environmental degradation caused by business operations.

Doctoral Student has accurately defined the research problem and provided a strong justification for its investigation. The author notes: “green innovation has evolved into a critical business aspect due to increasing demand to adhere to environmental standards and satisfy customer health and environmental preferences in recent years” (p. 6). Furthermore, the dissertation correctly highlights a significant research gap in the current literature—namely, the scarcity of studies addressing green innovation management in SMEs. While extensive research exists on large corporations and public or private sector entities, SMEs, which make up the majority of business entities, remain underexplored in this context. The Doctoral Student also demonstrates an insightful awareness of the potential reasons behind this gap. It may stem from the limited knowledge among entrepreneurs regarding the implementation of green management concepts and the development of innovations that support environmental, social, and economic sustainability.

In addition, the subject matter addressed in the dissertation holds both theoretical and practical value. From a cognitive standpoint, the study contributes to a deeper understanding of green innovation processes. From an applied perspective, it supports the development and consolidation of a green management paradigm in SMEs—one that aligns both economic and non-economic activities with the capacity and limitations of natural ecosystems. Moreover, the selection of this research problem carries methodological importance, as the identification and application of appropriate research methods and tools to explore the determinants of green innovation in organizational contexts.

In conclusion, the research problem identified in the dissertation fully satisfies the academic criteria for a doctoral thesis. The dissertation presents an original approach to a significant scientific problem. The topic is current, relevant, and clearly situated within the field of management and quality. It represents a valuable contribution to academic research in this area and may foster the development and adoption of effective, practical strategies for managing green innovation in organizations.

2. Aims of the study, hypotheses, methodology.

In defining the research objectives, questions, and hypotheses, the PhD student initially sought to identify existing research gaps. As a reviewer, I would like to note that, a more comprehensive and systematic analysis of these gaps would have further strengthened the justification for the study and underscored its necessity and relevance beyond doubt. Ideally, these gaps—theoretical, empirical, and practical dimensions—should have been more clearly articulated within the theoretical chapters, particularly in the context of the literature review, which attempts to adopt a systematic approach.

The main objective of the dissertation was to identify and explore key determinants of green innovation management in SMEs in Poland and Thailand. In addition, the author formulated four specific objectives that focus on comparative analysis of green management practices and determinants in both countries, and on developing policy recommendations for the implementation of green innovation management in organizations. It is worth noting that before the main and specific objectives, the PhD Student introduced four research questions. In my view, these questions are somewhat redundant, as they essentially overlap with the specific objectives. Moreover, from the perspective of doctoral research methodology in the social sciences, it is generally more appropriate to first present the aims of the research, followed by the formulation of research questions or hypotheses. In this case, the order was reversed, with the research questions preceding the statement of objectives.

Doctoral Student presented seven research hypotheses, which focus on assessing the influence of various factors—green regulations, green technical capabilities, green economic resources, green human resources management, and green standards compliance—on the adoption of green innovation management practices in SMEs. For future work, it would be better to distinguish between a main hypothesis and subsidiary hypotheses to enhance conceptual clarity. Nonetheless, the hypotheses as presented are well-integrated with the content of the substantive chapters—particularly chapter two—and are appropriately aligned with the overarching research topic. They are both intellectually engaging and directly connected to the dissertation's title, clearly delineating the scope of the research inquiry. Moreover, these hypotheses could serve as a crucial point for future studies in the field.

It is also important to highlight the methodological s demonstrated in the formulation of directional hypotheses, which define the expected direction of relationships between variables. This reflects a commendable level of methodological maturity on the part of the author.

To achieve the objectives and test the hypotheses, the PhD Student used both quantitative and qualitative research methods. Within the quantitative framework, a diagnostic survey

method was utilized, based on a structured questionnaire targeting entrepreneurs. The Doctoral Student developed an original instrument comprising 47 items, in addition to demographic questions. These items focused on several key constructs: green regulation management (9 questions), green technical capabilities (9 questions), green economic resources (8 questions), green human resources management (6 questions), green standards compliance (6 questions), and the adoption of green innovation management (9 questions).

The effort to ground variable selection in the existing literature is commendable; between pages 85 and 90, the author cites relevant academic studies to justify the inclusion of specific variables. Furthermore, reliability analysis was conducted appropriately using Cronbach's alpha, and construct validity was tested through two key components of SEM-PLS analysis: standardized factor loadings and average variance extracted (AVE).

Overall, I assess the survey instrument very positively. However, one minor limitation is the length of the questionnaire—comprising 47 items— which might have led to reduced response accuracy owing to the risk of respondent fatigue. Additionally, it is regrettable that the qualitative component did not include in-depth face-to-face interviews, which could have provided insights for analysis and for drawing final conclusions. Another shortcoming was the lack of justification for the sampling strategy—specifically, whether a purposive or random sample was used. Addressing this would have enhanced the methodological transparency of the study.

Despite these minor criticisms, it is evident that the Doctoral Student possesses a strong command of both quantitative and qualitative research methodologies. The selected methods were appropriate and effectively facilitated the achievement of the dissertation's research aims. It is important to emphasize that the discipline of management and quality is inherently empirical, with hypothesis verification being a cornerstone of the research process. From the standpoint of the classical scientific methodology, the application of quantitative and qualitative techniques—as used in this dissertation—is not only appropriate but methodologically sound.

In summary, when assessing the research methodology in relation to the defined objectives and hypotheses, I am confident that the dissertation meets the academic standards required of a doctoral thesis. The research design and methods were appropriately selected and competently executed, reflecting the Doctoral Student's strong foundation in research methodology within the discipline management and quality.

3. Scope of work and sources of information.

In evaluating the scope of the dissertation, the following observations can be made:

- the thematic scope of the dissertation focuses on identifying and analyzing the determinants of green innovation management in small and medium-sized enterprises (SMEs) in Poland and Thailand.
- the empirical scope included a survey of 428 Polish entrepreneurs and 413 Thai entrepreneurs.
- the temporal scope of the empirical research covered the period from July to October 2024.
- the spatial scope refers to companies operating in Poland and Thailand.

Regarding the sources of information utilized, it is worth highlighting that the Doctoral Student used upon 296 bibliographic sources in the theoretical part of the dissertation. These include monographs, articles in scientific journals, research reports, and press publications. The majority of these sources were published in English, indicating the author's engagement with international scholarship. From a quantitative point of view it's stated the number of sources used demonstrates a solid familiarity with the relevant academic literature. It is also notable that most of the cited works were published after 2018—a satisfactory indicator in light of the growing volume of scholarly publications in this field.

In terms of quality, the literature selected is highly relevant and contributes positively to the credibility and academic rigor of the dissertation. The bibliographic and netographic sources represent a broad spectrum of perspectives, theoretical approaches, and methodological frameworks. Moreover, the literature is appropriately interpreted and referenced by the Doctoral Student, both in the main text and in the footnotes, further demonstrating methodological diligence and scholarly competence.

4. Structure of the work

The reviewed dissertation, including the bibliography, list of tables, figures, charts, and the summary in Polish, comprises a total of 227 pages, with the main text accounting for approximately 74% of the entire work. The dissertation is of a theoretical-empirical nature, and the balance between the theoretical and empirical sections has been appropriately maintained. This proportion indicates a solid theoretical foundation, which effectively supports the Doctoral Student's original empirical research.

In my view, the overall structure of the dissertation is appropriate. The work includes all the essential components required of a doctoral thesis. The individual sections form a coherent and logically structured whole, aligned with the research objectives and hypotheses.

Furthermore, the chapter and subchapter titles are clearly and correctly formulated, and each part of the dissertation addresses the core issues outlined in the title in a substantive and focused manner.

5. Evaluation of the Dissertation Structure and Content

The structure of the dissertation is clearly aligned with the objectives of the research. In this regard, the introductory section outlines the key motivations for selecting the topic, including a justification for the area of analysis, the research objectives, research questions, and a description of the methods employed. Additionally, the doctoral student has outlined the overall structure and organization of the dissertation. As a reviewer, I must note that the research gaps should ideally be followed directly by the research objectives and hypotheses, with the research questions—if necessary—presented thereafter. In the present version, the research questions are redundant, as they closely and even semantically overlap with the formulated objectives. Nonetheless, the introduction is generally well-constructed, containing the essential elements expected in this section of a doctoral dissertation and providing a sound introduction to the research problem.

Chapter 1 presents the conceptual foundations of green innovation management in SME sector organizations. The PhD Student begins with a comparison of the SME definitions in Poland and Thailand. I believe that subsection 1.1 would be better positioned later in the dissertation—perhaps in Chapter 2 (e.g., subsection 2.1) when discussing green innovation management policies specific to the two countries. A more effective opening for Chapter 1 would have been a theoretical discussion, particularly a critical literature review of green innovation management concepts and definitions. The subsequent sections offer a correct characterization of the strategic processes involved in green innovation management for SMEs. However, the section on green supply chain management (pp. 25–26) lacks a detailed discussion of the individual stakeholders involved in the process. Similarly, in the section on green certification programs (p. 27), the Doctoral student omits an overview of the key determinants relevant to certification. Subsection 1.4, while it outlines the benefits of green innovation management for SMEs, does not address the barriers and challenges associated with its implementation. This omission is significant, especially given that financial and organizational constraints often hinder green innovation efforts in SMEs. Furthermore, while the content of Chapter 1.5 on “Green Innovation and Sustainability” is relevant, I suggest merging this with subsection 1.2 for better structural coherence. Likewise, subchapter 1.6, discussing “Strategies for Encouraging Green Innovation Management in SMEs,” would be

more logically integrated into subsection 1.3. Despite these criticisms, the doctoral student provides a notably strong discussion of green innovation definitions especially the inclusion of foundational works such as those by Porter and van der Linde (1995), Leal-Millán et al. (2017), and Kraus et al. (2020). The doctoral student has also successfully identified key strategic considerations in green innovation management and analyzed them in detail.

Chapter 2 focuses on the scholarly of "green research" and on policy frameworks for green innovation in Poland and Thailand. The chapter would have been more comprehensive with the inclusion of presentation of theoretical models relevant to the research, such as the Natural Resource-Based View (NRBV) and the Triple Bottom Line (TBL), before delving into country-specific policy issues. Furthermore, the discussion of green innovation in SMEs in countries such as Portugal, Indonesia, Pakistan, Italy, and Bangladesh (subsection 2.2) lacks a clear rationale for their selection and comparative relevance. Nevertheless, the inclusion of table 2.1, which links NRBV and TBL theories with green innovation management, is valuable and well-executed. subsection 2.3 effectively lays the groundwork for identifying six research areas: Green Economic Resources, Green Technical Capabilities, Green Regulations Management, Green Human Resources, Green Standards Compliance, and the Adoption of Green Innovation Management. These constructs formed the basis for both the conceptual model and the empirical research design.

In summarizing the theoretical chapters, it must be emphasized that the Doctoral Student has demonstrated considerable erudition and analytical skill. The definitional groundwork is comprehensive, and the analysis reflects a strong understanding of current academic debates. The structure and substance of these chapters illustrate a high level of cognitive engagement and the use of relevant, up-to-date literature.

Chapters 3 and 4 focus on the empirical component of the dissertation. Chapter 3 presents the methodology used to measure green innovation management in organizations. The research process is clearly divided into conceptual, empirical, and deductive-application stages. The methods and statistical tools for variable measurement are adequately described, and the selection of the research sample is reasonably justified. Table 3.1 effectively summarizes the research design and the rationale behind the variables used. Additionally, the reliability of the survey was verified using Cronbach's Alpha, and the doctoral student has addressed key ethical considerations in the research process.

Chapter 4 plays a central role in addressing the dissertation's research objectives. The chapter begins by characterizing the surveyed population and provides a comparative analysis of responses from Polish and Thai entrepreneurs regarding the six core research constructs. The

conceptual model is evaluated through FO-CFA and SO-CFA analyses, and each hypothesis is tested. Importantly, the interpretation of the results is firmly grounded in existing literature, with frequent references to relevant scholarly work. The Doctoral Student has successfully conducted what may be termed a "resultant comparison" and clearly distinguished both theoretical and practical contributions to the field of management and quality sciences. The findings are presented clearly and analyzed using methods appropriate to the empirical scope of the study. They contribute valuable insights into the determinants of green innovation management.

Based on this analysis, it can be concluded that the Doctoral Student has provided an original solution to the research problem and has demonstrated the capacity to conduct independent scientific inquiry. The empirical data supports conclusions with potential practical applications, reinforcing the applied value of the dissertation.

The conclusion of the dissertation provides a comprehensive summary of both theoretical and empirical findings. The Doctoral Student re-examines the research questions and proposes evidence-based policy recommendations for national and regional implementation. The limitations of the study are acknowledged, and directions for future research are outlined appropriately.

In summary, I find that across all sections of the dissertation, the author has demonstrated a thorough understanding of the research subject and has applied appropriate methodological and analytical skills. The dissertation presents a coherent, well-substantiated, and methodologically sound contribution to the field. Therefore, my overall assessment is positive.

6. Evaluation of the formal side

In terms of linguistic and formal aspects, the reviewed dissertation is written in a clear, communicative, and comprehensible style. The graphical elements, footnotes, and bibliography have been prepared with due diligence, and the overall language quality adds value to the work. The Doctoral Student maintains a logical sequence of arguments, effectively demonstrating both the ability to present complex phenomena and methodological reliability in interpreting the results.

In conclusion, the editorial quality of the dissertation can be assessed as good. It is evident that the Doctoral Student has taken appropriate care to ensure clarity, coherence, and accessibility of the content, thereby facilitating both the reading experience and the comprehension of the material presented.

7. Problem questions.

Having thoroughly reviewed the content of the dissertation, I would like to pose the following specific questions to the Doctoral Student, which I kindly request be addressed during the public defense:

1. What were the key considerations that led to the selection of Poland and Thailand as the empirical contexts for your study?. What key factors influenced the choice of these two countries—were they related to cultural differences, stages of economic development, approaches to eco-innovation, or other strategic considerations? Furthermore, would it be methodologically and substantively justified to expand this study to other geographical regions or countries? If yes, which regions would you consider particularly valuable for comparative analysis, and why?
2. How does the integration of green innovation into management processes contribute to the evolution of business models, particularly in light of growing environmental and social challenges?
3. What strategies or mechanisms do you consider most effective in encouraging SME entrepreneurs to adopt green innovation management, especially in the face of current challenges such as regulatory pressure, limited financial or technical resources, and shifting market expectations?

8. Conclusion.

The dissertation is an inspiring and intellectually engaging study on the management of green innovation in small and medium-sized enterprises (SMEs). I evaluate the dissertation positively. In my opinion, the Doctoral Student has demonstrated both broad and in-depth knowledge in the general and specific areas relevant to the subject of the study. The analyses undertaken in the dissertation are thoughtful and well-founded, and they merit recognition. Moreover, a close reading of the work reveals the Doctoral Student's ability to observe complex phenomena and to analyze them with accuracy and insight. The theoretical and analytical results presented in the dissertation reflect the Doctoral Student's solid preparation for conducting independent scientific research. The critical remarks included in this review are intended to further improve the already valuable work and do not detract from its overall positive assessment.

In conclusion, after a thorough review of the dissertation, I find that the submitted work meets the statutory requirements for doctoral theses as outlined in Article 187, paragraph 2,

points 1–3 of the Act of 20 July 2018 – Law on Higher Education and Science („Prawo o szkolnictwie wyższym i nauce” Dz. U. z 2018 r. poz. 1668 with later changes) namely:

- the dissertation confirms the Doctoral Student's general academic knowledge within the discipline of management and quality , particularly in the area of green innovation management;
- it demonstrates the Doctoral Student's ability to conduct independent scientific research;
- the dissertation presents an original solution to a scientific problem, which may form a theoretical basis for the practical application of research findings in the economic and business environment.

Therefore, I conclude that the reviewed doctoral dissertation of M.Sc. Anuphat Thirakulwanich, entitled "Drivers of Green Innovation Management Adoption in SMEs: Evidence from Poland and Thailand", written under the supervision of dr. hab. Sebastian Kot, prof. PCz, meets the formal and substantive requirements set forth in the above-mentioned Act. On this basis, I recommend that the dissertation be accepted and the Doctoral Student be admitted to the public defense.