

Bucharest University of Economic Studies



PhD school Business Administration

PhD THESIS

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PhD thesis title:

**RESEARCH ON ENERGY EFFICIENCY AND INTEGRATED
MANAGEMENT SYSTEMS FOR ENVIRONMENT AND ENERGY IN
THE CONTEXT OF SUSTAINABLE DEVELOPMENT**

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Bucharest, July 2024

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b) Key words:

integrated management systems for environment and energy, energy efficiency, environmental management system, energy management system, sustainable development, management system audits, digital transformation, energy efficiency indicators.

c) Summary:

This PhD-Thesis extends the understanding of innovative technologies, advanced management practices, and the implementation of integrated management systems for environmental and energy management in organisations. It assesses the impact of these systems on energy efficiency and their contribution to sustainable development. The analysis of the global energy transition focuses on new technologies and sustainable innovations, examines the role of digitalisation and artificial intelligence, and analyses the principles and risks of the "Energy 4.0" concept. The research highlights how technological innovations, policy measures, and social dynamics create synergies, particularly regarding the role of renewable energy in reducing greenhouse gas emissions. Additionally, it is demonstrated that digitalisation and artificial intelligence can significantly improve energy efficiency through enhanced analytical capabilities and decision-making processes. The "Energy 4.0" concept, characterised by the intensive use of digital technologies, substantially contributes to the sustainable transformation of energy infrastructure.

Legislative frameworks and national strategies play a crucial role in minimising energy consumption and promoting sustainable developments. Energy efficiency reduces operating costs in the long term, promotes energy-conscious behaviour, and significantly contributes to environmental protection. The multidimensional nature of energy efficiency, linked to sustainability, economic stability, and social responsibility, is emphasised by technical, economic, and social factors. Innovations in building technology, industry, and mobility are essential for significant energy savings and support the transition to renewable energy sources while offering economic benefits through reduced operating costs. The energy transition represents a comprehensive change where energy efficiency is central to reducing energy demand and carbon emissions and establishing a sustainable energy system.

Research on integrated management systems emphasises the importance of energy management systems, particularly ISO 50001. These systems are crucial for generating economic and ecological benefits and support the sustainable improvement of energy efficiency. The growing number of ISO 50001 certifications worldwide demonstrates their global acceptance and effectiveness in promoting sustainable developments. Parallel to this, the analysis focuses on environmental management systems according to ISO 14001, which enable

continuous improvement of companies' environmental performance. The systematic improvement and increasing number of certifications highlight the global significance of these efforts. The integration of energy management systems into other management systems is seen as a strategically important approach to leverage synergies and increase organisational efficiency. This approach promotes a holistic improvement of environmental and energy performance in the context of sustainable development. Overall, the research underlines the crucial role of integrated management systems for efficient and sustainable corporate governance. Integrated management systems for environment and energy contribute to increased operational efficiency, optimise environmental and energy performance, and support compliance with regulatory requirements, highlighting the need for further research in this area.

Against this background, the analysis of frameworks and approaches in the field of energy efficiency in German companies provides essential insights. The study examines the challenges and opportunities in both the public and private sectors that contribute to achieving national energy and climate goals. Particularly in North Rhine-Westphalia, studies on the readiness of public companies for energy audits reveal significant discrepancies between legal requirements and their practical implementation. This underscores the need to specifically adjust regulatory frameworks and improve communication strategies. The study on energy efficiency in small and medium-sized enterprises (SMEs) in Germany shows that despite high awareness and available support programmes, the actual implementation of these measures often falls short of expectations. This emphasises the urgency of targeted political support and adjustment of funding conditions to promote the practical application of energy efficiency initiatives. Moreover, the necessity to revise political frameworks is highlighted to create effective incentives for energy efficiency measures, thereby significantly improving energy efficiency in SMEs.

The proposed improvements to the evaluation criteria for energy efficiency in the context of sustainable corporate development demonstrate that the European Green Deal provides a crucial strategic framework in the face of ongoing digital transformation and changing regulatory requirements. Studies on digital transformation and self-managed team structures illustrate how new technologies and management approaches influence energy efficiency by promoting the establishment of effective evaluation criteria and the adaptation of personnel management strategies. The research findings underline that the use of intelligent technologies and the flexibilization of working models significantly increase operational efficiency and energy savings. Furthermore, the need to continuously adapt and expand evaluation criteria to capture both direct and indirect effects of energy efficiency measures is emphasised. The integration of multidimensional evaluation approaches not only promotes

employee motivation but also substantially contributes to increasing energy efficiency and achieving global sustainability goals.

Studies evaluating the impact of an Integrated Management System for Environment and Energy (IMS Environment-Energy) on energy efficiency indicators in companies have significantly contributed to understanding the effects of these systems on energy efficiency. The research findings demonstrate that IMS Environment-Energy increases stakeholder satisfaction and significantly improves various energy efficiency-related indicators. The detailed analysis of these indicators provides a deeper understanding of the function and benefits of IMS Environment-Energy in the context of sustainable corporate governance. Documented successes include the reduction of energy consumption, optimisation of energy intensity, increase in energy autonomy, and compliance with energy standards.

Investigations into the impact of non-conformities on energy efficiency indicators show that deviations from established management standards can have significant negative effects. This insight underscores the need for continuous monitoring and regular audits to ensure the integrity of IMS Environment-Energy. Additionally, the examination of challenges and solutions for improving system effects highlights how technological, organisational, and financial barriers can be overcome and processes for continuous improvement of energy efficiency optimised.

Finally, data collected from management reviews and audit documents confirm that Integrated Management Systems for Environment and Energy are essential for meeting regulatory requirements and provide measurable benefits such as reduced energy costs and improved energy efficiency indicators. These systems are therefore indispensable for optimising energy efficiency and promoting sustainability goals in companies. The continuous adaptation and improvement of these management systems are considered essential to maximise their effectiveness and comprehensively support the sustainability goals of companies.