

„INNOVATIVE APPROACHES IN APPLYING ECO-EFFICIENCY IN COMPANIES”

PhD Thesis – Summary

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SUMMARY

The business sector has a critical role in the sustainable development process and can be an effective factor of change, but for the change to occur, it is necessary to understand the general context of business, to know and recognize the benefits of a responsible behavior towards the environment and to adopt sustainable production and consumption patterns. The research that has been carried out from a qualitative perspective, the main purpose of the research is to explain the role of eco-efficiency in greening the industry and to demonstrate its applicability in companies, as well as to propose a new, holistic and global model applicable in companies, that allow them to become more resource efficient, have a lower impact on the environment, and to identify new and sustainable business solutions.

In this context, the research objectives were directed towards:

- A. Obtaining new data and information relevant to research on the role of eco-efficiency in the context of the global economic context, including the Romanian context.
- B. Optimization of the research object by analyzing the opportunity of approaches aimed at accelerating the adoption of eco-efficiency in industry
- C. Validation of the proposed methods in experimental research, based on the results obtained through the application of various eco-efficiency methods in companies.
- D. Comparison of different methods for enhancing eco-efficiency in companies based on multicriteria analysis method
- E. Proposal for a new eco-efficiency model to be applied in companies

The PhD thesis presents the results of the scientific literature research on the problem of unsustainable economic development, the existing global context and the problems identified in Romania, and discusses the impact of the global challenges on business, the eco-efficiency taxonomy and its role in changing the current economic paradigm.

At the theoretical level, the concepts and methods of eco-efficiency applied on a large scale and their evolution over the last 30 years are broadly developed. Their validation is proposed through the results obtained during the experimental researches carried out in a number of companies, with focused on the economic and ecological benefits obtained.

The approach to multicriterial analysis of four eco-efficiency methods, as possible alternatives, allows their prioritization, in order to finally identify a new eco-efficiency model for companies.

Contributions claimed by the author refer to:

- (1) contributions as a result of scientific literature research, that can be used for the enrichment of the Romanian literature, as well as for the updating of the university courses,
- (2) Contributions in the field of applied research with emphasis on the results obtained in practice, and
- (3) major contributions to the theoretical research with a focus on proposing a model of integration and extension of eco-efficiency practices (Green Entrepreneurs Club) and of a new eco-efficiency model, the ECO-EFICIENT AIDA to be applied in companies

Chapter 1 addresses the existing issues from the perspective of global environmental challenges, the European political and strategic context, and the situation in European and in particular Romanian companies. The purpose and objectives of the research are defined, as well as the contribution and significance of the research in solving the identified problems. In order to understand the role and importance of eco-efficiency, it is absolutely necessary to have the most accurate picture of the global situation from an economic, social and environmental perspective, and within this picture (synthetically presented in Chapter 3), the existing challenges and opportunities for green and sustainable development for companies and implicit benefits for the environment and society.

The purpose and objectives of the research are presented, including the author's perceptions on methods meant to support and accelerate the adoption of eco-efficiency in companies, experimental studies and their outcomes as well as a comparison of eco-efficiency methods based on common criteria.

Chapter 2 aims to review the global context and the environmental, social and economic problems challenges at the global level, including in Romania, based on the results of the international researchers groups working for World Resources Institute, Intergovernmental Panel on Climate Change, McKensy & Company and others.

Within this chapter are presented arguments of ecological, economic and social nature in support of the change of the current economic model and the effects of human activity on ecosystems, the state of biotic and abiotic natural resources and effects on human health and well-being. It explains the role of eco-efficiency in the current context as well as the challenges, barriers and resource productivity opportunities from the global economy and companies perspective. The context and the situation in Romania, as well as the premises of some future developments, are analyzed.

In conclusion, the shorter availability of resources and the degradation of the environment caused by human actions. determines companies to systematically focus on how they use resources, how to establish collaborative models within the value chain, optimize their products, and configuring new business models that can bring competitive advantages.

The challenge of resource productivity for companies is equally a huge opportunity to reduce costs, increase productivity and competitiveness, and boost innovation; this can only happen in the presence of a strong leadership and commitment to sustainability. They should help increase resource productivity and reduce dependence on resource consumption. From this perspective, companies should take into account the global trends that have been explained previously, such as: the rise in commodity prices and materials, increased price volatility, the correlation between the prices of different resources, the continuous increase in environmental costs, the escalation of political conflicts and their influence on the costs and availability of resources, the expected reduction in public subsidies, the need for societal acceptability, the opportunities that arise in the supply chain, the increasing importance of technology and the competitive advantages of cleaner technologies. The increasing market demand for more ecologic products and services (automobiles, less energy-consuming electrical and electronic equipment, more efficient heating and cooling systems, lighting LEDs and many more).is

another interesting opportunity.

Chapter 3 introduces the concept of industrial ecology, as well as other concepts and methods of eco-efficiency, and presents the main types of industrial systems from the ecological perspective as well as the role and application of eco-efficiency in industry. Understanding eco-efficiency and its benefits over the last 20 years, has led many companies to adopt new practices, methods and technologies with considerable success. Emissions and waste have been reduced, recycling has become a common practice, and many hazardous materials have been removed from processes and products. Solutions for pollution prevention or environmental design have been favored for "end of pipe" that they were logical and brought financial savings, as well as an effective contribution to a cleaner environment. A new clarification of eco-efficiency, offered by World Bank Council for Sustainable Development (WBCSD) Bjorn Stigson, defines more eco-efficiency as a "combination of goals of business excellence and ecology, and the way in which behavior corporatist can support sustainable development "and that" eco-efficiency is achieved by delivering competitive products and services that meet human needs and bring quality of life while progressively reducing the environmental impact and resource intensity over the entire life cycle, at least in line with the estimated capacity of the planet, "a definition that draws us closer to the concept of sustainable consumption and production systems

The importance of a sustainable consumption and production system in global environmental policy as well as in international programs promoted by the United Nations is presented as additional arguments for promoting and adopting widely in all industrial sectors methods and concepts of eco-efficiency such as efficiency resources and clean production, eco-innovation or the circular economy. These are explained from a the conceptual perspective and informatio on the way they have been applied so far in Romania is provided.

The conclusion is that being eco-efficient is no longer a desideratum, it is an obligation. In this respect, Chapter 3 proposes a new definition of eco-efficiency as a unique way for companies of any size and in any sector to become more competitive, more efficient and responsible, preserving natural resources and offering improved products that meet needs and reduce waste and pollution.

Chapter 4 proposes a new definition of the sustainable business model, based on research, discussions and experiences gained in scientific literature and industrial practice. The four proposed eco-efficiency methods are explained from the methodological perspective, and for each of them the results of the experimental researches based in companies from different industrial sectors are presented; four out of five examples are the result from projects led by the author, others are examples from business practices.

Also in this chapter it is stressed the need to replicate and multiply the application of eco-efficiency methods by proposing a model (RECP - Resource Efficiency and Cleaner Production Club) in this respect, by providing the practical, economic and ecological arguments and by providing examples and concrete results obtained in projects carried out in collaboration with the companies. The RECP Club, proposed by the author, is a performance enhancement model that works well for a variety of SMEs located in the same region, across different industries and services. The goal of the RECP Club is to support small and medium businesses in identifying viable economic solutions that both contribute to increase resource efficiency, productivity and competitiveness of businesses, and protecting the environment. The methods and experiments presented have the unique goal to demonstrate the benefits of applying the eco-efficiency methods to processes, products and services, for increasing resource efficiency, pollution reduction, improvements of product design, and returning waste in the economic cycle as resource. The barriers to eco-efficiency have long time analyzed. In the Romanian companies, the barriers relate to difficulties in understanding and

adapting to bureaucratic legislation, lack of specific expertise, poor understanding of the opportunities and benefits of eco-efficiency, human resources limited especially to SMEs, the limitations imposed by the supply chain, the cost of new technologies and difficult access to finance are barriers. "The list of these barriers is endless in the eyes of those who are not interested - those companies that have lagged behind that are not ready for any effort to save resources, while the same types of barriers can be overcome by those who are interested - road-opening companies seeking new ways to increase productivity and innovate" (Berkel, 2018)

Chapter 5 The decision-making process regarding the selection of the eco-efficiency methods to be applied by a company could be determined by applying the multicriteria analysis method. In this respect, the role of multicriteria analysis (AMC) in the assessment of eco-efficiency methods is presented, and the steps of building an evaluation matrix and finally the results obtained from modeling based on the use of Promethee-Gaia software are presented. It is finally proposed a new, innovative eco-efficiency model in companies.

Defining eco-efficiency in the context of the evaluation method selection is rather complex, considering that all ecological, economic, technical and social parameters have to be considered. (Jutta Geldermann, 2008).

Therefore, the use of AMC aims to establish a decision-making model in relation to the eco-efficiency methods that an enterprise should select and apply for the purpose of enhancing eco-efficiency, respectively economic and environmental performance and its long-term sustainability. The method selected was "PROMETHEE" - "Preference Ranking Organization Method for Enrichment Evaluation" (Brans, 1982), or "Method of organizing the preference system for achieving value". This method allows the evaluation of several possible alternatives according to several criteria and the identification of the best possible decision, the ordering of the best to the least good decisions, the visualization of the results of the analysis and the justification or invalidation of the decisions

By carrying out the multicriterial analysis of 5 possible alternatives, known and implemented in practice today, in singly or in various combinations, it became clear that a desired model should necessarily include more eco-efficiency methods. The application of these methods is closely related to the legal and general context. An adequate legal framework, meaning restrictive rules combined with the application of a system of economic and financial incentives for companies, as well as factors related to the global context such as access to resources, market competition or urgent action to combat pollution and climate change, are all decisive for adopting the eco-efficiency process in companies.

The new ECO-EFFICIENT AIDA eco-efficiency model proposed by the author proposes a gradual and systematic approach to the already demonstrated eco-efficiency methods: MM (Environmental Management) - RECP (Resource Efficiency and Clean Production) - ECOP (Product Eco-Innovation) - ECOO (organizational ecoinnovation) - CBM (Circular Business Models), which can be successful in an appropriate legal framework and in an existing context that motivates the urgency of actions. Application of the model requires effective information (ATTENTION) to draw attention to the changing conditions and the increasingly unfavorable global business context, awareness and education resources (INTEREST), an interested and willing management (DESIRE) to explore and apply strategic opportunities for business development (ACTION) in a complicated present and uncertain future. The proposed model is interesting because it draws attention to new elements that have not been taken into account in the multicriterial analysis performed. These factors refer to the level of information, awareness and education of companies and decision-makers involved in the development of the policy framework to stimulate enterprise leverage.

Chapter 6 presents the conclusions and personal contributions, but also the proposals for

future research. The area of sustainability is constantly changing, scientific communications, concepts, methods or practices that ultimately lead to eco-efficiency are launched in the last 10 years with a dynamic, often difficult to track even by experts in the field. Over the past 20 years, ideas such as industrial ecology, cleaner production, resource efficiency and more complex concepts such as eco-innovation, circular economy, low-carbon industry and so on, have gone from ideas to practice. All of them have the same goal: to increase eco-efficiency, meaning reducing resource consumption and pollution. This goal makes sense for companies, because it means financial savings, predictability, responsibility and openness to innovation. In practice, the challenges remain, mainly because enterprises do not (yet) perceive (need) the urgency and urgency of their environmental responsibility, and secondly because businesses have difficulty accessing the know-how, technology and funding needed to put implementing eco-efficiency methods.

Personal contributions of the author relate to: a) contributions following bibliographic research that can be used to enrich the Romanian literature, as well as to update the university courses with new topics related to the concepts and methods of eco-efficiency applied at the level b) Contributions in the field of applied research with emphasis on the results obtained in practice by conducting 4 experimental cases, as well as c) Major contributions to the theoretical research with emphasis on the proposal of a model for integration and extension of eco-efficiency practices (Club Green Entrepreneurs) and a new eco-efficiency model for ECO-EFFICIENT AIDA companies.

Research will continue as the author continues to carry out eco-efficiency projects and work with Green Club companies to apply eco-efficiency methods in practice, including, if possible, testing the new model ECO-EFFICIENT AID. Several demonstration projects are needed to convince industrial companies of the benefits of eco-efficiency.

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