

## SUMMARY

The habilitation thesis entitled "STUDIES AND RESEARCH ON INTEGRATED WASTE MANAGEMENT" is an overview of my professional, scientific and academic activity corresponding to the period after the PhD internship and PhD thesis presentation. (2006-2023).

The knowledge and skills acquired during the doctoral internship were the starting point for the future research directions that I developed after obtaining my doctorate. The research directions developed in recent years have a profound interdisciplinary character combining the tools of mathematical modelling and engineering sciences.

This thesis is structured in three parts, the content of which reflects both the experience accumulated and the main scientific contributions and directions of perspective specific to the academic career. The content of the thesis is in line with national and European priority research areas in the field of Environmental Engineering.

The first part of the habilitation thesis briefly presents the results obtained by the author after obtaining the title of PhD. In addition, the main scientific and professional achievements are presented in three sub-chapters. The second part of the thesis describes career development plans. Scientific achievements are based on the author's representative publications, as first author, corresponding author or co-author, and are synthesized on the research directions relevant to the current scientific context.

The research directions, which I have been focusing on after obtaining my PhD degree, were a continuation and a deepening of the topics of my PhD thesis, namely: Waste Management, Mechanical Treatment of Waste and Experimental Data Processing.

The first line of research **Waste Management** was developed from the study of the waste management system in a public institution, knowledge that was deepened and used to address this concept at national level. This research was subsequently extended to analyze the management of hazardous waste within the Małopolskie region of Poland and to carry out an assessment of urban landfills in the Kinshasa region. At the end of this sub-chapter a study is presented to determine the leachate production capacity of the landfill in Bihor, Romania.

The second line of research, the most extensive study presented in the habilitation thesis, is focused on the **Mechanical Treatment of Waste** and presents an integrated approach to the main stages of solid waste processing. What is relevant in this sub-chapter is the fact that regardless of the field under analysis, the methodology used for the study of experimental processes is based on video analysis. A number of concepts and principles related to Photogrammetry were used to identify the parameters under study. The results of the studies carried out are briefly described in 3 main sections as follows:

- In subchapter I.2.1 the results obtained from the study of the cutting process of different solid products are described. What makes this study different from those existing in the literature is that the value determination of cutting forces is obtained through video analysis of the cutting process.
- In sub-chapter I.2.2. the process of mechanical separation of a mixture of heterogeneous solid particles, i.e. separation on oscillating screens, is analyzed from a theoretical and practical point of view. The first part of the sub-chapter presents a number of theoretical contributions on the studied process. Among the parameters identified, the kinematic index corresponding to the movement of the solid particle

up the sieve and down the sieve can be listed, but what is relevant is that it was possible to identify another coefficient, the kinematic coefficient for the lateral movement of the solid particle. Also in the first part of this sub-chapter the mathematical relations describing the motion of an oscillating site were presented. The second part of this sub-chapter presents experimental results that highlight the following parameters of the motion of a solid particle on the oscillating surface: the trajectory of the different types of solid particles, the speed at which the solid particle moved and the actual values corresponding to the three kinematic indices (the kinematic index corresponding to the motion of the solid particle up on the sieve, down on the sieve and that for the lateral motion on the sieve of the solid particle). What differentiates these studies from those existing in the literature is, as specified above, the way of analyzing the separation process by solid particle size, i.e. the behavior of the solid particle on the oscillating surface, and the way of obtaining the experimental results;

- Subchapter I.2.3. presents the results of the studies carried out on the aerodynamic sorting process. And in this sub-chapter we have analyzed this process in two directions, one analytical, aiming at identifying new computational relations (corresponding to linear velocity or angular velocity, corresponding to the motion of a solid particle in an ascending vertical air stream; to visualize the streamlines around different types of solid particles; but also to identify the stationary position of a solid particle in an air channel of variable cross-section) and an experimental one whose main purpose was to identify the behavior of a solid particle in a vertical updraft. In the experimental determinations it was possible to identify the variations of the following parameters: the distance travelled by the solid particle in a time interval, its linear velocity and its angular velocity, the value of the Magnus force was identified.

The third line of research, **Experimental Data Processing**, focused on the statistical processing of experimental data and the identification of mathematical models corresponding to the different studies carried out, i.e.: waste management, solid particle grinding, mechanical separation of solid particles, aerodynamic separation of solid particles, leachate variation generated by a landfill, but also for the nano-filtration process and for the circulation of liquid pollutants in soil. All these studies have led to the creation of a general methodology for identifying the best mathematical model for complex experimental studies, regardless of the field studied.

In the second part of the habilitation thesis, future directions of development in academic and scientific career are presented. The elements of continuity and novelty and how their combination will be reflected in the development of my professional career are briefly presented.

In 1998 I graduated at the University of Bacău, Faculty of Engineering, specialization Technological Machine for Process Industries, study program Technological Machine for Food Industry, long term (5 years - 1994 - 1998). Starting from 1998 until 1999 I attended the Master's degree courses, specializing in Industrial Systems Logistics.

In 1998 I took and passed the entrance examination for the PhD in Mechanical Engineering, thus becoming a PhD candidate under the supervision of Prof. Dr. Univ. Eng. Vasile NECULAIASA. From February 2004 until May of the same year I carried out a research internship at the University of Zaragoza, Spain, where I studied the process of aerodynamic separation of heterogeneous mixtures of solid particles by means of the simulation program FLUENT.

The PhD was completed with the public presentation of the thesis entitled "Contributions on aerodynamic sorting of agricultural products" in 2006.

I started my academic career in 1998 by occupying the position of preparator in the Department of Process Machinery, Faculty of Engineering, University of Bacau, and in 2001 I occupied the position of university assistant. After occupying these two positions, I coordinated seminar, project and laboratory activities in the subjects: Food Industry Machinery and Plants, Specific Machinery in the Food Industry/Biochemical Engineering.

In 2004 I applied for the position of lecturer in the Department of Environmental Engineering and Mechanical Engineering, Faculty of Engineering, "Vasile Alecsandri" University of Bacau, and after occupying this position I coordinated the activity of the courses: Raw materials for process industries, Industrial waste management, Specific machinery in the food industry/Biochemical engineer. In addition to the course work I also had seminar, project and laboratory activities in different subjects.

Since the academic year 2014 and until now I have held the position of Associate Professor in the same department, and in my teaching activity I have held lectures and applications (seminar, practical work and project - as appropriate) in the following disciplines: Integrated Waste Management; Lifting and Conveying Plants/Specific Equipment in Environmental Engineering; Industrial Process Equipment/Mechanical Engineering/Elements of Mechanical Engineering; Mechanical Design with Specialized Software; Materials Science and Engineering; Industrial Process Optimization; Modern Industrial Product Development Methods; Process Equipment Operation Optimization.

In my teaching activity I use modern and interactive teaching methods, presentations on video projector using PowerPoint and Prezi software applications, thus contributing to a much faster transmission of knowledge. Also, in order to make it easier for students to access the teaching material and to make their assessment transparent, in 2016 we started using Google Classroom, which was later transferred to the Teams platform in 2020 (use of the platform was implemented at university level).

In addition to my teaching activity, I participated in the development of the specializations within the I.M.I.M. Department, respectively of the undergraduate programs: *Industrial Process Equipment, Engineering and Environmental Protection in Industry and Engineering and Management in Public Food and Agro-tourism* and the master degree programs: *Environmental Protection Management in Industry and Process Equipment Operation Management*.

Throughout this period I have actively participated in the development of the equipment base of the I.M.I.M. department by designing and building, but also in the purchase of laboratory equipment related to the following disciplines: Machinery and Plants for the Food Industry, Specific Machinery in the Food Industry/Biochemical Engineering; Materials Science and Engineering; Lifting and Conveying Plants/Specific Machinery in Environmental Engineering; Raw Materials for Process Industries, but also to the purchase of specialized software: Tabel Curve 3D, OriginLab, Prezi, EndNote, Mathcad Prime, LabView 7 and S

Thanks to my knowledge of the use of these softwares, every year, since 2019, I have given courses of presentation and use of Tabel Curve 3D, OriginLab, Prezi, EndNote softwares for PhD students who are part of the doctoral school of "Vasile Alecsandri" University of Bacau.

To support my teaching activity, I have published as first author and co-author 20 specialized books, some of them being published by ALMA MATER Bacău publishing house.

From 2004 to date I have been part of more than 80 contracts and research projects of which 8 as contract director. These contracts and projects are carried out with economic agents, international projects, POSDRU projects or other types of contracts.

The research activity has been valorized through the publication of scientific articles in specialized journals of more than 230 articles of which:

- 87 papers indexed on the Web of Science platform (Web of Science Researcher ID: B-1259-2015) of which 20 as lead or corresponding author;
- 93 papers indexed on the SCOPUS platform (AU-ID 23392953200);
- the rest are indexed in different databases corresponding to different journals.

From 2004 to 2018 I held the position of Financial Officer in the Department of Environmental and Mechanical Engineering, and from 2018 to October 2023 I held the position of Department Director in the same department.

In addition to teaching and research activities since 2010, I am responsible for the website of the Department of Environmental Engineering and Mechanical Engineering (<https://www.ub.ro/inginerie/structura/imim>), which is constantly updated with information on study programs, activities carried out by teachers in the department and necessary information for students. Since 2010 I have been co-opted to the editorial board of the Journal of Engineering Studies and Research and since 2015 I am also responsible for the journal's website (<https://jesr.ub.ro/1/index>).

Taking into account the professional experience gained in the research areas approached, respectively: Waste management; Study of the shredding process; Study of the mechanical size separation process of solid particle mixtures; Study of the aerodynamic separation process of solid particle mixtures; Processing and analysis of experimental data; the main research directions I intend to develop are: **a) Development of research activities in the research laboratories of the department to which they belong and of the faculty:** proposing and implementing new technologies through which the research activities in the laboratories can be recognized at national and international level; expanding the activities in the laboratories but also in the laboratories themselves, where appropriate, by attracting funding for research activities; setting up specialized and/or interdisciplinary research teams that can develop innovative research topics and keep abreast of international developments in the field of research; strengthening and expanding national and international cooperation, including by establishing cooperation with various economic agents interested in research activities; obtaining national and international research and development projects to fund research topics. **b) Use of research results by writing and publishing scientific papers:** publication of articles in peer-reviewed journals (ISI, BDI); publication of books by recognized publishers; participation in scientific events and conferences and publication of papers in their proceedings; maintaining and expanding involvement in editorial and review boards of as many international journals as possible; the results of my future research will be reflected in the books and papers I will publish and in the projects I will coordinate. I will also continue to support research teams as a member as well as a coordinator.

Professional and scientific achievements will result in the development of the field of Environmental Engineering, the establishment of new collaborative links and increased international recognition.