Universidade do Minho
Escola de Engenharia

CENTROALGORITMI

BOOK OF ABSTRACTS

DPISE 2026 Workshop

09th June 2026

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Title: Book of Abstracts - DPISE 2026 Workshop
Publisher: University of Minho
Publisher address: Campus de Azurém, 4800-058, Guimarães, Portugal

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Preface

This book brings together the abstracts presented at the 2026 Workshop of the Doctoral Program in Industrial and Systems Engineering (DPISE/PDEIS).

This annual event, currently in its ninth edition, took place on June 9, 2026, at the Azurém Campus of the University of Minho.

The workshop constitutes an important platform for the promotion of scientific activities within the doctoral programs, fostering interaction and collaboration among students, supervisors, and researchers sharing common interests in the DPISE/PDEIS research domains.

The event included a dedicated morning session during which students presented their individual research projects.

The Editors wish to express their sincere appreciation to all contributing authors and students for their commitment and for contributing to the overall success of the DPISE/PDEIS 2026 Workshop.

Rui M. Sousa
Organizing Committee Chair,
Director of DPISE/PDEIS

Program

09th June 2026 – Workshop DPISE/PDEIS 2026 PROGRAM			
9:30 AM	**Opening Session** (Room: 0.08/Ed.11) **Prof. Joana Cunha**, Vice-President of the School of Engineering of University of Minho **Prof. Paula Ferreira**, Director of the ALGORITMI Research Centre **Prof. Paulo Sampaio**, Director of the Department of Production and Systems **Prof. Rui Sousa**, Director of the Doctoral Program in Industrial and Systems Engineering **Paper Awards Announcement**		
PARALLEL SESSIONS #A			
10:00 AM	Session A1 / Moderated by Prof. Nélson Costa Room: 0.08/Ed.11	Session A2 / Moderated by Prof. Anabela Alves Room: 0.07/Ed.11	Session A3 / Moderated by Prof. Ana Cristina Braga Room: 0.11/Ed.11
11:00 AM	**Coffee-Break**		
PARALLEL SESSIONS #B			
11:15 AM	Session B1 / Moderated by Prof. Teresa Monteiro Room: 0.08/Ed.11	Session B2 / Moderated by Prof. Elsa Silva Room: 0.07/Ed.11	Session B3 / Moderated by Prof. Rui Sousa Room: 0.11/Ed.11
12:00 PM	**Closing Session** (Room: 0.08/Ed.11) **– Best Poster Award Announcement**		

Session A1

09th June 2026, 10:00 A.M. – 10:45 A.M. | Room: 0.08/Ed.11

Moderator: Prof. Nélson Costa

Integration of Ergonomics in the Design of Personalized Products through Hybrid Manufacturing

Lídia Daniela Lemos Ribeiro (lidialemos@dep.uminho.pt)

Abstract. Musculoskeletal disorders (MSDs) caused by prolonged use of cutting tools represent a significant occupational health challenge. This doctoral project, developed under the SHAPE-D project funded by Compete2030, addresses the need for ergonomically optimized scissors through an interdisciplinary approach combining human factors, product design, and advanced manufacturing technologies.
The research aims to: (i) characterize the biomechanical demands and ergonomic risk factors associated with scissor use through experimental analysis of hand anthropometry, force patterns, posture, and muscle activity; (ii) develop a parametric digital model to generate personalized scissor geometries based on individual anthropometric and biomechanical data; (iii) produce and validate prototypes using hybrid manufacturing — combining additive manufacturing and injection moulding — to balance personalization with industrial viability; and (iv) conduct user-centred testing to iteratively optimize the proposed solutions.
The project will be developed at the University of Minho, integrating the DONE Lab, Centro ALGORITMI, and Lab2PT, under a supervision team with expertise in ergonomics, product design, and polymer engineering. The expected outcomes include practical guidelines for implementing personalized ergonomic tools in industrial settings, contributing to MSD prevention, enhanced user comfort, and increased competitiveness of the national manufacturing industry.

Self-Sustainable Predictive Framework to support Decision-Making in Ergonomics and Human Factors

Mariana Maia Carneiro (id11554@alunos.uminho.pt)

Abstract. Work-related musculoskeletal disorders (WRMSDs) affect nearly 60% of European workers, underscoring the urgent need for dynamic, data-driven ergonomic assessments. My PhD project develops a self-sustainable predictive framework that integrates Artificial Intelligence (AI) and Machine Learning (ML) to support ergonomic decision-making in real-world industrial settings, particularly within food retail.
Using Design Science Research (DSR) and a mixed-methods approach, the framework will combine wearable sensors, motion capture, and ergonomic assessment methods (REBA, RULA, NIOSH) to create a robust database (Baseline). Neural network models will be trained to predict ergonomic risks, provide personalized recommendations, and simulate workplace interventions. A human-centered interface will ensure usability for ergonomists, managers, and workers.
The expected contributions include real-time risk prediction, adaptive personalization, and scalable, cost-efficient implementation aligned with Industry 5.0 principles. The framework aims to reduce WRMSDs, enhance worker well-being, and improve operational efficiency, bridging critical gaps in current AI-based ergonomic tools.

Session A2

09th June 2026, 10:00 A.M. – 10:45 A.M. | Room: 0.07/Ed.11

Moderator: Prof. Anabela Alves

Data-Driven Approach for Real-Time Operator Balancing in Manual Assembly Lines

Alberto António Bumba (id11153@alunos.uminho.pt)

Abstract. This paper presents a real-time and data-driven approach for dynamic operator balancing in multi-manned assembly lines. Unlike traditional Assembly Line Balancing approaches, where tasks are statically assigned during the line design phase, the proposed system considers industrial environments in which tasks remain physically fixed to workstations while operators are mobile and may execute sequences of tasks across multiple stations. Operator activity is continuously monitored using RFID technology, enabling real-time estimation of cycle times and workload distribution. When significant deviations between planned and observed cycle times are detected, the system automatically triggers a rebalancing process. The proposed architecture integrates real-time data acquisition, decision logic, and optimization within a closed-loop framework deployed through a web-based industrial application. A Large Neighborhood Search (LNS) heuristic is used as the primary optimization method, while supervised learning and reinforcement learning approaches are also supported through a hybrid decision strategy. The optimized allocation is automatically published to operator and station interfaces, guiding operators through updated execution sequences. The proposed approach enables adaptive workload balancing under dynamic production conditions while preserving operational constraints and production continuity.

Manufacturing System Failures Identification through Predictive Approach: a Contribute for Industry 5.0

Eduardo Santos (id11155@uminho.pt)

Abstract. Industry 5.0 represents a forward-looking vision that combines technological advancements with social responsibility, resilience, and sustainability. That context motivated the start of this PhD project in 2023 with the goal of establishing a predictive framework for detecting possible failures or deviation in mature manufacturing systems and products, as early as possible, before they manifest later in the process or at the customer. This is guided by a zero-defect strategy and human subjectivity reduction. Technology allows 100% product inspection at End of Line (EOL), but this is a non-perfect system that may result in critical failures in customer tests. To this end, an investigation on state-of-the-art predictive methods has started, having already published a critical literature revision article and one case study conference paper, to be followed by a forthcoming thesis chapter and a deeper case study demonstration. Additional relevant conditions include: (1) collection of data quality (DQ) with a rule-based choice mechanism (forthcoming); (2) assuring DQ dimensions through systematic literature revision research (ongoing), preceded by two conference papers published on measurement system analysis (MSA) for electronic devices; (3) and a thesis chapter on prescriptive analysis framework for KPIs decision modelling, after predictive framework demonstration (forthcoming).

Visual Assistant for Safety in Lean Construction

Guilherme Rui Sousa Silva (guilhermerui010@gmail.com)

Abstract. The construction sector remains one of the highest rated occupational accident sectors, many of them associated with human error and the misuse or non-use of Personal Protective Equipment (PPE). Although Lean Construction and digital technologies have evolved significantly, the integration between Lean principles, safety management and Augmented Reality (AR) remains limited.
This research proposes the development of a Visual Assistant for Safety in Lean Construction (VASiLC), a human-centered approach combining Lean Thinking, and AR to support PPE compliance and reduce safety-related waste. The system aims to provide real-time visual guidance, standardized procedures and contextual feedback to support safer and more reliable workflows in construction environments.
The methodology combines Systematic Literature Review, Lean Safety Mapping, and Design Science Research to identify inefficiencies associated with PPE usage and develop an AR-based prototype for PPE guidance and verification. The solution will be validated through expert assessment and controlled case studies.
Expected contributions include improving PPE adherence, strengthening safety culture, reducing waste, and advancing the integration of Lean Construction with Industry 5.0 technologies and Operator 4.0 concepts.
Currently, a Systematic Literature Review article on the research gap has already been written and submitted for presentation in October 2026, in Porto, at the European Lean Educator Conference (ELEC).

Session A3

09th June 2026, 10:00 A.M. – 10:45 A.M. | Room: 0.011/Ed.11

Moderator: Prof. Ana Cristina Braga

Assessment Suppressed Electricity Demand for Electricity in Angola's social Sector Schools and Hospitals

Budareld Maria Mbumba (budareldm@gmail.com)

Abstract. This study assesses energy consumption patterns in the social sector, in schools and hospitals in Angola. The research analyses energy consumption trends based on total consumption per school, and per hospital. Traditional demand forecasts often fail to account for suppressed demand (SD), a critical factor where by the minimum service levels necessary for human development are either unavailable to people or available only at an inadequate level. Furthermore, the study addresses critical gaps, proposes a methodology for estimating SD in developing countries, and applies this methodology to assess SD in Angola. The Angolan social sector faces two main challenges: low electrification rates in schools and hospitals, and a significant SD where by a substantial portion of the population, despite needing electricity, is unable to access or afford basic services. The results reveal a wide disparity between urban and rural areas in terms of the country's energy deficit. Although urban areas benefit from better connection to the electricity grid, they are hampered by constraints on the acquisition and use of equipment; the energy deficit resulting from this shortfall is estimated to amount to 725 GWh/year. Rural areas suffer from severe energy inequalities, and energy consumption due to a lack of access to the electricity grid reaches 111 GWh/year. Overall, total energy consumption in Angola is estimated at 12,455 GWh/year in urban areas and 1,384 GWh/year in rural areas.

Energy Forecasting and Performance Management in Large Commercial Buildings

Patricio del Rio Fernandes Palinhas (patriciopalinhas@gmail.com)

Abstract. Building energy consumption prediction (BECP), focusing on data types, machine learning (ML) algorithms, and factors affecting prediction accuracy, plays today a crucial role in energy control, design optimization, retrofit evaluation, energy price guidance, and carbon neutrality efforts. It helps improve energy efficiency and reduce carbon emissions in buildings. The study of social behavior is fundamental to energy consumption, because the way energy is produced, distributed, and used is directly linked to human behavior, living conditions, and social structures. This research aims to contribute to the development of a methodology to support the management of energy consumption in large commercial buildings, resulting in increased economic and environmental efficiency, ensuring the well-being of their users. This management should be predictive and intelligent. In terms of methodology, There is a range of possible methods and techniques for data management, collection, and analysis. To conduct this research process, it is necessary to identify approaches, strategies, techniques, and procedures. Data will be collected and analyzed from shopping centers located in the North, Centre and South of Portugal, with extensive populated urban centers. It will be important to analyze energy consumption, in shopping centers located in different regions of the country, with different weather conditions and different cultural levels.

Reverse Logistics for End-of-Life Batteries

Anna Luiza Souza Vieira Santos (anna.luizasvs@gmail.com)

Abstract. The increasing adoption of electric vehicles poses environmental and logistical challenges, especially in the management of end-of-life batteries. This research proposes a reverse logistics model for lithium-ion batteries (LIBs) in electric vehicles, focusing on the Iberian Peninsula. Initially, a study was carried out on the possible destinations of end-of-life LIBs, including recycling, reuse, and safe disposal. In addition, mathematical models were applied to predict the amount of discarded batteries by 2050. Based on this data, the research seeks to identify strategic locations for the collection of LIBs, where they will be evaluated before being sent to the most appropriate destination. The study aims to optimize the sustainable management of this waste, promote the circular economy, and reduce dependence on the extraction of critical materials, contributing to the decarbonization of the automotive sector.

Industry 4.0 'Technology Stacks' Drive Sustainability in the Built Environment: From Isolated Tools to Integrated Ecosystems

Filipe Machado (filipemacduarte@gmail.com)

Abstract. Industry 4.0 (I4.0) technologies are increasingly associated with sustainability transitions in the built environment, particularly through the integration of digital tools that support improved data management, interoperability, and decision-making processes. To examine how these relationships are currently conceptualised in the literature, a hybrid scoping review was applied to publications indexed in Web of Science and Scopus.

The analysis identified Building Information Modelling (BIM), Digital Twins (DT), Internet of Things (IoT), Artificial Intelligence (AI), and Blockchain as the most prominent technologies linked to sustainability applications across design, construction, and operational stages. Recurring technology combinations were found, frequently associated with enhanced monitoring, coordination, and sustainability performance within built environment processes.

The review also revealed substantial conceptual fragmentation across the literature, including inconsistent terminology, overlapping definitions, and limited empirical validation of integrated technological applications. These limitations constrain theoretical development and comparative analysis within the field. Greater conceptual alignment and more empirically grounded research are therefore needed to assess the effectiveness and sustainability implications of I4.0 technology integration in diverse built environment contexts.

Session B1

09th June 2026, 11:15 A.M. – 11:45 A.M. | Room: 0.08/Ed.11

Moderator: Prof. Teresa Monteiro

A Multiclass Model for Financial Distress and Bankruptcy Prediction

Ana Margarida Jorge Sousa (amjorgesousa@gmail.com)

Abstract. Corporate bankruptcy is seldom a sudden event. It is often preceded by a progressive decline in firms' financial condition. Nevertheless, many bankruptcy prediction studies still rely on binary models that classify firms only as healthy or failed, disregarding intermediate stages of financial instability. To address this limitation, this study develops a multiclass early-warning framework that describes firms' financial condition through three states: healthy, distressed, and pre-event. The pre-event state refers to the final observable accounting year before bankruptcy. Using a large firm-year panel from the Orbis database for the period 1997–2025, the empirical analysis focuses on Portuguese manufacturing firms. Firm-level financial indicators are combined with lagged macroeconomic variables to capture both internal firm weaknesses and the wider economic context. To preserve interpretability, a multinomial logistic regression model is estimated to predict firms' financial states. The model achieves good out-of-sample performance, with a balanced accuracy of about 0.75 and a macro-averaged F1 score close to 0.70. The results suggest that the pre-event state is distinguishable from healthy and distressed firms, while the intermediate distress state remains more difficult to identify. Taken together, the findings provide evidence consistent with a gradual deterioration process and suggest that interpretable econometric models can generate useful early-warning signals.

Modelling the Spread of Fake News: a Multi-Objective Approach

Daniel Botelho (daniel.botelho@dps.uminho.pt)

Abstract. The rapid dissemination of false information across social media presents a critical challenge in contemporary digital networks. Since this type of spread resembles biological epidemics, it can be described using compartmental epidemiological models. While aggressive moderation strategies can theoretically limit this spread, they impose significant operational costs and resource constraints on digital network platforms. This work proposes a multi-objective optimal control framework, built upon a compartmental epidemiological model, to systematically analyse the inherent trade-offs between mitigation efficacy and control effort. By formulating the moderation process as a dynamic optimisation problem, the Pareto frontier is determined to map the optimal equilibrium states between minimising the active spreading population and reducing the cumulative cost of intervening. The numerical solutions, obtained via nonlinear programming, using the CasADi tool and the Weighted Sum Method, provide a rigorous, data-driven decision-support framework that aims to balance both the operational and social costs. Ultimately, this approach allows platforms and lawmakers to implement strategies dynamically adapted to their specific operational constraints and mitigation targets.

From Analytical Insight to Organizational Decision: Rethinking Output Governance in Data-Driven Management

Hermenegildo Domingos Baptista (hermenegildo59@hotmail.com)

Abstract. Over the past two decades, analytics have been portrayed as transformative forces in supply chain management, reshaping decision-making and organizational performance. Prior research shows that organizations embed analytics into strategic, tactical, and operational activities, while automated systems integrate analytical outputs into workflows. However, this literature assumes analytical outputs move linearly from model generation to managerial action, emphasizing data quality, modeling sophistication, integration, and organizational alignment. We argue that this perspective overlooks a critical organizational layer: the interpretive and governance processes that mediate between analytical outputs and final managerial decisions. Even when models are technically robust, their outputs may be selectively interpreted, strategically reframed, delayed, filtered, or hierarchically overridden. Consequently, analytical recommendations may not reach enactment in their original form, becoming diluted, transformed, or decoupled from action. To address this gap, we introduce Output Governance, defined as the structures, processes, and accountability mechanisms that shape how analytical results are communicated, interpreted, legitimized, and enacted within organizations. By shifting attention from technical integration to the integrity of recommendations throughout the decision process, we reconceptualize analytics implementation as a governance challenge rather than solely a technical one.

Session B2

09th June 2026, 11:15 A.M. – 11:45 A.M. | Room: 0.07/Ed.11

Moderator: Prof. Elsa Silva

Real-Time Location Systems for Patient Flow Monitoring in Emergency Departments: A Pilot Study

Erik Teixeira Lopes (erik.lopes@algoritmi.uminho.pt)

Abstract. Emergency departments are among the most demanding healthcare environments, characterized by high patient volume, unpredictable demand, and the involvement of multiple clinical and administrative workflows. Obtaining reliable data on patient movement within these settings remains a persistent challenge, as traditional information systems often lack the granularity needed to capture actual physical flow. Real-Time Location Systems (RTLS) offer a promising alternative by enabling automatic, continuous tracking of patients across physical spaces.
In this context, a pilot study was conducted at the Emergency Department of Hospital Senhora da Oliveira Guimarães. Using a BLE-based RTLS platform with four anchors and patient wristband tags, location data was collected across six zones over approximately 50 days. A dedicated data processing pipeline was developed, incorporating bounce filtering and episode identification, reducing roughly 242,000 raw records by 88% and yielding 87 valid patient episodes. Analysis of zone-set membership patterns revealed significant variability in patient pathways and identified Radiology as a near-universal step, while the Waiting Area consistently showed the longest dwell times. The study demonstrates the technical feasibility of RTLS-based flow monitoring in a real hospital environment and establishes a reproducible data collection and processing methodology as a foundation for future process mining and simulation work.

Measuring Surgical Performance through KPIs: Gaps, Opportunities, and a Systemic Approach

Paulo Martins Fernandes (id11661@alunos.uminho.pt)

Abstract. The surgical department occupies a central role in hospital activity. Its particular, delicate, urgent and unpredictable nature, combined with its pressing demand for resources, requires a management approach that is both efficient and patient-centred. A lack of data - or its inadequate analysis - allows processes to remain obsolete and inefficient. Key Performance Indicators (KPIs) are essential instruments for a management model that brings these two characteristics together: efficiency and the patient at the heart of decision-making. KPIs enable a clearer understanding of operational reality and support data-driven decision-making within an operations management framework, facilitating the application of lean tools.
This study aimed to identify the KPIs reported in the literature as relevant to the surgical context, comparing them with those applied across different hospital settings. A further objective was to characterise these KPIs, mapping the difficulties reported by healthcare professionals in their use, as well as the improvement opportunities identified for the future.
A PRISMA-guided Systematic Literature Review (SLR) was conducted and triangulated with semi-structured interviews with surgical clinicians, nurses, and managers. The findings reveal considerable variation across institutions in the adoption and use of KPIs. Barriers to KPI use include insufficient training, limited access to information, difficulties in data capture, and slow reporting cycles.

Session B3

09th June 2026, 11:15 A.M. – 11:45 A.M. | Room: 0.011/Ed.11

Moderator: Prof. Rui Sousa

Towards Operational Excellence in Public Research Centres

Aline Magalhães de Barros (mbarros.aline@gmail.com)

Abstract. Research Centres (RC) operate in complex environments where scientific excellence must coexist with administrative inefficiencies, organizational barriers, and increasing societal expectations. However, most Operational Excellence (OpEx) models remain strongly associated with industrial settings, and a clear gap exists regarding models or structured applications adapted to public RC. This PhD project aims to develop an OpEx model tailored to public RC. Developed within the Centre of Biological Engineering (CEE), the research follows an Action Research approach combining theoretical and empirical stages. An integrative literature review analysing the eight most referenced OpEx models enabled the identification and consolidation of core OpEx principles into nine integrative classes. This knowledge, together with the researcher's immersion in the operational reality of RC, supported the definition of four analytical constructs, OpEx Principles, Critical Success Factors, Problematic Processes, and Employee Engagement, which structured the empirical phase of the research. The empirical work combined semi-structured interviews with directors and former directors of RC at the University of Minho, together with questionnaire data collected at CEB. The integration of theoretical and empirical findings supported the development of a context-sensitive OpEx model. Current work focuses partial validation through process analysis and intervention in administrative and support activities.

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