



Book of Abstracts

DPISE 2024 Workshop

29th May 2024



Universidade do Minho
Escola de Engenharia



CENTROALGORITMI

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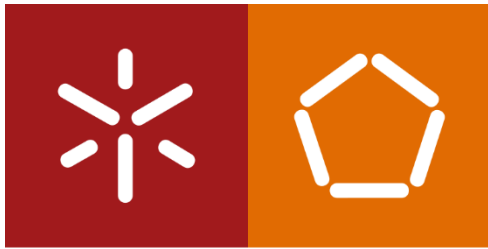
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Preface

This book compiles the abstracts presented at the 2024 Doctoral Program in Industrial and Systems Engineering (DPISE/PDEIS) Workshop.

The workshop took place on May 29th of 2024 at Campus Azurém, Guimarães.

This meeting was created to promote the doctoral programs scientific research areas, by getting together students, supervisors, and researchers with a special interest in the research areas covered by the doctoral program. This was the 7th of a series of annual meetings engaging DPISE members.

The workshop was held in a single morning devoted to the presentation of all the DPISE students' individual projects.

The Editors would like to thank all the authors/students of DPISE for their valuable contribution and for making DPISE 2024 Workshop such a big success.

Paula Ferreira
*Organizing Committee
Chair, Coordinator of DPISE*

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Program

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9:30 AM	Opening Session (Room: 0.08/Ed.11) Prof. Sameiro Carvalho, ALGORITMI Research Centre Prof. Nelson Costa, Department of Production and Systems Prof. Paula Ferreira, Doctoral Program in Industrial and Systems Engineering Paper Award Announcement		
	PARALLEL SESSIONS #A		
	Session A1 Room: 0.08/Ed.11 Moderator: Sameiro Carvalho	Session A2 Room: 0.07/Ed.11 Moderator: Ana Cristina Braga	Session A3 Room: 0.11/Ed.11 Moderator: Teresa Monteiro
	10:00 AM	The Naval Industry's Contribution to Sustainable Development in Angola Josério Adriano Vilança da Silva	Multiclass Prediction Models for Bankruptcy: A Comparative Study in Portugal Ana Margarida Jorge Sousa
10:15 AM	Simulating the Evaluation of Public Investments in Viticulture: A Case Study Thomaz Fagá	Dynamic Decision-Making Frameworks in Project Management Methodologies Marco António da Silva Esteves	Development of a real-time assessment framework for collaborative robotic systems André Cardoso
10:30 AM	A Firefighting Resource Dispatch Problem Optimization using Metaheuristics Marina Araújo de Matos	The future of electric vehicles batteries: Pathways, challenges and opportunities Anna Luiza Souza Vieira Santos	Worker Line Balancing Optimization through the Integration of Real-Time Data from Machines and Operators: a Big Data Analytics Approach. Part 1. Heuristics Methods for Worker Line balancing: a literature review Alberto António Bumba
10:45 AM	Assessing Sustainability Impacts In Projects: A Systematic Review Of Accounting Practices Filipe Machado	Use of indoor location technologies in healthcare contexts: a scoping review Erik Teixeira Lopes	Challenges and prospects of electricity generation and usage in sub-saharan Africa Budareld Maria Mbumba
11:00 AM	Coffe-Break		

PARALLEL SESSIONS #B		
	Session B1 Room: 0.08/Ed.11 Moderator: Anabela Tereso	Session B2 Room: Room: 0.11/Ed.11 Moderator: Ângela Silva
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11:45 PM	Application of NSGA-III to a Multi-Objective Job Shop Optimization Problem with Independent Parallel Machines Francisco Álvaro dos Santos	Manufacturing system failures identification through predictive approach: a contribute for industry 5.0 Eduardo Manuel Cardoso Dias de Pessoa Santos
12:00 PM	Parallelization of local search heuristics for the pollution routing problem using GPU computing Mário Leite	A Sustainable Framework approach for European Digital Start-ups Go to Market Rui Filipe Galvão Brito
12:15 PM	Escalonamento de múltiplos projetos - problemas e soluções Renan Oliveira Zocca	Assessment of circular solutions for solar photovoltaic waste in Portugal Marcela Leonardo Jorio
12:30 PM	Closing Session (Room: Room: 0.08/Ed.11) Best Posters Awards Announcement	

Session A1

29th May 2024, 10:00 A.M. – 11:15 A.M. | Room: 0.08/Ed.11

Moderator: Sameiro Carvalho

The Naval Industry's Contribution to Sustainable Development in Angola

Josério Adriano Vilança da Silva (id10501@alunos.uminho.pt)

Abstract. The main aim of this paper is to analyse the potential contribution that the development of Angola's shipbuilding industry could offer towards the country's sustainable development. Angola is a developing country facing many economic and social challenges such as low GDP growth, rising unemployment, inflation, and a low level of industrial production. As for the industrial sector, the country depends heavily on the oil sector, particularly, and, to a lesser extent, on non-oil sectors such as agriculture, fisheries, mining, timber and others. The paper is based on an exploratory investigation relying on the collection of scientific articles, national and international reports as well as information specific to Angola. This allowed for an assessment of how the shipbuilding industry can contribute to tackling the challenges identified and achieving the sustainable development objectives.

Simulating the Evaluation of Public Investments in Viticulture:

Thomaz Fagá (id8682@alunos.uminho.pt)

Abstract. The growing concern about verifying the results and impacts of projects financed by European cohesion funds highlights a methodological gap in the local scenario, particularly for small-scale projects. Currently, these projects often lack detailed planning and concrete result commitments, posing a challenge for effective public resource management.

This study aims to address this gap by presenting a practical interface that integrates various international public policy evaluation methodologies. This interface is designed to support the structuring of project proposals and facilitate the effective evaluation of the results and impacts of public investments. The ultimate goal is to enhance the decision-making process and enable the assessment of small-scale impacts.

The effectiveness of this interface is demonstrated through a hypothetical case study on the restructuring of viticulture fields and the establishment of a cooperative winery in a specific location in the north of the country. Data collection involved consultations with producers, cooperative members, and an existing cooperative winery engaged in the vineyard restructuring process of its cooperative suppliers.

A Firefighting Resource Dispatch Problem Optimization using Metaheuristics

Marina Araújo de Matos (mmatos@algoritmi.uminho.pt)

Abstract. Forest fires are a growing concern in our planet, as they have been increasing in frequency and severity over the last few decades. It is therefore essential to manage firefighting in order to prevent and reduce the damage caused to life, the economy and ecosystems. This work deals with the forest firefighting resource dispatch problem using metaheuristics. It is essential to know when and which suppression resources should be sent to extinguish the ignitions. Note that the faster the resources act, the smaller the burned area. An adapted genetic algorithm and differential evolution algorithm are used to solve a firefighting resource dispatch problem aiming to find the optimal allocation of resources to ignitions, and at what instant of time each resource is assigned to each ignition, in order to minimize the total burned area.

The two metaheuristics are applied to a set of 60 randomly generated instances, comprising 5, 7 and 10 resources to extinguish 20 or 30 ignitions. A statistical analysis of the results is used to compare the efficiency of the metaheuristics, where the GA shows more competitive results.

Assessing Sustainability Impacts In Projects: A Systematic Review Of Accounting Practices

Filipe Machado (filipemacduarte@gmail.com)

Abstract. This study delves into empirical methodologies concerning project sustainability, with a specific focus on the development, testing, and practical application of innovative methods, underlining the importance of both return on investment (ROI) and sustainability. Notably, it highlights the trend of models being tailored to specific case studies, which poses a significant challenge to the generalization of findings across different contexts. Furthermore, the research identifies the early stages of many studies, suggesting a dynamic area of inquiry at the convergence of sustainability and economic indicators for measuring sustainability impacts in projects. Despite the richness of the literature, there exists a notable fragmentation due to the predominance of singular contributions, which could potentially impede the formation of a cohesive knowledge base in this field. However, the selected research design effectively captures a broad spectrum of studies, indicating the potential limitation of a narrower keyword focus in overlooking significant contributions. Key challenges identified in the study include data limitations and the inherent difficulty in quantifying the economic value of non-economic elements, which introduces subjectivity into assessments. This complexity underscores the need for future research to standardize methodologies and enhance data quality to foster a deeper understanding of sustainability's economic implications within project contexts.

Session A2

29th May 2024, 10:00 A.M. – 11:15 A.M. | Room: 0.07/Ed.11

Moderator: Ana Cristina Braga

Multiclass Prediction Models for Bankruptcy: A Comparative Study in Portugal

Ana Margarida Jorge Sousa (amjorgesousa@gmail.com)

Abstract. In contemporary economic reality, organizations must anticipate and prevent financial emergencies. This research paper comprehensively examines models for predicting bankruptcy past and future, given the continuous effects of the deadly COVID-19, as well as current significant events like Russia's invasion of Ukraine. In 2007, the subprime crisis led to an increase in bankruptcy cases among Portuguese companies. Keeping solid risk management systems and anticipating financial difficulties require bankruptcy prediction models. Traditionally, the prevalent focus of these models has been on financial indicators. However, new studies validate the importance of incorporating wider-ranging indicators, such as macroeconomic ones, for improving prediction performance. Although these current models primarily rely on statistical or artificial intelligence, they are not free of limitations, especially regarding their interpretability, overfitting, and generalisability, despite their beneficial effects on accuracy. This study aims to provide a brief overview of bankruptcy prediction models. A multiclass framework is explored as an alternative to the traditional binary classification model. Therefore, it is crucial to define different periods of bankruptcy to increase the accuracy rate of predicting the difficulty businesses may have in operating in difficult economic times. It provides an in-depth understanding of what causes firms to go bankrupt economically.

Dynamic Decision-Making Frameworks in Project Management Methodologies

Marco António da Silva Esteves (marco.esteves@pt.bosch.com)

Abstract. Choosing the proper project management methodology is crucial for success, yet there's a gap in comprehensive decision-making frameworks for this task. This study addresses critical questions to enhance project success, what decision-making frameworks/models exist for selecting project management methodologies, and how they differ. What project characteristics are commonly considered in this selection process? What are these frameworks' reported benefits and limitations in practice, and how are they evaluated? What are the gaps and challenges in current literature? Our current systematic literature review reveals a scarcity of research, emphasising the need for further investigation. By synthesizing existing literature, we aim to develop a comprehensive framework to aid project managers in methodology selection, thereby improving project outcomes. Following the literature review, we will publish the findings and conduct a clustering analysis to categorise decision-making frameworks based on project complexity, team dynamics, and methodology type. This

structured approach will facilitate informed decision-making in real-world project scenarios.

The future of electric vehicles batteries: Pathways, challenges and opportunities

Anna Luiza Souza Vieira Santos (id10820@uminho.pt)

Abstract. The transport sector is the second largest emitter of Greenhouse Gas Emissions (GHG). As such, there is an increasing interest in the use of electric vehicles (EV) as they represent an important technology to reduce the emissions of the sector. Lithium-Ion Batteries (LIB) have been widely used as a favourite storage option in EV due to their high-density properties. Despite the importance of EV for reducing GHG emissions, the End-of-Life (EoL) solutions for their batteries remain an important issue to be solved. Solutions for these EoL batteries demand attention due not only to the recognized negative environmental effects and health hazards but also due to the economic value that these batteries may bring. Having in mind this problem, this article analysed the possible pathways and challenges for EoL LIB management. The results put in evidence 9 challenges which were analysed under two perspectives: according to the problem they present and by responsibility. Some actions were suggested to overcome the identified challenges. Further, this article concludes that it is necessary a joint effort by the government, academia, and industry to tackle these challenges.

Use of indoor location technologies in healthcare contexts: a scoping review

Erik Teixeira Lopes (erik.lopes05@gmail.com)

Abstract. Healthcare institutions are continually striving to enhance their performance, adopting various industrial methodologies, and leveraging numerous technologies. Despite the remarkable advancements in healthcare technology, indoor location tools remain significantly underutilized within healthcare settings. Nevertheless, these tools hold the potential to deliver efficiency gains, streamline workflows, and reduce costs.

The objective of this review is to delve into the realm of indoor location technologies in healthcare. It aims to elucidate the current research landscape, identify influential authors, institutions, and countries, and explore the factors that contribute to the success or failure of real-time location systems (RTLS) implementations.

To achieve this objective, the review follows the PRISMA Extension for Scoping Reviews guidelines. The search process spanned across six databases, and selected studies underwent data extraction by two independent reviewers. The findings are presented through a narrative summary, graphical representations, and tabular formats.

Ultimately, this review provides a comprehensive understanding of the usage of indoor location technologies in healthcare, shedding light on critical aspects crucial for the development of future solutions.

Session A3

29th May 2024, 10:00 A.M. – 11:15 A.M. | Room:0.11/Ed.11

Moderator: Teresa Monteiro

Analysing misinformation dynamics: a case study of fake news propagation

Daniel Botelho (id10948@alunos.uminho.pt)

Abstract. In today's digital age, social networks serve as powerful platforms for instant information dissemination. However, the spread of fake news is increasingly presenting as a profound societal challenge. This research study explores the application of epidemiological models to study and simulate the spread of misinformation and examines the dynamics and mitigation strategies of information propagation. Through a combination of literature review, theoretical analysis, model implementation and empirical validation, this study seeks to illuminate the complexities surrounding fake news dynamics. Such understanding is essential for the creation of effective preventive measures to counteract the viral spread of misinformation, safeguarding societal well-being in an increasingly digital world.

Work that has already been undertaken includes the analysis of a real incident of fake news on the social media platform X (formerly Twitter) where the SIR (Susceptible-Infectious-Recovered) model was applied to investigate its epidemic-like propagation. By calibrating the SIR model with real data, we pinpointed optimal parameters governing the dissemination of this specific data. Furthermore, simulations were conducted to assess the efficacy of a control measure in restricting the misinformation's spread. This research study underscores the utility of epidemiological frameworks in comprehending and fighting the viral dissemination of fake news amidst the ongoing move towards digitalization.

coworkers.

Development of a real-time assessment framework for collaborative robotic systems

André Cardoso (andre.cardoso@dps.uminho.pt)

Abstract. The Industry 5.0 paradigm prioritizes the well-being and safety of workers within production processes. However, despite its aims, the contemporary industrial landscape faces several challenges. These challenges encompass global market demands for personalized goods, as well as the prevalent occurrence of Work-Related Musculoskeletal Disorders and an aging workforce. These obstacles underscore the ongoing need for human-centered solutions, allowing adaptations that align with the physical and cognitive constraints of humans. The potential of Human-Robot Collaboration (HRC) is far from exhausted. Presently, Collaborative Robots (Cobots) are promoted for their ease of implementation and ability to operate alongside humans without physical barriers. Yet, even when programmed to accommodate some level of

interaction with human workers, these robotic systems lack awareness of Ergonomics & Human Factors. The absence of a robust ergonomics framework, informed by the implications of HRC, and the lack of alignment between risk assessment/prevention and complementary robot behaviors hinder progress in this domain. To advance the current state-of-the-art in HRC within the manufacturing sector, the proposition of a requirements definition for a real-time assessment framework tailored to HRC tasks is advocated. This anticipated outcome aims to facilitate the development of Cobots capable of comprehending and adjusting to enhance the physical and cognitive ergonomics of human coworkers.

Worker Line Balancing Optimization through the Integration of Real-Time Data from Machines and Operators: a Big Data Analytics Approach. Part 1. Heuristics Methods for Worker Line balancing: a literature review

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

Abstract. Assembly Line balancing Problem (ALBP) has been widely explored since the 1950s. The solutions methods to solve this type of problem are mostly exact and heuristics. Exact methods are used to obtain optimum solution. However, they take a lot of time. Heuristics don't guarantee an optimum solution. However, they give a close to the optimum solution in a reasonable time. This work reviews the most used heuristics methods for worker line balancing and provide some statics data.

Were collected and analyzed 21 reviews papers from Scopus, IEEE and b-on data base from year 2005 to 2023. As result, it was possible to see that many heuristic models have been developed to solve different nuances of ALBP. They are constructive heuristic, a method which starts with an empty solution and repeatedly scale until a complete final solution. And meta heurists, which starts with an initial solution from a constructive heuristic. Then uses other algorithms to improve neighbor solution, which do not prevent from worsening the local optimum solution and stops when an optimum solution is found.

Challenges and prospects of electricity generation and usage in sub-saharan Africa

Budareld Maria Mbumba (id11154@alunos.uminho.pt & budareldm@gmail.com)

Abstract. Electricity production and consumption play a crucial role in the development trajectory of countries, especially in Africa, where challenges related to affordability and sustainability persist. Despite the abundance of renewable and non-renewable energy sources, achieving universal access to electricity remains a significant challenge. A reliable and affordable energy system is still far from being achieved in many African countries, hampering economic and social progress. This paper analyses the specific challenges faced by sub-Saharan Africa, particularly in Angola, the Democratic Republic of Congo (DRC), and Mozambique, in achieving clean energy goals electricity assess to all. Through a comprehensive analysis of current conditions in the electricity sector, the study identifies the main obstacles and discusses potential solutions. Based on a critical review of existing literature, the paper

describes the motivations, objectives and provides information on the electricity sector in the selected countries. The findings reveal that while access to electricity remains extremely low in these countries, particularly in rural areas, there is a remarkable disparity between them. Our findings emphasize the vital role of access to electricity in poverty reduction and economic growth in the region, but access rates remain below 51%, with rural areas being disproportionately poor.

Session B1

29th May 2024, 11:30 A.M. – 12:45 A.M. | Room:Room: 0.08/Ed11

Moderator: Anabela Tereso

Multi-Project Scheduling Under Uncertainty: an approach to exploit resource flexibility

Marzieh Aghileh (aghileh70@gmail.com)

Abstract. Project scheduling problems are among the most important in both research and practice. In the 1950s, approaches for project control and planning evolved, such as Program Evaluation and Review Technique (PERT) and the Critical Path Method (CPM), in which resources are assumed to be unlimited. However, in the early 1960s, the study of planning and control of projects began to take into account the existence of limited resources. This culminated in the proposal of the Resource-Constrained Project Scheduling Problem (RCPSP). The Resource-Constrained Multi-Project Scheduling Problem (RCMPSP) is an extension of the RCPSP that takes into consideration multiple projects. Perceiving this, researchers expanded their attempts to model the basic project management variables, time and resources, which are not deterministic but are affected by uncertainty. In the sequel, several models for optimizing resource allocation in projects were developed, taking into account stochastic work contents, proactive/reactive project scheduling techniques to deal with uncertainty, and a variety of approaches to investigate resource flexibility. As a result, it is the researcher's challenge to present a new model based on previous ideas to be applied to multi-project settings, allowing for effective multi-project management under uncertainty while taking resource flexibility into consideration.

Barriers in Data Science Projects: a DEMATEL-ANP Analysis

Natan Labarrère Mendes (natan.labarrere@gmail.com)

Abstract. Organizational processes often undergo changes when a decision-making algorithm is developed, such as a Machine Learning model. This means that the business processes are modified as a result of an organizational improvement driven by a data science project. Projects like this have a considerably low success rate, due to a series of technological and human barriers, which are poorly understood. Thus, the objective of this study is to understand the barriers challenging the success of data science projects that involve organizational change. The barriers were listed as part of a systematic literature review study, which was the previous stage of this doctoral project. The objective, now, is to deepen the understanding of these barriers, based on Multi-Criteria Decision-Making (MCDM) methods, specifically a combination of Decision Making Trial and Evaluation Laboratory (DEMATEL) and Analytic Network Process (ANP). The methodology involves interviewing experts in the field, and aims to analyze the interdependencies between the barriers and prioritize them.

Application of NSGA-III to a Multi-Objective Job Shop Optimization Problem with Independent Parallel Machines

Francisco Álvaro dos Santos (francisco_dos_santos@outlook.pt)

Abstract. Engineering often encounters job scheduling problems that can be solved using optimisation algorithms. However, in general, these problems involve multiple conflicting objectives. As the number of objectives increases, so does the complexity of the problems. Thus, algorithms capable of solving optimisation problems that involve two or more objectives simultaneously have to be applied. In this work, the goal is to minimize, simultaneously, the makespan, the average complete time of each job and the standard deviation of the complete time of the job. NSGA-III is used to solve instances with different sizes in terms of number of jobs and machines. The results of optimising these three objectives in a collection of job shop scheduling instances, involving unrelated parallel machines and sequence-dependent setup times are presented.

Parallelization of local search heuristics for the pollution routing problem using GPU computing

Mário Leite (mario.leite@dps.uminho.pt)

Abstract. This presentation addresses the Pollution-Routing Problem (PRP), a particular concept of the Vehicle Routing Problem (VRP) accounting for minimizing fuel and driver expenses and greenhouse gas emissions. The vast majority of models for the vehicle routing problem focus simply on reducing costs based on distance travelled, often ignoring several essential elements that affect the actual cost of the routes and their impact on the environment. With other features of both vehicle and road, and even driver skills, the vehicle's load and speed in each arc travelled are crucial factors in pollution-routing issues. Since PRP is an NP-hard problem, we provide optimization techniques based on local search heuristics and meta-heuristics, applying parallel programming strategies on the Graphics Processing Unit (GPU). Combining the Central Processing Unit (CPU) and the General-Purpose GPU to take advantage of parallel programming is as challenging as promising since it can achieve better solutions by moving through the search space faster than a traditional sequential version. We provide the findings of the parallel computational experiments on benchmark instances for the PRP to assess the quality of the proposed methods by comparing them to the existing sequential approaches.

Escalonamento de múltiplos projetos - problemas e soluções

Renan Oliveira Zocca (renan_zocca@hotmail.com)

Abstract. Esta tese centra-se no desenvolvimento de um novo modelo destinado a auxiliar os gestores na afetação eficaz dos recursos disponíveis a vários projetos em simultâneo (Resource Constraint Multi-Project Scheduling Problem-RCMPSP). Está a ser elaborada uma revisão sistemática da literatura sobre o RCMPSP, empregando o método PRISMA. Estão a ser avaliados 167 trabalhos científicos, extraídos da Scopus e da WoS. Esta etapa é fundamental para o avanço do conhecimento na área e para contextualizar o trabalho que irá ser desenvolvido. Com base na revisão sistemática da literatura, será avaliada qual a solução mais adequada para este problema, para que possa ser útil para as organizações, prevendo-se o desenvolvimento de um novo modelo para o RCMPSP. A eficácia deste modelo na resolução do problema será avaliada posteriormente. A análise dos resultados será essencial para possíveis ajustes no modelo, se necessário. Todos os resultados desta investigação serão formalizados em artigos científicos, que serão submetidos a revistas académicas relevantes para obter feedback da comunidade científica.

Session B2

29th May 2024, 11:30 A.M. – 12:30 A.M. | Room:0.11/Ed.11

Moderator: Ângela Silva

Advancing Supply Chain Management: Trends, Challenges, and Strategies for Practical Adoption of Data-Driven Models

Hermenegildo Baptista (hermenegildo59@hotmail.com)

Abstract. Resilience, proactivity, intelligence, and agility are crucial attributes that have become necessary to meet the complex difficulties that businesses are currently facing, which include the handling of massive amounts of data in all activities across their supply chains. This enables decision-makers to act more effectively in all phases of the chain - strategic, tactical, and operational - across various areas and functions. Despite the continuous development of methods and models by academics and business professionals, there is an observed low practical adoption of these solutions in organizations. Therefore, understanding the reasons behind this reluctance and identifying strategies to make these applications viable and advantageous becomes crucial.

A review of 1025 articles have been conducted to identify the developed methods and models, the tools used, the limitations encountered, the strategies employed to overcome them, and the impact of these applications on the supply chain. It was found that optimization models and heuristic and meta-heuristic methods, applied especially in the design of supply chain networks with the support of optimization software such as CPLEX and GAMS, have been the most predominant over the last decades. However, the rate of practical application of these models remained low, with several limitations.

Moreover, from 2016 onwards, over 60% of developed models were predictive, with a particular emphasis on machine learning models.

The Role of Cost Saving on Demand Response Acceptance in Household Electricity Consumer

Sara Golmaryami (sara.golmaryamii@gmail.com)

Abstract. This study explores the acceptance of demand response (DR) programs among Portuguese residential electricity consumers, focusing on the impact of Time-of-Use (ToU) pricing and potential cost reduction on consumer willingness to shift electricity usage. Data collected through a questionnaire from Portuguese electricity households allowed us to infer the consumer's flexibility and response to the potential cost savings obtained from ToU tariffs. The research highlights the importance of consumer segmentation, particularly by household size, in understanding the differential responses to DR gains. The findings reveal that the highest the saving potential, the highest the stated willingness to shift. On the other hand, the highest the shift period, the lowest the the stated willingness to shift households to change their

electricity usage patterns. The segmented analysis showed an overall highest acceptance trend for larger houses and with higher bills. The research highlights the critical role of consumer segmentation in the effectiveness of DR programs. Understanding the nuanced preferences of different consumer segments can lead to more efficient and widely adopted energy conservation strategies.

Manufacturing system failures identification through predictive approach: a contribute for industry 5.0

Eduardo Manuel Cardoso Dias de Pessoa Santos (id11155@uminho.pt)

Abstract. In the last two decades, there has been a big growth in the development and adoption of information technologies. This had a great influence on products innovation and quality, diversity, and faster delivery. Therefore, it led manufacturers to revise their production paradigm to quickly adapt to the market. In this context, digital transformation and intelligent automation were recognized as challenges and opportunities technology-oriented and defined the base of smart factories, as a cyber-physical system. The absence of human resources and the dehumanization of cyber-physical systems led to the emergence of the concept of industry 5.0. Recognizing that human-centric approaches are essential, the European Commission introduced this concept with three interconnected core values: centralization in the human being, sustainability, and resilience. Industry 5.0 represents a forward-looking vision that combines technological advancements with social responsibility, resilience, and sustainability. The technology allows 100% product inspection (EOL), but this is a non-perfect system that may result in critical failures in customer tests. This project started in September 2023 and has the goal of establishing a predictive framework for premature failures in manufacturing systems, by reducing human subjectivity and developing predictive methods in a zero-defect strategy. Currently, the project is under the phase of literature revision and one article is expected to be published soon.

A Sustainable Framework approach for European Digital Start-ups Go to Market

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Abstract. Start-ups are at the forefront of the greatest technological revolutions of the contemporary world. The growth of this business concept has led to the democratization of knowledge and technological breakthroughs, with significant milestones for society such as access to Digital Twinning and GenAI. However, in an era marked by geopolitical and environmental uncertainty, the growth of these start-ups has faced unprecedented challenges, such as wars in the Middle East and Eastern Europe, as well as COVID-19. These new challenges led to a careful consideration of environmental, social, and governance factors before launching any new feature to the market. Go-to-Market strategies must adhere to more demanding 'standards' at a time when investments are guided by the principle of efficiency. In addition to the shift in Go-to-Market strategies, sustainability strategies are becoming increasingly important in business strategy design. With new European directives, companies must meet much more ambitious environmental targets and constantly validate their business models to ensure economic sustainability.

This doctoral program aims to establish the correlation between Go-to-Market and sustainability strategies to ensure greater economic and social capacity for each technological investment. Fast validation of the feasibility and viability of each feature in the market is crucial for an effective business development.

Assessment of circular solutions for solar photovoltaic waste in Portugal

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Abstract. Global solar photovoltaic (SPV) deployment is followed by serious challenges to aligning end-of-life (EoL) SPV management with European climate targets. In this respect, this investigation incorporates the Material Flow Analysis (MFA) to simulate possibilities for the EoL SPV waste in Portugal, aiming to get early recognition to meet sustainability. From the historical SPV installation, waste flows were projected for 2028 – 2053, considering three scenarios of circularity. Results reveal a cumulative SPV waste flow of more than 325 tons. In addition, secondary materials flows, and emissions avoided are calculated and the economic viability of a possible EoL SPV recycling centre is discussed. The study concluded that some circularity targets can hardly be reached even in compliance with the Waste Electrical and Electronic Equipment Directive. Theoretical and practical contributions of the research include advancing the MFA application for assessing SPV waste and management and the presentation of policy implications for improving EoL SPV circularity in Portugal.

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