



IX EPPGEP 2024
Encontro de Pesquisa e Pós-Graduação
em Engenharia de Produção

25, 26 e 27 de Setembro de 2024

<https://www.anpepro.org.br/eppgep2024/>

BOOK OF ABSTRACTS

O EVENTO

EPPGEP é o Encontro Científico da ANPEPRO, que tem como objetivos: Foco em Pesquisa; Criação de um ambiente de aconselhamento aos alunos de Pós-Graduação; e, Reconhecimento dos alunos de Pós-Graduação em Engenharia de Produção com melhores resultados.

O processo seletivo dos artigos é realizado de forma descentralizada por meio dos Programas de Pós-Graduação (PPG's), para garantir a seleção dos melhores artigos pelos colegiados dos programas.

- Cada PPG pode selecionar até 2 artigos de Mestrado Acadêmico (MA), 3 de Doutorado (DO) e 1 de Mestrado Profissional (MP); além de 2 de Produto Tecnológico (PT), podendo ser MA, MP ou DO.
- Podem participar egressos, desde que tenham sido alunos até o ano anterior do evento.
- Todos os alunos que apresentam o trabalho no EPPGEP recebem um certificado da ANPEPRO de aluno destaque do PPG, visto que foram selecionados como os melhores do seu Programa e cada Programa Associado tem credenciamento da ANPEPRO.
- Há premiação para o melhor trabalho apresentado por alunos de DO, MA, MP e de PT (que pode ser aluno de qualquer modalidade).

LOCAL DO EVENTO

Em 2024, o EPPGEP e o ENPEPRO ocorreram nas dependências da Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio), na Cidade do Rio de Janeiro (RJ), contou com o patrocínio da CAPES e CNPq e teve a PUC-Rio como Instituição Organizadora Local.

COMISSÃO ORGANIZADORA LOCAL

Rodrigo Goyannes Gusmão Caiado (PUC-Rio) – Coordenador
Igor Tona Peres (PUC-Rio) – Vice-coordenador
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Leonardo Bastos (PUC-Rio)
Márcio Tavares Thomé (PUC-Rio)
Rafael Martinelli (PUC-Rio)
Daniel Pacheco Lacerda (Unisinos)
Fabio Antonio Sartori Piran (Unisinos)

COMISSÃO ORGANIZADORA ANPEPRO

Diretor Presidente: Fernando Cyrino (PUC-Rio)
Diretora Executiva: Ana Paula Cabral (UFPE)
Diretor Científico: Flávio Sanson Fogliatto (UFRGS)
Diretora de Eventos: Cristina Gomes de Souza (CEFET/RJ)

Realização:



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COMITÊ CIENTÍFICO

Flávio Sanson Fogliatto (UFRGS)
Cristina Gomes de Souza (CEFET/RJ)

COMITÊ DE PROGRAMA

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Alvaro Neuenfeldt Júnior (UFMS)
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Andrei Bonamigo (UFF)
Antônio Augusto Chaves (UNIFESP)
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Caroline Rodrigues Vaz (UFSC)
Cláudia Fabiana Gohr (UFPB)
Cristiano Hora de Oliveira Fontes (UFBA)
Cristina Gomes de Souza (CEFET-RJ)
Daniel Pacheco Lacerda (UFSC)
Diego de Castro Fettermann (UFSC)
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Gilson Brito Alves Lima (UFF)
Glauro Henrique de S. Mendes (UFSCAR)
Helenice de Oliveira F. Silva (UNESP)
Horacio Hideki Yanasse (UNIFESP)
Igor Tona Peres (PUC-Rio)
Istefani Carisio de Paula (UFRGS)

Julio Michael Stern (USP)
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Luciano Ferreira (UFRGS)
Lucila Maria de Souza Campos (UFSC)
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Luiz Felipe R. Scavarda do Carmo (PUC-Rio)
Luiz Leduino de Salles Neto (UNIFESP)
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Marcone Jamilson Freitas Souza (UFOP)
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Miguel Afonso Sellitto (UNISINOS)
Mischel Carmen Neyra Belderrain (ITA)
Nestor Ayala (UFRGS)
Osvaldo Luiz Gonçalves Quelhas (UFF)
Paula Medina Maçaira Louro (PUC-Rio)
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Sandra Naomi Morioka (UFPB)
Sergio E. Gouvea da Costa (UTFPR)
Tarcisio Abreu Saurin (UFRGS)
Tharcisio Cotta Fontainha (UFRJ)

PROGRAMAÇÃO COMPLETA 2024

RECEPÇÃO E CREDENCIAMENTO: INÍCIO DIA 25/08/2024, QUARTA-FEIRA, 08H30MIN				
INÍCIO	FIM	AUDITÓRIO	SALA 1	SALA 2
DIA 25/09/2024 (QUARTA-FEIRA)				
09:00	09:20	Mesa de Abertura		
09:20	11:00	Sessão DO-01	Sessão MA-01	Sessão MA-02
11:00	11:20	Intervalo/Coffee-Break		
11:20	12:40	Sessão DO-02	Sessão MA-03	Sessão MA-04
12:40	14:00	Almoço		
14:00	15:20	Mesa: Pesquisa e Indicadores		
15:20	15:40	Intervalo/Coffee-Break		
15:40	17:20	Sessão DO-03	Sessão MA-05	Sessão PT-01
17:20	17:40	Intervalo/Coffee-Break		
17:40	19:00	Sessão DO-04	Sessão MA-06	Sessão MA-07
DIA 26/09/2024 (QUINTA-FEIRA)				
09:00	10:40	Sessão PT-02	SESSÃO MP	
10:40	11:00	Intervalo/Coffee-Break		
11:00	12:20	Mesa: Relações com Indústria		
12:20	12:40	Reunião fechada (Chairs)		
12:40	14:00	Almoço		
14:00	15:20	Mesa: Programas de PG		
15:20	15:40	Intervalo/Coffee-Break		
15:40	17:10	Plenária de Doutorado		
17:10	17:30	Intervalo/Coffee-Break		
17:30	18:30	Plenária de Doutorado		
18:30	19:00	Reunião fechada (Comitê)		
DIA 27/09/2024 (SEXTA-FEIRA)				
08:00	09:00	Assembleia ANPEPRO		
09:00	10:20	Mesa: CNPQ		
10:20	10:40	Intervalo/Coffee-Break		
10:40	12:00	Mesa: CAPES		
12:00	12:20	Entrega Prêmio ANPEPRO		
12:20	12:40	Premiação Trabalhos		
12:40	13:00	Fotografia oficial do evento no Solar Grandjean de Montigny (PUC-Rio)		
13:00	14:30	Encerramento / Brunch		

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CAPES



Conselho Nacional de Desenvolvimento Científico e Tecnológico

DIA 25/09/2024 (QUARTA-FEIRA)							
Abertura 08:30		RECEPÇÃO - CREDENCIAMENTO					
INÍCIO	FIM	AUDITÓRIO		SALA 1		SALA 2	
09:00	09:20	MESA DE ABERTURA					
09:20	09:40	SESSÃO DO-01	[044-AC-PO] UFPE	SESSÃO MA-01	[020-AC-EO] USP	SESSÃO MA-02	[018-WP-PO] PUC-PR
09:40	10:00		[004-AC-EO] UFSCAR		[035-AC-EO] UFRJ		[023-AC-PO] UNESP Guar
10:00	10:20		[010-AC-EO] UFRGS		[038-WP-EO] UFSM		[034-AC-PO] UFRJ
10:20	10:40		[031-AC-EO] UFRJ		[039-AC-EO] UFSC		[045-AC-PO] UFPE
10:40	11:00		[043-AC-EO] UFPE		[048-AC-EO] UFPR		[052-AC-PO] PUC-Rio
11:00	11:20	INTERVALO/COFFEE-BREAK					
11:20	11:40	SESSÃO DO-02	[004-AC-EOPP] UNIFESP	SESSÃO MA-03	[005-AC-EOPP] UFABC	SESSÃO MA-04	[007-AC-EQ] UFSCAR
11:40	12:00		[012-AC-EOPP] UFRGS		[017-AC-EOPP] PUC/PR		[028-AC-EOPP] UTFPR
12:00	12:20		[050-AC-CS] PUC-Rio		[053-AC-EOPP] PUC-Rio		[066-RE-EOP] UNISC
12:20	12:40		[069-AC-ET] UFF		[062-AC-EOPP] UFMG		[068-AC-EOPP] UFF
12:40	14:00	ALMOÇO					
14:00	15:20	MESA: REFLEXÕES SOBRE A INTEGRIDADE E ROBUSTEZ DA PESQUISA CIENTÍFICA E DE SEUS INDICADORES Chair: Cristina Souza (CEFET/RJ - Diretora de Eventos) Palestrante: Prof. Helder Gomes Costa (UFF)					
15:20	15:40	INTERVALO/COFFEE-BREAK					
15:40	16:00	SESSÃO DO-03	[019-WP-PO] PUC/PR	SESSÃO MA-05	[006-AC-ES] UNISINOS	SESSÃO PT-01	[015-AC-ES] CEETEPS
16:00	16:20		[021-AC-PO] USP		[014-AC-ES] UFRGS		[042-AC-EO] UFPE
16:20	16:40		[029-AC-PO] UFPE		[040-AC-ES] UFSC		[055-AC-PO] PUC-Rio
16:40	17:00		[038-AC-PO] UFRJ		[059-AC-ES] UFPB-JP		[058-AC-PO] PUC-Rio (Prof)
17:00	17:20		[049-AC-EOPP] PUC-Rio		[061-RE-ES] UNISC		[060-AC-CS] UFF
17:20	17:40	INTERVALO/COFFEE-BREAK					
17:40	18:00	SESSÃO DO-04	[016-AC-EOPP] PUC/PR	SESSÃO MA-06	[022-AC-PO] USP/SC	SESSÃO MA-07	[013-AC-EE] UFRGS
18:00	18:20		[032-AC-EOPP] UFRJ		[037-AC-PO] UFSM		[026-RE-EE] USP
18:20	18:40				[046-AC-PO] UFPE		[064-AC-EQ] UFSCAR
18:40	19:00		[063-AC-EOPP] UFSCAR		[047-AC-PO] UFPR		[070-AC-ET] UFF

DIA 26/09/2024 (QUINTA-FEIRA)						
INÍCIO	FIM	AUDITÓRIO		SALA 1		SALA 2
09:00	09:20	SESSÃO PT-02 (05)	[008-AC-ES] UFSCAR	SESSÃO MP (05)	[014-AC-EOPP] CEETEPS	
09:20	09:40		[030-RE-PO] UFPE		[025-WP-PO] UFPE	
09:40	10:00		[036-AC-EP] UFRJ		[027-AC-EO] UNESP Guar	
10:00	10:20		[056-AC-PO] PUC-Rio		[041-AC-EOPP] UFF	
10:20	10:40		[057-AC-PO] PUC-Rio (Prof)		[054-AC-CS] PUC-Rio	
10:40	11:00	INTERVALO/COFFEE-BREAK				
INÍCIO	FIM	AUDITÓRIO				
11:00	12:20	MESA: RELAÇÕES COM A INDÚSTRIA Chair: Prof. Bruno Fanzeres dos Santos (PUC-Rio) Palestrante: Marcelo Ruas (Cientista de Dados da Stone e Coordenador do StoneLab – PUC-Rio) e Raul Rentería (Prof. de Informática PUC-Rio e VP de dados na Stone)				
12:20	12:40	REUNIÃO FECHADA (CHAIRS)				
12:40	14:00	ALMOÇO				
14:00	15:20	MESA: COORDENADORES DE PROGRAMAS DE PÓS-GRADUAÇÃO (NOTAS 6 E 7) Chair: Prof. Flávio Fogliatto (UFRGS - Diretor Científico da ANPEPRO) Palestrantes: Profa. Fernanda Baiao (PUC-Rio); Prof. Flavio Fogliatto (representando a UFRGS); Profa. Lizandra Vergara (UFSC); e Profa. Luciana Hazin (UFPE)				
15:20	15:40	INTERVALO/COFFEE-BREAK				
15:40	16:10	PLENÁRIA: FINALISTAS DE DOUTORADO Comitê de Premiação: Chair - Profa. Ana Paula Cabral (Diretora Executiva da ANPEPRO - UFPE); Profa. Carolina Lino Martins (UFMS); Prof. Helder Gomes Costa (UFF); Prof. Sérgio Gouvêa (UTFPR)			[003-AC-EOPP] UNISINOS	
16:10	16:40				[005-AC-PO] UNIFESP	
16:40	17:10				[011-AC-PO] UFRGS	
17:10	17:30				INTERVALO/COFFEE-BREAK	
17:30	18:00				[051-AC-PO] PUC-Rio	
18:00	18:30				[065-AC-EOPP] UFSCAR	
18:30	19:00	REUNIÃO FECHADA (COMITÊ)				

DIA 27/09/2024 (SEXTA-FEIRA)		
INÍCIO	FIM	AUDITÓRIO
08:00	09:00	ASSEMBLEIA ANPEPRO
09:00	10:20	MESA: CNPQ Chair: Prof. Luiz Felipe Scavarda (PUC-Rio) Palestrantes: Membros do CA-EP - Profa. Lucila Campos (UFSC) e Prof. Mário Otávio Batalha (UFSCAR)
10:20	10:40	INTERVALO/COFFEE-BREAK
10:40	12:00	MESA: CAPES Chair: Prof. Fernando Cyrino (Presidente da ANPEPRO - PUC-Rio) Palestrantes: Prof. Gherhardt Ribatski (USP/SC - Coordenador da Área Engenharias III) e Prof. Leandro Sphaier (UFF - Coordenador Adjunto de Programas Acadêmicos)
12:00	12:20	CERIMÔNIA DE PREMIAÇÃO: ENTREGA PRÊMIO ANPEPRO
12:20	12:40	CERIMÔNIA DE PREMIAÇÃO: ENTREGA PRÊMIOS DOS TRABALHOS DO, MA, MP E PT
12:40	13:00	FOTOGRAFIA OFICIAL DO EVENTO - LOCAL: SOLAR GRANDJEAN DE MONTIGNY (PUC-RIO)
13:00	14:30	ENCERRAMENTO / BRUNCH

Realização:



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Sessão DO-01 (Auditório, Quarta-feira, 25/09/2024, 09h40 - 11h00) - Chair: Paula Maçaira (PUC-Rio) - Cochair: Fabio Sartori Piran (UNISINOS)

Código/Instituição	Título	Autores
[044-AC-PO] UFPE	A Multimodal Fusion Approach from Biological Data-Driven Models for Drowsiness Detection	Plínio M.S. Ramos, Caio B.S. Maior, Márcio José das Chagas Moura, Isis D. Lins
[004-AC-EO] UFSCAR	The impact of Environmental Performance on Financial Performance: An analysis of the Agri-food sector	Vitor Melão Cassânego, Ana Catarina Gandra de Carvalho, Herick Fernando Morales, Mário Otávio Batalha
[010-AC-EO] UFRGS	Quantifying the effect of innovation ecosystem on startups' innovation: evidence from matching methods	Nicole Cecchele Lago, Arthur Marcon, Jose Luis Duarte Ribeiro, Daniel de Abreu Pereira Uhr, Yasmin Olteanu, Klaus Fichter
[031-AC-EO] UFRJ	A Bibliometric Review of Soft Skills: Understanding the Trajectories and Research Agenda	Marcelle Feitoza Bassi Costa, Carla Martins Cipolla
[043-AC-EO] UFPE	A risk management maturity model proposal for Brazilian public organisations	Ana Luiza Freire de Lorena, Ana Paula Cabral Seixas Costa

Sessão MA-01 (Sala 1, Quarta-feira, 25/09/2024, 09h20 - 11h00) Chair: Adriana Leiras (PUC-Rio) - Cochair: Priscilla Cabral Ribeiro (UFF)

Código/Instituição	Título	Autores
[020-AC-EO] USP	Knowledge Management Enablers, Barriers, and Capabilities in Project Level: A Multimethod Approach	Marly Monteiro de Carvalho, Josivan Leite Alves
[035-AC-EO] UFRJ	Cybersecurity in cyber-physical systems: state of art and analysis of a case in the Brazilian electricity sector	Wesdres de Santana Teixeira, Tharcisio Cotta Fontainha
[038-WP-EO] UFSM	Análise dos fatores que influenciam a decisão de compra de veículos elétricos no Brasil	Marceli Adriane Schvartz, Lucas V. Avila, Luciane N. Canha, Júlio Cezar M. Siluk, Thiago A. Beuron, Elda R. S. Kraetzig, Pauline de Lima Sagrilo
[039-AC-EO] UFSC	Abordagem Multicritério Construtivista para Apoio à Gestão da Inovação no Setor Portuário	Luiz Junior Maemura Yoshiura, Sandra Rolim Ensslin
[048-AC-EO] UFPR	Modelo de gestão baseado em ferramentas Lean para controle e melhoria contínua do chão de fábrica em empresas de pequeno e médio porte: personalização através de um questionário diagnóstico	Marcia de Moraes Erbs, Silvana Pereira Detoro, Carla Regina Mazia Rosa

Sessão MA-02 (Sala 2, Quarta-feira, 25/09/2024, 09h20 - 11h00) - Chair: Andrei Bonamigo (UFF) - Cochair: Sandro César Bortoluzzi (UTFPR)

Código/Instituição	Título	Autores
[018-WP-PO] PUC-PR	Analysis of Multi-Objective Optimization Techniques for Robotic Arm Path Planning: A Systematic Literature review	Tiago Melo da Silva, Gilberto Reynoso Meza
[023-AC-PO] UNESP Guar	Machine learning-based gestational age prediction for preterm birth risk assessment in São Paulo, Brazil: approach utilizing maternal and pregnancy information	Elias Carlos Aguirre Rodríguez, Elen Yanina Aguirre Rodríguez, Luiz Fernando Costa Nascimento, Aneirson Francisco da Silva, Fernando Augusto Silva Marins
[034-AC-PO] UFRJ	Faces Eficientes de Dimensão Completa (FDEF) em DEA: Revisão da literatura e proposta de um novo software DEA-FDEF	Gabriel Martins Soares, Marcos Pereira Estellita Lins
[045-AC-PO] UFPE	Bearing fault detection in the Oil and Gas Industry via Physics-Informed Deep Learning	Leonardo Streck Raupp, Isis D. Lins, Márcio C. Moura, Caio B.S. Maior
[052-AC-PO] PUC-Rio	Decision-Dependent Uncertainty-Aware Distribution System Planning Under Wildfire Risk	Felipe Piancó, Alexandre Moreira, Bruno Fanzeres dos Santos, Ruiwei Jiang, Chaoyue Zhao, Miguel Heleno

Sessão DO-02 (Auditório, Quarta-feira, 25/09/2024, 11h20 - 12h40) - Chair: Máisa Silva (UFPE) - Cochair: Fernando Deschamps (PUC-PR)

Código/Instituição	Título	Autores
[004-AC-EOPP] UNIFESP	A rolling horizon approach for a production planning and inventory management problem under uncertain demand	Jeferson Cruz, Luiz Leduino de Salles Neto, Cleder Schenekemberg
[012-AC-EOPP] UFRGS	Anticipating for tensions between digital technologies and workers: building strategies during the technological project design stage	Jéssica de Assis Dornelles, Alejandro Germán Frank
[050-AC-CS] PUC-Rio	Data-driven decision support framework for Maintenance, Repair, and Operation (MRO) inventory planning: a Lean, Agile, Resilient, and Green (LARG) perspective	Guilherme Henrique de Paula Vidal, Luiz Felipe Roris Rodriguez Scavarda do Carmo, Paulo Ivson, Jose Arturo Garza-Reyes, Rodrigo Goyannes Gusmão Caiado
[069-AC-ET] UFF	A new lens on systemic accident analysis: bridging work activity analysis and resilience engineering	Raquel Cançado, Rodrigo Arcuri, Eliel Prueza de Oliveira, Francisco José de Castro Moura Duarte

Sessão MA-03 (Sala 1, Quarta-feira, 25/09/2024, 11h20 - 12h40) - Chair: Marcelo Alencar (UFPE) - Cochair: Kelly Alonso Costa (UFF)		
Código/Instituição	Título	Autores
[005-AC-EOPP] UFABC	Lean Maturity Level Analysis for Industry 4.0	Anderson Tadeu de Santi Barbosa de Almeida, Douglas Roberto De Gennaro, Ugo Ibusuki
[017-AC-EOPP] PUC/PR	The implications of Digital Transformation and Corporate Social Responsibility integration on business performance: An institutional and stakeholder view	João Felipe Capioto Seelen, Jéssica Alessandra Mendonça, Fernando Henrique Lermen, Guilherme Brittes Benitez
[053-AC-EOPP] PUC-Rio	PV and Wind Power Spatio-Temporal Scenarios Simulation	Gustavo de Andrade Melo, Fernando Cyrino, Paula Medina Maçaira, Erick Meira
[062-AC-EOPP] UFMG	Metodologia de análise de rede de filas multi-classes para melhorar o desempenho de serviços de urgência	Alecio Rodrigues, Lásara F. Rodrigues, Maurício C. de Souza

Sessão MA-04 (Sala 2, Quarta-feira, 25/09/2024, 11h20 - 12h40) - Chair: Rafael Martinelli (PUC-Rio) - Cochair: Jônatas A. de Almeida (UFPE – CAA)		
Código/Instituição	Título	Autores
[007-AC-EQ] UFSCAR	Uma proposta de identificação das causas raízes de baixa produtividade de uma fazenda de Soja (Glycine max)	Felipe Carnacini, Murilo Aparecido Voltarelli, João Eduardo Azevedo Ramos da Silva, Carla Segatto Strini Paixão, Jonathan Gazzola
[028-AC-EOPP] UTFPR	Data science framework for Brazilian small and medium enterprises	Alex Franklin, Marisa Nilson, Érick Oliveira Rodrigues, Edson Pinheiro de Lima, Gilson Adamczuk Oliveira
[066-RE-EOP] UNISC	Análise de sementes empregando processamento de imagens e aprendizado de máquina	Alexandro Ricardo Rodrigues de Souza, Demis Pessato Faqui, Roberta Oliveira Santos, Rolf Fredi Molz, Adilson Ben da Costa
[068-AC-EOPP] UFF	Refining the PROMETHEE-Scoring Method: Propositions and an Economic Freedom Assessment	Igor Danilo Costa Matos, Helder Gomes Costa, Diogo Lima, Marcos Costa Roboredo

Sessão DO-03 (Auditório, Quarta-feira, 25/09/2024, 15h40 - 17h20) - Chair: Flavio Fogliatto (UFRGS) - Cochair: Debora Oliveira (UNISINOS)		
Código/Instituição	Título	Autores
[019-WP-PO] PUC/PR	Predictive Maintenance Strategies in Agriculture Using Survival Analysis	Rodrigo Hermont, Gilberto Reynoso Meza
[021-AC-PO] USP	Markov Chain approach to get control limits for a Shewhart Control Chart to monitor the mean of a Discrete Weibull distribution	Leandro Alves da Silva, Linda Lee Hoo, Roberto da Costa Quinino
[029-AC-PO] UFPE	Project Portfolio Selection with the FITradeoff Method: A Combinatorial Analysis Approach	Adriana Cavalcante Marques, Eduarda Asfora Frej, Adiel Teixeira de Almeida
[038-AC-PO] UFRJ	Russell Measure-adjusted DEA-Malmquist to assess COVID-19 pandemic impact on productivity Brazilian teaching hospitals	Henrique de Castro Rodrigues, Marcos Pereira Estellita Lins, Maria Stella de Castro Lobo
[049-AC-EOPP] PUC-Rio	From effectiveness to fairness: designing food allocation in food aid programs for traditional peoples and communities	Fábola Negreiros de Oliveira, Adriana Leiras, Douglas Alem

Sessão MA-05 (Sala 1, Quarta-feira, 25/09/2024, 15h40 - 17h20) - Chair: Silvio Hamacher (PUC-Rio) - Cochair: Pedro Carlos Oprime (UFSCAR)		
Código/Instituição	Título	Autores
[006-AC-ES] UNISINOS	Method for transforming existing public buildings into Net Zero Energy Buildings	Bárbara Pisoni B. Andrade, Fabio Antonio S. Piran, Daniel P. Lacerda, Lucila Maria de S. Campos, Júlio Cezar M. Siluk, Guilherme Trapp
[014-AC-ES] UFRGS	Industry 4.0 and Smart Consumption: How digital transformation can enhance the use of industrial resources	Michelle Santana Ramos, Laura Visintainer Lerman, Benjamin Meindl, Alejandro Germán Frank
[040-AC-ES] UFSC	Pedagogical strategies for incorporating sustainability into engineering education: A focus on teaching practices and the SDGs	Daniel Pacheco Lacerda, Lucila Maria de Souza Campos, Jeffson Veríssimo de Oliveira
[059-AC-ES] UFPA-JP	Avaliação sistêmica e participativa da interação Water-Energy-Food Nexus: Proposta e aplicação da ferramenta MESMIS-NEXUS na agricultura familiar	Maria Clara Batista Santos, Sandra Naomi Morioka
[061-RE-ES] UNISC	Requisitos para a proposição de um modelo de sistema de gestão, controle e avaliação do relacionamento com o egresso: diagnóstico e análise em instituições de ensino superior comunitárias	Taís Niederauer, Rolf Fredi Molz, Liane Mahlmann Kipper

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[042-AC-EO] UFPE	IMPACTUS: Sistema de informação para avaliação e monitoramento do impacto de ativos nos processos e estratégias de negócio	Gabriel Herminio Lima, Gabrielle R. Ribeiro, Everton B. da Silva, Roberta B. da Silva, Eliana S. Lima, Ana Paula Cabral S. Costa, Adiel Teixeira de Almeida
[055-AC-PO] PUC-Rio	Decision Support System for Smart Maintenance combining Multicriteria and Machine Learning approaches: Case Study at the Brazilian Mint	Jaqueline Alves do Nascimento, Rodrigo Goyannes Gusmão Caiado, Luiz Felipe Scavarda, Renan Silva Santos
[058-AC-PO] PUC-Rio/Prof	Hierarchical time series forecast for a retailer's Omnichannel	Bárbara S. Hue Lessa, Paula Medina Maçaira, Fernando Cyrino
[060-AC-CS] UFF	Sales forecast using meta-learning model as complementary to lean 4.0	Cicero Gomes Leo, Andrei Bonamigo

Sessão MA-06 (Sala 1, Quarta-feira, 25/09/2024, 17h40 - 19h00) - Chair: Rodrigo Caiado (PUC-Rio) - Cochair: Ormeu Coelho da Silva Junior (CEFET/RJ)

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[022-AC-PO] USP/SC	Blockchain Governance in Creating Virtual Enterprises: An Enterprise Modeling Approach	Lívia Maria Bettini de Miranda, Fabio Müller Guerrini
[037-AC-PO] UFMS	Planejamento de recursos energéticos em residências: uma abordagem determinística	Maria Luani Pereira dos Santos, Vinícius Jacques Garcia
[046-AC-PO] UFPE	Integração de métodos de aprendizagem de máquina em modelo de votação para detecção de vazamentos de óleo em imagens de sensoriamento remoto	Caique Emanuel da Silva Nunes, Isis D. Lins
[047-AC-PO] UFPR	Exact Method for a Dynamic Pricing Problem: a Case Study in Road Passenger Transport	Lorayne Veri, Mariana Kleina, Alexandre Checoli Choueiri

Sessão MA-07 (Sala 2, Quarta-feira, 25/09/2024, 17h40 - 19h00) - Chair: Ana Paula Cabral (UFPE) - Cochair: Leonardo Bastos (PUC-Rio)

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[026-RE-EE] USP	Otimização de Portfólio para associação de usinas eólicas e solares fotovoltaicas no setor elétrico brasileiro	Victor Garboggini Moretti, Celma de Oliveira Ribeiro
[064-AC-EQ] UFSCAR	Desafios da difusão de carros conectados	Yago Martins, Guilherme Sales Smania, Paulo Augusto Cauchick-Miguel, Eloiza Kohlbeck, Glauco Mendes
[070-AC-ET] UFF	Understanding the impact of performance variability on access to healthcare: an analysis of regional referral centers' resilience	Maria Cecilia Bruzi, Rodrigo Arcuri, Hugo Cesar Bellas, Jaqueline Vianna, Luiza dos Santos, Anna Sophia Moraes

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Código/Instituição	Título	Autores
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[036-AC-EP] UFRJ	Flood Risk Insurance and Finance: a proposition developed according to the Brazilian context	Cassio Alan Ferreira Maduro, Tharcisio Cotta Fontainha
[056-AC-PO] PUC-Rio	WindAnalyzer: An Interactive Tool for Wind Energy Reanalysis in Brazil - Joint modeling of wind speed and power via a nonparametric approach	Saulo Custodio de Aquino Ferreira, Fernando Cyrino, Paula Medina Maçaira
[057-AC-PO] PUC-Rio/Prof.	Otimização do dimensionamento de frota alugada para distribuição urbana em uma empresa do setor alimentício	Ana Raquel Fernandes, Rafael Martinelli, Igor Tona Peres

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[025-WP-PO] UFPE	Uma nova abordagem para promoção dos concursos de remoção na Polícia Federal	Antonio Carlos Garcia Mendes, Caroline Maria Miranda Mota
[027-AC-EO] UNESP GUAR	Avaliação do uso de serious games em treinamento corporativo: Um Case de Montadora Automotiva	Marcos Fonseca Oliveira, Jorge Muniz Júnior, José de Souza Rodrigues
[041-AC-EOPP] UFF	Lean 4.0 in operational performance on hydraulic systems of a steel plant for decision-making support	Nuno Miguel de Matos Torre, Andrei Bonamigo
[054-AC-CS] PUC-Rio	A framework to develop resilience based on Artificial Intelligence in the Brazilian Defense Industry's Supply Chain	Rafael de Oliveira Vargas, Rodrigo Goyannes Gusmão Caiado, Adauto Bueno, Renan Silva Santos, Daniel Luiz de Mattos Nascimento

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[011-AC-PO] UFRGS	Enhancing emergency department patient arrival forecasting: a study using feature engineering and advanced machine learning algorithms	Bruno Matos Porto, Flavio Fogliatto
[051-AC-PO] PUC-Rio	PolieDRO: a novel classification and regression framework with non-parametric data-driven regularization	Tomas Gutierrez, Davi Michel Valladão, Bernardo Pagnoncelli
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DESIGNING FOR EFFICIENT MANUFACTURING: A MECHANISM-BASED PERSPECTIVE ON LEAN PRODUCTION AND THEORY OF CONSTRAINTS

Leandro Gauss¹
Lúcio Cantarelli Noal²
Daniel Pacheco Lacerda¹
Georges L. Romme³

ABSTRACT

Understanding the sources of variability and the buffers arising from it is essential to designing efficient manufacturing systems. Two major operations management theories addressing these challenges are lean production and the theory of constraints. However, researchers and practitioners do not yet fully understand the underlying mechanisms in these theories, which may give rise to suboptimal systems and inhibit the development of a more comprehensive theory. This paper therefore draws on a mechanism-based perspective to explore whether and how the theory of constraints can enhance lean production theory, in the context of optimizing a welding line in a manufacturing company. We first analyze the existing (suboptimal) application of lean production to this welding line. Subsequently, lean production theory and the theory of constraints are combined to design an intervention that significantly improves the productivity and the economic efficiency of the line. An additional quasi-experiment shows the causal relationship between the intervention and the outcome. Moreover, formative evaluations serve to define the factors that inhibit lean solutions as well as the key mechanisms that connect lean production theory with the theory of constraints. Finally, we synthesize the main findings into a set of propositions that can guide future research.

Keywords: Theory of Constraints; Lean Production; Design Science; Mechanisms; Manufacturing Processes; Quasi-experiment.

Programa: UNISINOS - Engenharia de Produção e Sistemas (42007011015P4)

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A ROLLING HORIZON APPROACH FOR A PRODUCTION PLANNING AND INVENTORY MANAGEMENT PROBLEM UNDER UNCERTAIN DEMAND

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ABSTRACT

In this paper we propose a Rolling Horizon (RH) approach to dynamically determine the production and inventory management plan for a perishable product. The practical problem faced by a large dairy producer, previously presented in the literature, considers: production plants, a First Expired, First Out (FEFO) policy in two inventory level, demand uncertainty and a set of practical constraints. To investigate the key performance indicators: profit, service level and destroyed items, a comparative study is carried out between a static and a dynamic approach considering some variants such as: updating the expected demands in each re-planning and the use of different study horizons. The results point to the great superiority of the dynamic RH over the static approach, making it possible to obtain better economic and service level results while promoting a cleaner and more sustainable operation through a significant reduction in the waste level.

Keywords: Rolling Horizon; Perishable Product; Production Plan; Inventory Management

Programa: Pesquisa Operacional (33009015094P9)

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TRAVELING BACKPACKER PROBLEM WITH PRIORITIES: MONO-OBJECTIVE AND MULTI-OBJECTIVE FORMULATIONS

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Mariá C. V. Nascimento²

ABSTRACT

The Traveling Backpacker Problem (TBP) is a combinatorial optimization problem that aims to find the minimum-cost route in low-cost airlines. With limited travel time, pre-defined stay lengths in each destination, and time-varying airfare costs, there have been few studies on the TBP, especially using heuristic methods. This Ph.D. thesis presents the following contributions: (i) the definition of efficient heuristics for the original TBP; (ii) the introduction of mono-objective formulations based on the prize collecting paradigm considering a limited budget and classification of destinations based on traveler preferences; (iii) and the proposal of a bi-objective problem to consider the trade-off between the costs and traveler satisfaction. In line with this, the Prize Collecting Traveling Backpacker Problem (PCTBP) is presented in two distinct mono-objective integer programs, revealing different route patterns in experiments. The Bi-objective PCTBP (BO-PCTBP) was also introduced aiming at minimizing costs and maximizing the prize collected. Furthermore, new instances are proposed. Experiments using the NSGA-II metaheuristic showed a diverse Pareto frontier.

Keywords: Metaheuristic; Traveling Backpacker Problem; Mono/Multi-objective Optimization.

Programa: UNIFESP - Pesquisa Operacional (33009015094P9)

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QUANTIFYING THE EFFECT OF INNOVATION ECOSYSTEM ON STARTUPS' INNOVATION: EVIDENCE FROM MATCHING METHODS

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Yasmin Olteanu³
Klaus Fichter⁴

ABSTRACT

This study quantifies how cooperation with actors in the innovation ecosystem impacts startups' innovation. The quantitative study was based on an analysis of data collected by a German innovation survey in 2021, including responses from 1,512 startups. We analyzed the impact of the innovation ecosystem on startups' innovation level regarding business model, processes, products/services, and technologies. The Propensity Score Matching method using the Kernel Tricube estimator was used to estimate the impact. We found that higher levels of cooperation with innovation ecosystem actors positively impact startups' business model, process, and technological innovation. On the other hand, the effect of cooperation on product and service innovation seems to be non-significant in the context of German startups. Our findings shed light on governments, universities, established companies, and other ecosystem agents' role in leveraging innovation in startups and, consequently, in the economies where they participate. Likewise, the findings highlight the importance of cooperation with other startups, established companies, and research institutions, as these actors can offer an adequate structure to complement their limited resource base and help them deal with the complexity of developing and commercializing innovations. Based on that, our study presents theoretical, practical, and political implications.

Keywords: Entrepreneurship; Innovation; Nascent business; Cooperation; Matching methods.

Programa: UFRGS - Engenharia de Produção (42001013059P3)

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ENHANCING EMERGENCY DEPARTMENT PATIENT ARRIVAL FORECASTING: A STUDY USING FEATURE ENGINEERING AND ADVANCED MACHINE LEARNING ALGORITHMS

Bruno Matos Porto¹
Flavio Fogliatto¹

ABSTRACT

Background: Emergency department (ED) overcrowding is an important problem in many countries. Accurate predictions of patient arrivals in EDs can serve as a management baseline for better allocation of staff and medical resources. In this article, we investigate the use of calendar and meteorological predictors, as well as feature engineered variables, to forecast daily patient arrivals using datasets from eleven different EDs across 3 countries.

Methods: Six machine learning algorithms were tested, considering forecasting horizons of 7 and 45 days ahead. Tuning of hyperparameters was performed using a grid-search with cross-validation. Algorithms' performance was evaluated using 5-fold cross-validation and four performance metrics.

Results: The eXtreme Gradient Boosting (XGBoost) achieved better performance considering the two prediction horizons compared to other models, also outperforming results reported in past studies on ED arrival prediction. This is also the first study to utilize Light Gradient Boosting Machine (LightGBM), Support Vector Machine with Radial Basis Function (SVM-RBF) and Neural Network Autoregression (NNAR) for predicting patient arrivals at EDs.

Conclusion: The Random Forest (RF) variable selection and grid-search methods improved the accuracy of the algorithms tested. Our study innovates by using feature engineering to predict patient arrivals in EDs.

Keywords: Emergency department; Feature engineering; Machine learning algorithms; Patient visits forecast; Time series forecasting.

Programa: UFRGS - Engenharia de Produção (42001013059P3)

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ANTICIPATING FOR TENSIONS BETWEEN DIGITAL TECHNOLOGIES AND WORKERS: BUILDING STRATEGIES DURING THE TECHNOLOGICAL PROJECT DESIGN STAGE

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Alejandro Germán Frank¹

ABSTRACT

This article investigates the paradoxical tensions between technology and work that arise during the early stages of technological definition, specifically the technological project design stage, within manufacturing digital transformation. Conducted over one year, the research unfolds as a longitudinal case study within a high-end furniture company, focusing on the crafting of an Industry 4.0 technology roadmap aimed at steering the manufacturing digital transformation toward a human-centric, smart working system. The study adopts a multifaceted approach, encompassing in-site data collection methods such as interviews, active participation in company meetings, field observations of production activities, and analysis of implemented technologies. These diverse sources inform the identification and analysis of tensions as well as management strategies to address them. The findings, rooted in paradox theory, delineate ten paradoxical tensions and propose five management strategies that often surface during the technological project design stage. These insights underscore the inherent challenges and conflicts intrinsic to digital transformation within manufacturing contexts. Furthermore, the study extends the paradox theory by correlating these paradoxical categories with the primary challenges encountered by companies striving to establish a smart working system. By furnishing management strategies tailored to navigate these tensions, the research equips companies with tools to cultivate a smart working environment within the Industry 4.0 framework, even in the nascent phases of digital transformation initiatives.

Keywords: Industry 4.0; Workers; Paradoxical tensions; Smart working; Industry 5.0.

Programa: UFRGS - Engenharia de Produção (42001013059P3)

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INVESTIGATING DIGITAL SUPPLY CHAIN CONFIGURATIONS AND BUSINESS PERFORMANCE RELATIONSHIP: A META-ANALYSIS

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Guilherme Brittes Benitez¹

ABSTRACT

Purpose – This study investigates the relationship between Digital Supply Chain (DSC) configurations and business performance, addressing gaps in the literature on DSC definitions and potential outcomes. Therefore, this study investigates the nuances of the DSC concept by considering supply chain configurations based on singular technologies (i.e., Internet of Things, Cloud Computing, Big Data, Artificial Intelligence, Blockchain) and when organisations integrate several digital and emerging technologies.

Design/methodology/approach – This study employed a literature review and meta-analysis examining 50 empirical studies to investigate the relationship between the DSC and business performance. Potential moderators were identified and coded, and multiple subgroup analyses were conducted to assess the nuances of technology-based DSCs using Organisational Information Processing Theory and Resource-Based View perspectives.

Findings – The study confirms the positivist perspective regarding DSC and business performance with a medium effect size of strength. In addition, the outcomes suggest that organisations which use big data as the core technology have a stronger positive effect size. In contrast, blockchain-based DSC has no significant relationship with business performance. The moderators' outcomes suggest a significant difference between SMEs and large companies in business performance, while the effect size of economic classification is larger when the country is less developed.

Originality – The study categorises and defines technology-based DSCs often superficially explained in the operations management literature. This research sheds light on potential outcomes when organisations choose to orchestrate their DSCs around specific technologies or sets of technologies.

Keywords: Digital Supply Chain; Digital transformation; Business performance; Meta-analysis.

Programa: PUC/PR - Engenharia de Produção e Sistemas (40003019010P1)

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PREDICTIVE MAINTENANCE STRATEGIES IN AGRICULTURE USING SURVIVAL ANALYSIS

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Gilberto Reynoso Meza¹

ABSTRACT

This study explores the application of survival analysis models—Kaplan-Meier, Cox Proportional Hazards, Aalen’s Additive, and Random Survival Forests—to predict failure times and identify critical factors influencing the reliability and efficiency of agricultural machinery. By integrating Directed Acyclic Graphs (DAGs), the research enhances the understanding of causal relationships among operational variables, thus providing a robust framework for predictive maintenance strategies. Utilizing simulated data to ensure confidentiality and integrity, this study demonstrates how modern data science techniques can significantly optimize maintenance schedules and reduce unplanned downtime. The findings underscore the potential of survival models to revolutionize agricultural machinery management by facilitating data-driven decisionmaking, improving operational efficiency, and reducing maintenance costs. The research not only contributes to agricultural engineering but also offers broader implications for predictive maintenance practices across various industries.

Keywords: Survival analysis; Predictive maintenance; Agricultural machinery; Data science; Operational efficiency; Directed Acyclic Graphs.

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MARKOV CHAIN APPROACH TO GET CONTROL LIMITS FOR A SHEWHART CONTROL CHART TO MONITOR THE MEAN OF A DISCRETE WEIBULL DISTRIBUTION

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ABSTRACT

Typically, failure time is modeled using continuous distributions such as the Weibull or Gamma distributions. In many practical scenarios, data is recorded in terms of discrete counts, such as the number of days or cycles, therefore the Discrete Weibull distribution is employed to model such cases. In this paper, we propose the use of a Shewhart X control chart to monitor the mean of a Discrete Weibull process. While the distribution of the sum of Discrete Weibull random variables does not have a closed-form expression, it can be determined through a Markov Chain procedure, which enables the calculation of precise control limits. The Average Run Length (ARL) is the metric used to assess the performance of the control chart. Two numerical examples are provided to illustrate its practical application.

Keywords: Sum Distribution; Average Run Length; Count data; Monte Carlo simulation.

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PROJECT PORTFOLIO SELECTION WITH THE FITRADEOFF METHOD: A COMBINATORIAL ANALYSIS APPROACH

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ABSTRACT

The efficient generation of portfolios that optimize resource usage and achieve strategic objectives is a complex task. This work presents a new proposal for the FITradeoff method in portfolio decision analysis, incorporating partial information about decision-makers' preferences. In this context, two approaches were proposed. The first involves the explicit generation of portfolios, while the second utilizes heuristics to optimize the portfolio generation process. The first proposed approach uses the concept of c-optimal portfolios and refinement strategies of feasibility and efficiency during the process of generating a portfolio while endeavoring to keep both computational and cognitive efforts within reasonable limits. This work also proposes novel heuristic-based multiattribute decision approach to reduce the solution space when generating feasible and efficient project portfolios incorporating the decision-maker's preferences. The FITradeoff approach to combinatorial portfolio is incorporated into a Decision Support System, and stands out as a significant contribution, providing a practical implementation of the proposed method. The results share relevant evidence, demonstrating that the computational outcomes using the proposed methods exhibit good performance in terms of minimizing computational effort and reducing the cognitive effort required of the decision-maker. While the two proposed approaches address the challenge of portfolio generation from distinct perspectives, they complement each other, offering insights that can be integrated into different contexts. They are flexible, allowing replication in diverse situations. This synergy between the approaches provides a comprehensive framework that can be effectively applied in practical situations, consolidating the utility and adaptability of these models for solving the project portfolio problem.

Keywords: Portfolio decision analysis; Multicriteria decision making/aiding; FITradeoff; Partial information; Heuristics; Project portfolio problem.

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A BIBLIOMETRIC REVIEW OF SOFT SKILLS: UNDERSTANDING THE TRAJECTORIES AND RESEARCH AGENDA

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ABSTRACT

Soft skills have emerged as a relevant and cross-cutting research topic in various areas of knowledge, reflecting the growing importance attributed to the intrapersonal and interpersonal dimensions in the contemporary world. The study aims to systematically map and analyze the academic literature on soft skills in prominent journals, identifying trends, research gaps, key authors, and areas of interest. Using the bibliometric method, three research questions were formulated to guide the study: (a) What is the time frame for publications on soft skills? (b) What are the countries, journals, and authors that publish the most on soft skills? (c) What are the main areas of knowledge investigating soft skills, what are the main research topics, and which articles receive the most citations? The results indicate a significant increase in publications on soft skills since 2013, with a wide geographical distribution of countries with scientific production. The social sciences lead research on the topic, followed by engineering and technology. Major research topics are related to higher education and the labor market. Co-authorship analysis revealed low collaboration between researchers, indicating a lack of articulation and cooperation among research groups dedicated to the topic. Finally, the suggested research agenda highlights opportunities to investigate the relationship between soft skills and issues of sustainable development and other emerging themes in dealing with global challenges.

Keywords: Soft skills; Bibliometric analysis; Social Sciences; Engineering.

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CONTRIBUTIONS OF THE GROUNDED THEORY FOR DISASTER AND HUMANITARIAN OPERATIONS: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Purpose: Disaster are increasing in frequency and impact, as well as the number of scientific publications focusing in this topic. Therefore, this article aims to assess the contributions of theories for disaster and humanitarian operations (DHO) developed through the Grounded Theory method.

Design/methodology/approach: This study applies a Systematic Literature Review in the Scopus and Web of Science databases, leading to an initial analysis of 822 abstracts and a full analysis of 102 articles.

Findings: Based on a classification of theories according to their resulting contributions to DHO, the research identifies a higher frequency of low-range theories, followed by middle and high-range level theories. Therefore, we sign the need for a debate on high-range theories for DHO as they enable generalizations to different scenarios and contribute to a structured relationship of middle and lower-range theories. The scientific development of such high-range theories in DHO has the potential to shed light on the epistemological and ontological nature of DHO and provoke more significant contributions to both researchers and practitioners.

Originality: This study provides three main contributions that synthesizes its originality: the state-of-the-art of research in DHO that adopts the GT method and delivery theories; the classification and assessment of theories based on their topic, allowing their adoption for practitioners; the research agenda with suggestions for future research and discussion.

Keywords: Grounded Theory; Humanitarian Logistics; Humanitarian Supply Chain; Disaster Management.

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RUSSELL MEASURE-ADJUSTED DEA-MALMQUIST TO ASSESS COVID-19 PANDEMIC IMPACT ON PRODUCTIVITY BRAZILIAN TEACHING HOSPITALS

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ABSTRACT

This study aims to evaluate the application of the Russell Measure-adjusted DEA-Malmquist model as method of measuring the impact of the COVID-19 pandemic on the productivity of Teaching Hospitals (THs) in Brazil and propose parameters and care goals for planning after the public health emergency ending. The developed model used the Russell Measure as adjustment to the efficiency score calculated by Data Envelopment Analysis (DEA) and used by the Malmquist Index. DEA is a linear programming technique that defines a productivity frontier from efficient units. DEA Malmquist is a method that analyses the change of efficiencies over time regarding the frontier shift and catch-up effects. The adjustment using the Russell Measure was necessary so that efficiency scores were calculated in relation to targets on the Pareto-Koopmans region of the frontier, known as strongly efficient frontier. The model was applied to Brazilians Teaching Hospitals (THs) that worked to combat the COVID-19 pandemic. The productivity frontiers of THs in the years 2019 (immediately before the pandemic) and 2021 (immediately after the outbreak of the pandemic) were compared using the proposed model. The results revealed a reduction in hospital productivity and contraction of the frontier from 2019 to 2021. This drop can be explained by the contraction of the technological frontier, resulting from the THs social commitment to deal with COVID-19. Regarding the proposition of scenarios for productivity recovery, the frontiers of both years were considered together to establish benchmarks. The targets indicate the need for increases in 96.5% of hospitalizations and 107.4% of surgeries to recover hospital efficiency. The herein proposed Russell Measure-adjusted DEA-Malmquist model allowed assessing the drop in productivity, find benchmarks at region of the frontier considered strongly efficient, and made it possible to establish goals for the resumption of highly complex procedures after the public health emergency ending.

Keywords: Operational Research; Data Envelopment Analysis; Malmquist index; Russell's measure; Teaching Hospitals; COVID-19.

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A RISK MANAGEMENT MATURITY MODEL PROPOSAL FOR BRAZILIAN PUBLIC ORGANISATIONS

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ABSTRACT

This research proposes a new maturity model to assess RM implementation in Brazilian public organisations. For such, three connected studies are presented. The first one explores RM implementation through the support of government policymakers in 6 Brazilian states. Qualitative content analysis demonstrated that policymakers employ strategies to approach public organisations and operationalise RM as contingent variables are perceived. These strategies are expected to attenuate the difficulties in progressing RM maturity. The second study investigates which attributes and contingent factors are crucial to develop a public sector RMmaturity model (PSRMMM). Accordingly, a path of multivariate statistical techniques (CATPCA, K-modes, and multinomial logistic regression) was used to analyse the collected data. Results reveal 12 statistically significant variables that explain 5 different levels of public sector RM maturity. The third study is a complement to the second and proposes the PRisk-MM, a PSRMMM containing 5 levels of maturity and 23 attributes related to 15 dimensions. The model was elaborated following the scientific rigour found in the literature, being divided into 2 phases: the development of the model and its validation in 5 public organisations. The Prisk-MM's assessment procedure uses triangular fuzzy numbers to better treat the subjectivity and ambiguity of human judgement. The second and third studies were published in the Journal of Risk Research, and the latter has a filed patent. This research has important practical implications because the PRisk-MM was developed as a government tool policymakers can use to assess the public organisations' maturity status. Moreover, the PRisk-MM is adaptive to governments' contexts and, once applied, presents prescriptions on what organisations must do to develop their RM practices.

Keywords: Public sector risk management; Contingency theory; Multivariate statistics; Maturity models; Fuzzy set theory.

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A MULTIMODAL FUSION APPROACH FROM BIOLOGICAL DATA- DRIVEN MODELS FOR DROWSINESS DETECTION

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ABSTRACT

Industrial sectors such as oil and gas, chemical, and nuclear industries have witnessed catastrophic accidents occurring over the years in complex and critical systems. Governments and industries worldwide continue to intervene to enhance safety in operations. However, they face inherent human-based challenges as they recognize that improvements in physical systems alone are insufficient to eliminate safety risks completely. Fatigue-related issues, including poor resting habits, sleep deprivation, night shifts, and stress, have been associated with reduced alertness and increased risk of accidents, while drowsiness has been reported by operators and professionals in several industrial sectors. In recent times, the advancement of technology has provided unprecedented access to physiological data, including electroencephalogram (EEG) signals with the capability of capturing brain activity and facial information that provides insight into visual expressions. Thus, proposes a data fusion approach using EEG signals and computer vision to enhance drowsiness detection accuracy. It analyzes EEG data and facial features separately, then combines them using a decision rule. Experimental results show improved accuracy compared to using EEG alone. The proposed data fusion approach provides a promising framework to enhance drowsiness detection systems, improving safety and performance across diverse industrial real-world applications.

Keywords: Machine Learning; O&G industry; EEG; Data fusion; Computer Vision; Deep Learning.

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FROM EFFECTIVENESS TO FAIRNESS: DESIGNING FOOD ALLOCATION IN FOOD AID PROGRAMS FOR TRADITIONAL PEOPLES AND COMMUNITIES

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ABSTRACT

Daily access to food is one of the most basic human needs. Still, millions of people experience acute food insecurity. Hunger and food insecurity do not affect everyone equally. Unsurprisingly, millions of undernourishment cases and food deprivation are especially reported among children, black people, indigenous communities, rural farmers, and other marginalized groups. One of the main strategies employed by governments to tackle food insecurity involves the distribution of food. In this paper, we develop a resource allocation model that aims to distribute food baskets as part of food aid programs targeted at traditional peoples and communities, such as indigenous, quilombolas and extractive people. Through a practical case, we are pleased to look at such vulnerable peoples, who are often overlooked by governments and society. We formulate and analyze a mathematical model to design effective and equitable food distribution strategies by which governments can allocate food baskets to food-insecure traditional populations. Using the concept of fair share, we model equity both in terms of populations and the geographic area these populations are based. We also incorporate a prioritization factor to ponder population vulnerabilities within our allocation model. Finally, we analyze the effectiveness and equity trade-off to better guide government decisions in food basket allocation.

Keywords: Hungry; Food insecurity; Prioritization; Equity; Food aid; Public policies.

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DATA-DRIVEN DECISION SUPPORT FRAMEWORK FOR MAINTENANCE, REPAIR, AND OPERATION (MRO) INVENTORY PLANNING: A LEAN, AGILE, RESILIENT, AND GREEN (LARG) PERSPECTIVE

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ABSTRACT

Artificial Intelligence (AI) can improve Operations and Supply Chain Management (OSCM) from the perspectives of Lean, Agile, Resilient, and Green (LARG) paradigms. However, empirical research examining data-driven inventory planning from a LARG perspective is still lacking. This is particularly relevant for Maintenance, Repair, and Operation (MRO) inventories, which typically exhibit irregular demand patterns with significant financial and operational implications. Thus, this study proposes the development of a data-driven decision support management artifact for MRO inventory planning from a LARG perspective. The first stage of the proposed framework involves demand forecasting, which is implemented using a model that combines a genetic algorithm and an artificial neural network (GA-ANN). The second stage involves time-series clustering using k-means and dynamic time-warping (DTW) metrics. The GA-ANN and k-means clustering models were implemented using Python. Lastly, the proposed framework incorporates practical implications for each LARG paradigm. The framework is applied to a case study using real data from a railway logistics operator. The research findings revealed superior performance in demand forecasting compared to current practices at the company and various academic forecasting models. In addition, time-series clustering enabled the practical analysis and segregation of items based on similarity. Thus, the proposed framework is a crucial data-driven decision-support artifact for enhancing MRO inventory planning within the LARG paradigm. The railway logistics operator estimates potential gains of approximately 4 million dollars per year with the adoption of the developed artifact within rails and sleepers, which can be increased by the inclusion of additional SKUs through the clustering process.

Keywords: Industry 4.0; Machine learning; Artificial intelligence; Demand planning; Clustering; Railway.

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PolieDRO: A NOVEL CLASSIFICATION AND REGRESSION FRAMEWORK WITH NON-PARAMETRIC DATA-DRIVEN REGULARIZATION

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ABSTRACT

PolieDRO is a novel analytics framework for classification and regression that harnesses the power and flexibility of data-driven distributionally robust optimization (DRO) to circumvent the need for regularization hyperparameters. Recent literature shows that traditional machine learning methods such as SVM and (square-root) LASSO can be written as Wasserstein-based DRO problems. Inspired by those results we propose a hyperparameter free ambiguity set that explores the polyhedral structure of data-driven convex hulls, generating computationally tractable regression and classification methods for any convex loss function. Numerical results based on 100 real-world databases and an extensive experiment with synthetically generated data show that our methods consistently outperform their traditional counterparts.

Keywords: Machine learning; Data-driven distributionally robust optimization; Hyperparameter-free; Regression; Classification.

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FARM MANAGEMENT INFORMATION SYSTEMS ADOPTION IN BRAZIL: EMPIRICAL EVIDENCE FROM AN EMERGING ECONOMY

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ABSTRACT

Digital agriculture technologies offer significant opportunities to rural producers. They can reduce costs, save resources, and increase productivity. However, many farmers are hesitant or face challenges when adopting digital technologies. In this context, identifying and analyzing the factors influencing the acceptance and use of digital technologies among Brazilian farmers is of significant relevance and urgency. To this end, this study proposes an adaptation of the Unified Theory of Acceptance and Use of Technology (UTAUT) to analyze the acceptability of Farm Management Information Systems (FMIS) among Brazilian farmers. An analytical model was proposed and empirically tested through a survey, with respondents invited to participate electronically online. The collected data were analyzed using descriptive and multivariate statistics. Structural equation modeling (SEM), through a partial least squares (PLS-SEM) approach with global goodness-of-fit, was used for model analysis. The results confirmed three of the ten proposed hypotheses: effort expectancy and external pressure positively influence farmers' behavioral intention to use FMIS. Conversely, perceived cost negatively impacts farmers' intention to use FMIS. This study provides valuable contributions to behavioral model research and understanding the role of various factors in FMIS acceptability. The findings may be beneficial to farmers, rural extension agents, technology developers, government, agronomists, and rural workers, among others.

Keywords: Digital Agriculture; Acceptability; Behavioral Models; Farmers.

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DATA-RELATED TENSIONS IN DIGITAL SERVICITIZATION ECOSYSTEMS: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Digital servitization has been an important trend in the manufacturing industry. There are many examples of manufacturers (e.g., Rolls-Royce, Scania, Alstom, Caterpillar, General Electric) boosting their service offerings with the advent of digital technologies such as IoT, big data and cloud computing. In addition to offering benefits such as optimizing back-end operations and creating new opportunities for customer interaction, these technologies allow manufacturers to collect product and customer data and deliver more advanced solutions. Examples range from predictive diagnostics based on intelligent algorithms for optimizing customers' operations to analytic services that add value to business performance. Hence, data play a critical role in digital servitization by providing insights into product usage and customers' processes for customized service offerings. As data gain importance in digital servitization, so does inter-firm collaboration within ecosystems. To succeed in providing data-driven solutions, manufacturers must rely on data from different actors (e.g., customers, suppliers, technology providers, etc.). Thus, efficient collaboration between actors within ecosystems contributes to the proliferation of business information available to manufacturers and other service providers. As an immediate consequence, data governance plays a key role in taking advantage of the opportunities generated by the abundance of data in digital servitization ecosystems. However, since multiple actors are involved in inter-firm collaboration, a wide range of tensions may emerge. Tensions are conflicts, crises, and problems in business relationships that prevent actors from co-creating value and achieving the collaboration's expected results. In digital servitization ecosystems, actors often have different views or interests on how data should be collected, stored, shared, and explored, which can result in tensions such as data privacy concerns, opportunism perceptions, and dependency issues. We call the conflicts and tensions that arise in the context of data exchange as data-related tensions. Considering this scenario, this article investigates data-related tensions and their corresponding coping strategies arising from inter-firm collaboration in digital servitization ecosystems. We conducted a systematic literature review based on thematic and network analyses, covering a sample of 191 articles on digital servitization. The findings offer a set of 11 tensions organized into six dimensions: (i) data strategy, (ii) data partnership governance, (iii) data quality, (iv) data security and privacy, (v) data architecture, and (vi) data lifecycle. Additionally, we identify seven coping strategies to address these tensions, which we categorized into three approaches: (i) governance, (ii) technology, and (iii) organization. These tensions and their corresponding coping strategies are arranged and presented in a conceptual framework, leading into five propositions. We also provide a research agenda outlining future research opportunities to expand knowledge on the tensions arising from inter-organizational relationships when creating and providing data-driven services. For practitioners, we offer insights into how to manage ecosystem relationships by suggesting strategies to cope with these tensions, and for policy makers we shed light on crucial matters for future data governance policies and laws.

Keywords: Digital servitization; Digital servitization ecosystems; Inter-firm collaboration; Data-related tensions; Coping strategies.

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A NEW LENS ON SYSTEMIC ACCIDENT ANALYSIS: BRIDGING WORK ACTIVITY ANALYSIS AND RESILIENCE ENGINEERING

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ABSTRACT

This paper proposes a new tool for accident analysis using concepts and approaches from (a) Activity Analysis; (b) Resilience Engineering; and (c) Safety Culture. We outline its development and conduct an application in the subsea operations within the Brazilian offshore oil & gas (O&G) segment. Development was carried out under a participatory research design. The tool consists of a protocol guided by a flowchart and scripts for data collection and analysis. The proposal has helped us to better track contributing factors to accidents within a complex safety-critical domain, as rich findings from ethnographic-oriented activity analysis can be progressively gathered and systematized into a significant database, part of which will be modeled and analyzed through scenarios that explain near misses and accidents from in-depth knowledge of work activity. The tool design allows for identifying instances of manifestation of proactive safety from the work-as-performed, foregrounding the workers' knowledge, cooperative actions, and decision aides as crucial factors in conducting safe operations and preventing accidents.

Keywords: Ergonomic work analysis; Safety culture; FRAM; Oil & Gas; Subsea operations

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LEAN MATURITY LEVEL ANALYSIS FOR INDUSTRY 4.0

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ABSTRACT

Purpose – This study seeks to identify the ideal moment for the transition from Lean Manufacturing to Industry 4.0, identifying which are the right tools for companies and industries to move towards industrialization evolution.

Methodology – To analyze the maturity of Lean Manufacturing, we developed a survey based on the Lean 4.0 maturity of Matternich et. al. [1]. The questions were divided into five groups, based on the lean principles presented in Systematic Literature Review. This survey was applied to small and medium companies from Brazilian Industry.

Findings – With the results in hand, it was possible to verify the relationship between the lean methodology and the technologies of Industry 4.0 and identify the best transition scenario.

Originality – Many references make a theoretical analysis on the relationship between lean and Industry 4.0, while this study makes a more in-depth analysis of companies that have a certain maturity in lean and that are in the process of transition or preparing to implement Industry 4.0, with the objective of analyzing this relationship and the respective maturities and understanding some gaps presented in previous studies.

Keywords: Industry 4.0; Lean Manufacturing; Maturity; Survey.

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METHOD FOR TRANSFORMING EXISTING PUBLIC BUILDINGS INTO NET ZERO ENERGY BUILDINGS

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ABSTRACT

Net Zero Energy Buildings (NZEB) are a promising alternative for reducing CO₂ emissions and energy consumption in public buildings. However, the literature focuses on studying the application of NZEB in new buildings. As a result, there are few studies focusing on existing buildings, which may offer even greater potential for energy savings. Energy efficiency in the public sector can lead to a reduction in public expenditure, thus increasing its impact on society. The objective of this study is to propose a method to transform existing public buildings into NZEB. The proposed method is rooted in the Brazilian scenario. Called NZEP (Net Zero Energy Public), it is composed of five macro-steps, divided into 25 micro-steps of design. These steps range from the selection of the building to be transformed to the measurement and verification of the transformation results. The method was evaluated and validated by experts and applied to two transformation projects in existing buildings in the Brazilian public sector. The results show that the NZEP can support and drive the research and transformation of the Brazilian public building stock to NZEB standards. Leading to an acceleration of the efficiency of the segment, which can result in reduced energy consumption and operating costs for the sector.

Keywords: NZEB; Energy Efficiency; Public Buildings; Reducing CO₂ Emissions.

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COST OF STROKE IN LATIN AMERICA: A MULTICENTRIC TIME-DRIVEN ACTIVITY-BASED COSTING STUDY

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ABSTRACT

Objective: This study aims to lay the foundation for establishing value-driven stroke centers in Latin American countries by analyzing the precise costs of acute ischemic stroke and their regional variabilities using accurate microcosting techniques.

Methods: A multicenter international study was conducted to analyze direct costs and outcomes among patients hospitalized for acute ischemic stroke between December 2021 and December 2022. Patient data from stroke centers across Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, and Uruguay were included. Employing a microcosting method, direct costs across the stroke care pathway were evaluated, and descriptive cost analyses were performed, with data stratified by country. Factors such as favorable outcomes based on the modified Rankin Scale (mRS 0-2), clinical risk levels derived from age and stroke severity, and treatment interventions including medical treatment alone, intravenous thrombolysis (IVT), and mechanical thrombectomy (MT) were considered. Cross-country comparisons were facilitated by applying purchasing power parity adjustments and converting local currencies to international dollars (I\$). Generalized Estimating Equation (GEE) models were utilized to assess the relationship of clinical variables with the total cost per patient.

Results: A total of 1,106 patients were included in the study, distributed across eight Latin American countries: Argentina (13%), Brazil (14%), Chile (11%), Colombia (14%), Costa Rica (18%), Mexico (9%), Peru (11%), and Uruguay (9%). Among these patients, 74% received medical treatment alone, 18% received IVT, 4% underwent MT, and 3% received combined IVT plus MT. The mean cost per patient was I\$20,746 (SD I\$22,163), with 49% achieving a favorable functional outcome. Compared to medical treatment alone, MT incurred costs 2.3 times higher, with an incremental cost of I\$23,652 per patient ($p < 0.001$). Patients classified in the modified Rankin Scale (mRS) 5-6 categories at discharge were 2 times more costly than those in the mRS 0-2 categories. Across all countries, costs increased according to patients' clinical risk and treatment options, with hospital structure emerging as the primary cost driver.

Conclusion: Our study highlights significant disparities in stroke costs across Latin American nations, influenced by variations in treatment accessibility, patient outcomes, and clinical risk profiles. These findings offer essential insights for shaping health policy decisions to enhance the long-term sustainability of stroke care worldwide. Prioritizing accessibility and advocating for adopting value-based care models are essential to mitigate these inequalities and improve regional patient outcomes.

Keywords: Stroke; Cost; Cost evaluation; Cost impact.

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INDUSTRY 4.0 AND SMART CONSUMPTION: HOW DIGITAL TRANSFORMATION CAN ENHANCE THE USE OF INDUSTRIAL RESOURCES

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ABSTRACT

The industry 4.0 literature has recently focused the attention on the role of digital technologies for sustainable operations. However, sustainability has not been addressed as a clear dimension of the Industry 4.0 technological structure. This research aims to broaden such a view by proposing the concept of Smart Consumption. To this aim, we consider three main types of resource consumption: material, energy, and water consumption. The study adopts a Systematic Literature Review to consolidate the main technologies adopted within these three Smart Consumption dimensions. The study analyzes 108 articles in this field and investigates which digital technologies have been adopted and how they are applied in each of the dimensions of Smart Consumption. Based on the analyzed articles, a structured concept of Smart Consumption is proposed.

Keywords: Industry 4.0; Smart Consumption; Sustainable Consumption; Digital Technology.

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THE IMPLICATIONS OF DIGITAL TRANSFORMATION AND CORPORATE SOCIAL RESPONSIBILITY INTEGRATION ON BUSINESS PERFORMANCE: AN INSTITUTIONAL AND STAKEHOLDER VIEW

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ABSTRACT

The study investigates the moderating effect of Digital Transformation (DT) on Corporate Social Responsibility (CSR) practices and business performance relationships. CSR was evaluated from a stakeholder's view, considering labor, consumers', and suppliers' practices. The synergy of CSR and DT was investigated through an institutional view, considering when organizations integrate Base and Front-end technologies and digital strategies with CSR for business performance. Using a sample of 402 Brazilian organizations, we analyze the proposed relationships using factor analysis and hierarchical linear regression. We validate the stakeholder's view by finding positive associations between CSR and business performance indicators. Our findings corroborate the institutional view that DT and CSR integration may yield no substantial changes in financial performance, suggesting that such synergy does not directly lead to organizational returns and profitability. However, the positive outcomes on innovation and workers' performance indicate that organizations may directly benefit in other aspects when integrating DT and CSR.

Keywords: Corporate Social Responsibility; Digital Transformation; Financial Performance; Innovation Performance; Workers' Performance.

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ANALYSIS OF MULTI-OBJECTIVE OPTIMIZATION TECHNIQUES FOR ROBOTIC ARM PATH PLANING: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

In industrial robotics, optimizing robotic manipulator trajectories is a key topic that has a direct influence on operating efficiency, energy consumption, and maintenance costs. Robotic manipulators are widely used in many industries, including manufacturing, assembly, and logistics, where precision and efficiency are critical. However, the problem to optimize all of these objectives at once while meeting several constraints hard task, that could be solve through multi-objective optimization (MOO), by constructing a parametric model with the right software and training MOO algorithms to take into account all of the set parameters and constrains in order to build the optimal Pareto curve regarding the set objectives.

Keywords: Multi-Objective Optimization; Robotic Arm; Path Planing; Pareto Curve; Computational Intelligence.

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KNOWLEDGE MANAGEMENT ENABLERS, BARRIERS, AND CAPABILITIES IN PROJECT LEVEL: A MULTIMETHOD APPROACH

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ABSTRACT

Knowledge is a strategic resource, it is the basis for innovative projects, applied to the development of Dynamic Capabilities (DCs) and the reason for sustaining Absorptive Capability (AC). Recent literature on projects has been discussing the role of knowledge associated with these capabilities in the development of innovative projects. In this sense, Knowledge Management (KM) process the fundamental information and knowledge generated in projects. Factors such as organizational culture, technological infrastructure and communication influence KM, as well as KM barriers. The main objective of this research is to investigate the contribution of Knowledge Management to project management through the identification of the main barriers, enablers and capabilities for innovation in projects. We apply a multimethod approach: First, we propose a framework and propositions through a Systematic Literature Review; secondly, we developed quantitative research, through structural equation modeling, where we proposed a theoretical model and validated it through hypothesis tests; finally, we conducted multiple case studies. In Paper 1 (#P1), a framework was created detailing three propositions that explore the KM relationship and capabilities. It also presents unresolved questions and new trends for future research agendas. In Paper 2 (#P2) the results show the significant and positive effect of organizational culture and technology for knowledge sharing in KM. The study also reveals the complex path that organizations take towards KM. In Paper 3 (#P3) we support our theoretical model with empirical evidence on the role of KM and capabilities in the development of innovative projects in Project-Oriented Organizations (PBOs) with proactive collaborations (with establishment of open innovation model). Our findings suggest that the link between KM and capabilities generate benefits for the development of innovative projects. The articulation between capabilities and KM is a bidirectional process, simultaneously top down, where the knowledge generated in each innovation project is incorporated in the KM process and bottom-up, where each different project contributes to the constant evolution of project capabilities. The results show the positive and significant effect of enablers no KM and the communication barriers has a moderating effect on the relationship between knowledge sharing barriers and KM for the development of innovative projects. Finally, the establishment of formal KM processes can facilitate the generation of new knowledge through collaboration with the external environment for innovative projects. Thus, we conclude that both the literature and the practical community of project management recognize the influence of knowledge in maintaining the competitive advantage and survival of project-based organizations. The evolution of technology and the creation of new markets impose the constant search for external knowledge that enables the company to diversify its portfolio of projects and be prepared for new challenges.

Keywords: Knowledge Management; Capabilities; Project Management; Technology; Culture; Open Innovation.

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BLOCKCHAIN GOVERNANCE IN CREATING VIRTUAL ENTERPRISES: AN ENTERPRISE MODELING APPROACH

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ABSTRACT

Firms collaborate through network-based organizations, such as Virtual Enterprises, combining complementary competencies to foster competitiveness and innovation outcomes in response to business opportunities. However, network governance in creating Virtual Enterprises encompasses coordination challenges, mistrust, data privacy concerns, and incentive misalignment among stakeholders. In contrast, blockchain governance can establish exchange rules and organize stakeholder interactions through self-governing and automated agreement enforcement. In this setting, this research uses the For Enterprise Modeling (4EM) method to identify the organizational requirements for blockchain governance in creating Virtual Enterprises. Proposed blockchain governance mechanisms include an on-chain voting system, token-based reputation, on-chain reward and sanction policies, identity management, and a privacy policy. An analytical evaluation demonstrates the feasibility of blockchain governance mechanisms through organizational behavior simulations. As a result, this study proposes a conceptual model that exposes blockchain governance and its relationships with traditional governance towards being extended to different types of Virtual Enterprises and inter-organizational relationships at the network level.

Keywords: Blockchain; Virtual Enterprises; Collaborative Network.

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MACHINE LEARNING-BASED GESTATIONAL AGE PREDICTION FOR PRETERM BIRTH RISK ASSESSMENT IN SÃO PAULO, BRAZIL: APPROACH UTILIZING MATERNAL AND PREGNANCY INFORMATION

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ABSTRACT

Preterm birth occurs before the 37th week of gestation, and it is associated with a high risk of physical and neuropsychomotor complications in newborns, being considered the main cause of neonatal mortality. In line with one of the Sustainable Development Goals (SDGs) focused on Health and Well-being, which aims to reduce neonatal mortality by 2030, the application of technological tools, such as machine learning, can offer support in medical care and decision-making. Thus, this research aims to apply machine learning techniques to develop a predictive model to identify the risk of preterm birth based on gestational age, using data from the municipality of São Paulo from 2015 to 2019. This cross-sectional study can also be classified as applied research; its approach is quantitative, using the modeling and simulation research method. Data from the Department of Informatics of the Unified Health System - DATASUS were used, specifically 794,696 live birth records after data cleaning, related to maternal and pregnancy information from the municipality of São Paulo in Brazil, during the period 2015-2019. The analysis was based on the regression approach to estimate gestational age, using methods such as Linear Regression, Decision Tree, Random Forest, Gradient Boosting, and Extreme Gradient Boosting. The models were internally validated through a 10-fold cross-validation process, and the Random Search technique was utilized for hyperparameters optimization. As a result, this study identified mothers between 15 and 44 years of age and newborns with gestational ages between 27 and 42 weeks. During the training and testing process, the machine learning algorithms showed a good performance, and using different error measures was possible to evaluate and select the model with the best performance metrics, where the best model with the lowest error values was the Gradient Boosting model, with MAE = 1.186, MSE = 2.833, RMSE = 1.683, and MAPE = 3.182. In conclusion, the regression model demonstrated good performance, showing that machine learning techniques are effective tools in the healthcare field. They allow specialists to make timely decisions regarding the identification of preterm births, contributing to the implementation of control measures and, consequently, to the reduction of neonatal mortality rates, in accordance with the SDGs.

Keywords: Preterm birth; Gestational age; Primary health care; Machine learning; Predictive models.

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DATA SCIENCE FRAMEWORK FOR BRAZILIAN SMALL AND MEDIUM ENTERPRISES

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ABSTRACT

Small and Medium Enterprises (SMEs) account for a considerable share of the market, whether in emerging or developed economies. In China, they encompass around 75% of the workforce, while in Canada and European Union countries, this rate reaches 64% and 67% respectively, whereas in Brazil, about 78% of jobs are generated solely in Micro and Small Enterprises. However, the economic representation does not reflect the level of adoption of Information Technologies (IT) for SMEs, where a diffusion between 7% and 33% is estimated in this business model, while for large companies, it's around 77%. Issues such as IT maturity level, lack of investment, and technical capacity often limit the use of such technologies to large companies or startups born in a digital environment, while SMEs remain on the sidelines of a growing market. Given the relevance of incorporating disruptive technologies and their impact on the success of organizations, this study sought, through literature review and field research, to prospect elements for proposing a Data Science Framework (DSF) in the context of Brazilian SMEs. The methodology involves topic modeling for the constitution of the bibliographic portfolio and application of the Latent Dirichlet Allocation (LDA) algorithm in the context of text mining, added to market contributions through interviews with professionals working in the technology segment. Regarding the perception of value and adjustments of the generic DSF, the interviewees agreed that the DSF can be used to guide the adoption of Data Science processes in various companies. Improvement in information governance was mentioned as the most valuable point, followed by improved process efficiency and increased team performance. The interviewees also highlighted clarity in project/product scope, decision-making, improvement in IT governance, and other benefits provided by the DSF. Lack of qualified human capital and low perception of value were identified as the main barriers in SMEs. Other mentioned obstacles include financial limitations, lack of organization, organizational culture, and insufficient technological availability. As supplementary information, the interviewees proposed developments on system interoperability, DSF segmentation by company size, and value delivery in phases based on companies' maturity levels. In summary, the generic DSF can be applied as a guide for structuring data flow and improving decision-making efficiency in SMEs.

Keywords: Small and Medium Sized Enterprises; Data Science; Framework; Text Mining.

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FACES EFICIENTES DE DIMENSÃO COMPLETA (FDEF) EM DEA: REVISÃO DA LITERATURA E PROPOSTA DE UM NOVO SOFTWARE DEA-FDEF

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ABSTRACT

Esse trabalho tem como objetivo realizar uma revisão da literatura da aplicação de Faces Eficientes de Dimensão Completa (FDEF) em Análise Envoltória de Dados (DEA) e propor um novo software DEA capaz de executar, além dos modelos clássicos, os modelos FDEF levantados pela revisão da literatura. O software também possibilita a visualização gráfica tridimensional dos resultados dos modelos e das fronteiras de produção, sinalizando as FDEF, quando houver, ou indicando as Faces Eficientes de Dimensão Máxima (MDEF). O software é desenvolvido na linguagem Python, utilizando bibliotecas Open Source, com interface gráfica e integração com o Microsoft Excel, por onde os dados de entrada para o modelo serão inseridos. As motivações desse trabalho estão: (1) na escassez de trabalhos que abordem as Faces Eficientes de Dimensão Completa (FDEF), em especial que abordem uma revisão sobre o assunto, e (2) na falta de um software disponível para a utilização de metodologias que utilizem FDEF, sobretudo que possibilite visualizar graficamente o modelo. Com esta contribuição, almeja-se contribuir, auxiliar e incentivar a comunidade científica e profissional em aplicações futuras da metodologia. Neste trabalho, os modelos DEA e FDEF são aplicados em um problema real envolvendo 52 países para avaliação de desempenho em saúde utilizando dados retirados da base de dados da Organização Mundial da Saúde (OMS), relativos ao ano de 2019, com informações de expectativa de vida, número de médicos por 10.000 habitantes e despesas correntes de saúde per capita.

Keywords: PO; DEA; FDEF; Desenvolvimento de Software.

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CYBERSECURITY IN CYBER-PHYSICAL SYSTEMS: STATE OF ART AND ANALYSIS OF A CASE IN THE BRAZILIAN ELECTRICITY SECTOR

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ABSTRACT

Cyber-Physical Systems (CPS) are systems responsible for connecting physical devices to cyberspace and are applied in essential services and critical infrastructures, which poses the criticality of CPS cybersecurity. Therefore, this research aims to analyze the main approaches associated with responding to cyber incidents in CPS and the challenges and opportunities faced by organizations when addressing CPS cybersecurity. This research adopts a multimethodological approach combining a systematic literature review (SLR) and a case study. The SLR considered the analysis of 299 abstracts and 19 papers and contributed to identifying the main application sectors, the incident response process phases, and the visual representations of these processes and stakeholders' relationships. The case study considered the context of power grid operations in the Brazilian Electricity Sector (BES), and the findings revealed the adherence and applicability of a particular combination among the approaches identified in the SLR. This result indicates the need for different reference frameworks to guide the decision for modular combination in defining the framework for CPS cybersecurity for a specific group of organizations or sector. Future research might address case studies in the context of power grid operations in other countries or other case studies in different types of CPS to compare with the specific combination observed in the BES.

Keywords: Technological disaster; Disaster Preparedness; Disaster response; Disaster Operations.

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ANÁLISE DOS FATORES QUE INFLUENCIAM A DECISÃO DE COMPRA DE VEÍCULOS ELÉTRICOS NO BRASIL

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ABSTRACT

O setor de transportes, especialmente com o aumento da propriedade de veículos individuais, contribui significativamente para a poluição atmosférica. A transição para veículos elétricos (VEs) é vista como uma alternativa sustentável para reduzir as emissões de gases poluentes. No entanto, no Brasil, o mercado de VEs ainda não atingiu números expressivos. Diante desse cenário, este estudo tem como objetivo analisar os fatores que exercem influência na decisão de compra de VEs no Brasil, destacando variáveis pessoais, psicológicas, econômicas, de desempenho, ambientais e as barreiras percebidas pelos consumidores. O estudo caracteriza-se como quantitativo e compreendeu-se por meio da realização de uma pesquisa survey, com a participação de 514 respondentes. A mensuração foi realizada por procedimentos estatísticos e a utilização de Equações Estruturais. Os principais resultados obtidos, revelaram uma tendência entre os participantes, indicando que, no contexto brasileiro, a tomada de decisão para a compra de VEs é primariamente influenciada pelos fatores de desempenho. Essa constatação destaca a importância atribuída pelos consumidores à autonomia, locais de recarga e manutenção.

Keywords: Veículos elétricos; Decisão de compra; Brasil.

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ABORDAGEM MULTICRITÉRIO CONSTRUTIVISTA PARA APOIO À GESTÃO DA INOVAÇÃO NO SETOR PORTUÁRIO

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ABSTRACT

O modal marítimo é o principal meio de transporte utilizado para movimentar mercadorias em escala global, fazendo dos portos centros de concentração logísticos fundamentais para operacionalização da cadeia de suprimentos. Sua importância demanda grande eficiência das atividades executadas dentro dos terminais, sendo pressionados por armadores, outros portos, transportadoras, órgãos regulatórios e demais atores envolvidos nesse mercado. Com isso, um dos caminhos adotados pelo segmento para atender às necessidades de melhoria é o desenvolvimento e a adoção de soluções inovadoras. Nesta pesquisa, será desenvolvido um estudo de caso na Portonave S/A, terminal portuário de uso privado, localizado na cidade de Navegantes, no estado de Santa Catarina, sendo um dos expoentes nacionais na movimentação de contêineres. O objetivo deste estudo é construir um modelo de avaliação de desempenho para apoiar a gestão do processo de inovação do Terminal de Navegantes. Para construção do modelo, foi utilizada a metodologia Multicritério de Apoio à Decisão-Construtivista (MCDA-C). A aplicação da metodologia MCDA-C viabilizou a construção de um modelo singular para apoiar o processo de gestão da inovação desenvolvido na Portonave. Dessa forma, o estudo apresenta uma contribuição prática, concretizada em todo o conhecimento gerado durante o processo de construção do modelo e ao entregar para o terminal uma ferramenta capaz de diagnosticar a situação atual do desempenho de sua gestão da inovação, assim como evidenciar pontos críticos e auxiliar no planejamento de melhorias. A análise do modelo mostrou que o processo de gestão da inovação, desenvolvido na Portonave, ainda possui oportunidades de melhoria e apresenta falhas básicas que devem ser priorizadas, especificamente envolvendo a criação de métricas para coletar dados e controlar todos os projetos inovadores em progresso. Além disso, os resultados da pesquisa representam uma contribuição para a literatura do tema, que ainda precisa ser mais bem desenvolvida, bem como afeta diretamente os gestores do Terminal Portuário de Navegantes e todo o sistema regional portuário e de inovação.

Keywords: Avaliação de desempenho; Gestão da inovação; Apoio à gestão; Portos; Abordagem multicritério construtivista.

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PEDAGOGICAL STRATEGIES FOR INCORPORATING SUSTAINABILITY INTO ENGINEERING EDUCATION: A FOCUS ON TEACHING PRACTICES AND THE SDGs

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ABSTRACT

Purpose: Higher Education Institutions (HEIs) play a significant role in achieving the Sustainable Development Goals (SDGs). Many HEIs promote the development of pedagogical strategies and the implementation of teaching practices to incorporate the SDGs into engineering education. This study aims to identify teaching practices applied in the engineering curriculum and propose a prioritisation model for Industrial Engineering (IE) courses based on the degree of importance and the causal relationships.

Design/methodology/approach: Based on a Systematic Literature Review, the primary teaching practices adopted to insert sustainability and the SDGs into engineering education were identified. Data collection in the empirical phase involved the application of a questionnaire and conducting interviews with course coordinators. Data analysis employed Fuzzy DEMATEL and content analysis of interviews to gain insights from experts regarding the level of incorporation of practices and causal relationships among them.

Findings: The results indicate that the most prominent and causal practices are those with a transversal nature and are more closely linked to methodological aspects. "Encouraging the development of sustainability competencies", "Transdisciplinary sustainable actions" and "Promotion of practical initiatives" are the most prominent practices in the model. A strategic map was drawn to guide engineering schools in the incorporation of the SDGs into their pedagogical initiatives.

Originality: This study proposed a model for prioritising teaching practices, providing a guiding framework for including sustainability in teaching and aligning engineering courses with the SDGs. The adoption of these teaching practices in the programmes and their systematic application is essential to train future professionals in knowledge about the SDGs.

Practical implications: The findings provide pathways for the insertion of sustainability into the curriculum, aiming to align engineering courses with the sustainability demands. The findings assist educators, researchers, and students who aspire to incorporate sustainability principles into their educational practice. Additionally, they can support managers in formulating public policies to achieve the SDGs.

Keywords: Sustainability; Practices; Curriculum; Industrial Engineering; MCDM; Fuzzy DEMATEL.

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BEARING FAULT DETECTION IN THE OIL AND GAS INDUSTRY VIA PHYSICS-INFORMED DEEP LEARNING

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ABSTRACT

Reliability of equipment and systems plays a key role in the competitiveness of industries, contributing significantly to their success. Condition-Based Maintenance (CBM) policies and Prognostics and Health Management (PHM) programs have emerged as crucial tools for managing equipment based on their health status, resulting in an increasing demand for reliability engineering approaches. Recent advancements in data storage, sensor technology, and computational power have fueled interest in data-driven methods, including Machine Learning (ML) and Deep Learning (DL), for reliability assessment in complex systems like those in the Oil and Gas (O&G) industry. During the study, it was identified that most ML and DL models are statistical models that rely solely on data to extract patterns and perform predictions. While those have proven promising in some fields, their data dependency may potentially lead to false alarms and reduced prediction confidence if the available data fail to adequately characterize specific equipment. One of the reasons for these limitations is the lack of physics adequacy in the models. In response, Physics-Informed approaches, such as Physics-Informed DL, have emerged as a solution to address these challenges. In this context, Physics-Informed often includes physical information regarding the system in the model's loss function, which is used to guide its training procedure. This study proposes a Physics-Informed Deep Learning approach for fault detection in bearings within the O&G industry, which integrates a threshold model classification based on three states – healthy, light damage, and heavy damage – into the network's loss function. The methodology was evaluated in a publicly available bearing dataset. Our results show that, although the performance of our Physics-Informed DL model was similar to the same model without using the physical information, the addition of physical information improved the detection performance of both healthy and heavy damage classes. It is also noted that the errors produced by the model were less likely to be extreme, such as healthy data being classified as heavy damage and vice versa.

Keywords: Deep learning; Physics-informed deep learning; Reliability; Fault detection; Oil and gas industry.

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INTEGRAÇÃO DE MÉTODOS DE APRENDIZAGEM DE MÁQUINA EM MODELO DE VOTAÇÃO PARA DETECÇÃO DE VAZAMENTOS DE ÓLEO EM IMAGENS DE SENSORIAMENTO REMOTO

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ABSTRACT

A indústria de óleo e gás tem investido em tecnologias de inteligência artificial que sejam capazes de detectar automaticamente vazamentos de óleo no mar. No entanto, a identificação desses vazamentos é dificultada por outros fenômenos oceanográficos, conhecidos como look-alikes. Para contornar este problema, propomos a integração de quatro modelos de aprendizagem de máquina por meio de um sistema de votação. Estão inclusos dois modelos de classificação multi-rótulo, um modelo de multiclassificação e um modelo de reconstrução de imagens. O objetivo é distinguir look-alikes e aumentar a precisão na detecção de óleo, fornecendo suporte para decisões que visem minimizar os danos e custos associados a esse tipo de situação. Os modelos foram treinados e testados com os bancos de dados Oil Spill Detection Dataset e TenGeoP – SARwv, compostos por imagens do satélite Sentinel-1 geradas por meio da técnica Synthetic Aperture Radar - SAR.

Keywords: Vazamento de óleo; Look-alike; Classificação multi-rótulo; Máquinas de vetores de suporte; Redes neurais convolucionais; Autoencoder variacional.

Programa: UFPE - Engenharia de Produção (25001019021P8)

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EXACT METHOD FOR A DYNAMIC PRICING PROBLEM: A CASE STUDY IN ROAD PASSENGER TRANSPORT

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ABSTRACT

Having the ability to plan scenarios and anticipate price behavior in each of them is a significant competitive advantage for organizations, and dynamic pricing is used for this purpose. Succinctly put, dynamic pricing aims to determine the prices of products or services based on market information analysis. When a passenger road transport company seeks to price its tickets, various variables are involved, making the use of dynamic pricing necessary. In this study, a mathematical model was proposed to portray a real problem of a road transport company in Brazil. The model was solved accurately in real instances and the results were compared with those of the company without mathematical optimization. Computational experiments showed that for 100 trips there was a 13% increase in the company's revenue with the optimization model.

Keywords: Dynamic Pricing Model; Optimization; Nonlinear Optimization; Passenger Road Transport.

Programa: UFPR - Engenharia de Produção (40001016070P1)

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MODELO DE GESTÃO BASEADO EM FERRAMENTAS LEAN PARA CONTROLE E MELHORIA CONTÍNUA DO CHÃO DE FÁBRICA EM EMPRESAS DE PEQUENO E MÉDIO PORTE: PERSONALIZAÇÃO ATRAVÉS DE UM QUESTIONÁRIO DIAGNÓSTICO

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ABSTRACT

Este estudo propõe um modelo personalizado destinado à gestão, controle e melhoria contínua em Pequenas e Médias Empresas (PMEs) por meio de práticas Lean. Embora haja diversos modelos de gestão Lean disponíveis na literatura, identificar as ferramentas apropriadas e determinar a etapa ideal para sua implementação apresenta-se como um benefício importante para empresas desse porte, considerando suas limitações em recursos financeiros e humanos. Em 2022, as PMEs representaram 30% do PIB brasileiro, destacando sua significativa contribuição econômica e a urgência de uma abordagem específica para superar os desafios na adoção de práticas Lean. O objetivo principal é desenvolver e aplicar um questionário diagnóstico para identificar as etapas a serem implementadas do modelo proposto, avaliando sua eficácia na priorização dessas etapas. A metodologia envolve o desenvolvimento e aplicação do questionário em empresas selecionadas para avaliar a maturidade Lean e identificar as etapas a serem implementadas. O questionário forneceu uma identificação precisa das áreas prioritárias, otimizando o uso de recursos. Os resultados obtidos através da aplicação do questionário proporcionam insights valiosos sobre a maturidade Lean das empresas selecionadas, permitindo uma abordagem personalizada para a implementação futura do modelo proposto. O aprimoramento contínuo do modelo e sua aplicação em um espectro mais amplo de PMEs são cruciais para promover práticas Lean eficazes e impulsionar o crescimento econômico dessas empresas.

Keywords: Lean Manufacturing; Ferramentas Lean; Melhoria contínua; Chão de fábrica.

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DECISION-DEPENDENT UNCERTAINTY-AWARE DISTRIBUTION SYSTEM PLANNING UNDER WILDFIRE RISK

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ABSTRACT

The interaction between power systems and wildfires can be dangerous and costly. Damaged structures, load shedding, and high operational costs are potential consequences when the grid is unprepared. In fact, the operation of distribution grids can be liable for the outbreak of wildfires when extreme weather conditions arise. Within this context, investment planning should consider the impact of operational actions on the uncertainty related to wildfires that can directly affect line failure likelihood. Neglecting this can compromise the cost-benefit evaluation in planning system investments for wildfire risk. In this paper, we propose a decisiondependent uncertainty (DDU) aware methodology that provides the optimal portfolio of investments for distribution systems while considering that high power-flow levels through line segments in high-threat areas can ignite wildfires and, therefore, increase the probability of line failures. The methodology identifies the best combination of system upgrades (installation of new lines, hardening existing lines, and placement of switching devices) to provide the necessary leeway to operate the distribution system under wildfire-prone conditions. Our case study demonstrates that by modeling the DDU relationship between power flow prescriptions and line failures, investment decisions are more accurate and better prepare the grid infrastructure to deal with wildfire risk.

Keywords: Index Terms—Power Systems Investment Planning; Wildfire Resilience; Optimization Under Uncertainty; Decision-Dependent Uncertainty; Topology Reconfiguration.

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PV AND WIND POWER SPATIO-TEMPORAL SCENARIOS SIMULATION

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ABSTRACT

The increased participation of variable renewable energy sources (VREs) in electrical matrices worldwide brings several challenges to the planning and operation of power systems, mainly due to the intermittency of VREs. In this context, the complementary effects between different intermittent resources have garnered growing attention in the literature since such properties offer a collective capability to capture the stochastic nature of intermittent power generation when simulating scenarios. This work proposes a stochastic simulation model of renewable energy generation that explores several complementary effects between wind and photovoltaic resources in different Brazilian locations. The approach considers calculating energy generation states to simultaneously represent the generation of multiple renewable sources and using probability transition matrices based on historical data. The synthetic time series are subsequently assessed using statistical methods that indicate good adherence of the generated scenarios to most stylized facts of the historical series.

Keywords: Renewable Energies; Modeling; Stochastic Simulation; Joint Scenarios; Temporal Complementarity; Space-Time Complementarity.

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AVALIAÇÃO SISTÊMICA E PARTICIPATIVA DA INTERAÇÃO WATER-ENERGY-FOOD NEXUS: PROPOSTA E APLICAÇÃO DA FERRAMENTA MESMIS-NEXUS NA AGRICULTURA FAMILIAR

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ABSTRACT

O WEF (Water, Energy, Food) Nexus vem sendo usado como perspectiva para desenvolver soluções para o desenvolvimento sustentável. Esse conceito traz em evidência as interdependências entre segurança hídrica, segurança energética e segurança alimentar. Propriedades de agricultura familiar podem se beneficiar dessa perspectiva para tomada de decisões. Mas isso ainda está sendo pouco explorado. Este estudo tem como objetivo propor e aplicar uma ferramenta de abordagem sistêmica e participativa para avaliar as interações WEF Nexus em propriedades agrícolas segundo a percepção dos agricultores familiares. Para tanto, adotou-se estudos de caso em sete propriedades rurais familiares brasileiros após um estudo de caso piloto da ferramenta. A coleta de dados contou com um roteiro de entrevista baseada na ferramenta proposta denominada MESMIS-NEXUS. A ferramenta amplia os três eixos básicos do WEF Nexus e inclui outros elementos provenientes da literatura (terra/solo, subsistência, trabalho e capital) que até então não haviam sido estudados em conjunto com a abordagem WEF Nexus. Os resultados mostraram que os agricultores perceberam os setores de capital, energia e subsistência como os mais problemáticos nas propriedades estudadas. O estudo identificou 15 desafios atrelados à perspectiva sistêmica dos elementos do WEF Nexus sob articulação de indicadores e processos. Esta pesquisa contribui para uma reflexão sobre o cenário das interações WEF Nexus e quatro novos elementos, considerando aplicação prática em contexto local. Assim, a principal contribuição inédita dessa pesquisa foi a ferramenta MESMIS-NEXUS, a qual evidencia que uma avaliação sistêmica e participativa das interações WEF Nexus e setores terra/solo, subsistência, trabalho e capital permite diagnosticar desafios de propriedades de agricultura familiar. Estudos futuros têm oportunidades para investigar mais a fundo como essas interações afetam o desenvolvimento sustentável e o sucesso dessas propriedades.

Keywords: Water-Energy-Food Nexus; Avaliação WEF Nexus; Estudo de caso; Agricultura familiar; Subsistência; Capital.

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REQUISITOS PARA A PROPOSIÇÃO DE UM MODELO DE SISTEMA DE GESTÃO, CONTROLE E AVALIAÇÃO DO RELACIONAMENTO COM O EGRESSO: DIAGNÓSTICO E ANÁLISE EM INSTITUIÇÕES DE ENSINO SUPERIOR COMUNITÁRIAS

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ABSTRACT

Este trabalho propôs um sistema de gestão, controle e avaliação do relacionamento com o egresso a partir do diagnóstico e análise em Instituições de Ensino Superior (IES) comunitárias, visando a construção de mecanismos efetivos no acompanhamento e na manutenção do vínculo contínuo do egresso como patrimônio intelectual e financeiro valioso da instituição e desenvolver estratégias para a fidelização do egresso. A metodologia adotada para a elaboração de um sistema de gestão do controle e avaliação do relacionamento do egresso em instituições comunitárias foi exploratória, por meio de diagnóstico da situação atual em IES comunitárias e da análise da literatura, mediante a avaliação de requisitos constatados com o estudo de caso da aplicação de programas e benefícios institucionais para a exploração e a captação de informações estratégicas de acompanhamento. Com base na análise das funcionalidades constatadas em portais de egressos das IES comunitárias do RS e nas proposições desenvolvidas para manter o vínculo do egresso pelo uso de benefícios, descontos e serviços, constatou-se a importância dos requisitos. Os resultados apontam a indispensabilidade de um sistema de gerenciamento dos dados integrados à rede de relacionamento a partir da análise das informações do egresso com a utilização de dispositivo móvel. Para tanto, é fundamental a gestão de um sistema de relacionamento que fortaleça o vínculo institucional do egresso desde o seu ingresso na instituição para a avaliação da adequação da oferta e qualidade dos cursos de graduação nas IES. Conclui-se que a análise do perfil do egresso para o planejamento de diretrizes de manutenção em cursos de formação continuada e a qualificação da formação, a partir das informações com a inserção profissional, é fundamental para o desenvolvimento institucional. Os principais resultados encontrados foram: necessidade do levantamento para análise e avaliação do perfil do egresso, avaliação institucional pelo egresso, gestão de controle e construção de mecanismos efetivos para acompanhamento e manutenção do vínculo, egresso como patrimônio intelectual valioso da instituição, desenvolvimento de diretrizes e estratégias para a fidelização do egresso, implementação e manutenção do portal do egresso como fonte de informação e comunicação, necessidade de desenvolver um aplicativo móvel para comunicação e notificação, criação de uma rede de relacionamento institucional. Também foi verificada a importância de requisitos para a construção de um sistema contemplando o registro do perfil pessoal e socioeconômico do egresso, cadastro atualizado, portal do egresso, acompanhamento do egresso com auxílio de ferramenta móvel, base de dados confiáveis e atualização do currículo acessível a empresas, desenvolvimento de uma ferramenta organizacional para o controle e avaliação da gestão de egressos.

Keywords: Diagnóstico institucional; Egressos; Sistema de gestão; Avaliação; Dispositivo móvel; Fidelização do egresso.

Programa: UNISC - Sistemas e Processos Industriais (42020018004P1)

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METODOLOGIA DE ANÁLISE DE REDE DE FILAS MULTI-CLASSES PARA MELHORAR O DESEMPENHO DE SERVIÇOS DE URGÊNCIA

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ABSTRACT

Este trabalho deriva um modelo de rede de filas aberta de um projeto de serviço de urgência destinado a aumentar a capacidade do pronto-socorro para tratar seus pacientes. O modelo captura diferenças específicas do hospital no perfil de risco clínico dos seus pacientes, padrões e volumes de chegada e eficiência dos processos em um único modelo computacional. Uma implementação das equações de filas resultantes é utilizada, para dimensionar as áreas do pronto-socorro usando o tempo de espera, fator de utilização e a probabilidade de overflow como metas de qualidade de serviço. Padrões de chegada não homogêneos, distribuições não exponenciais de tempo de atendimento e cinco perfis de pacientes são todos incorporados. O modelo foi aplicado em um pronto-socorro de um hospital privado.

Keywords: Otimização; Redes de filas abertas; Curvas de trade-off.

Programa: UFMG - Engenharia de Produção (32001010050P8)

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ANÁLISE DE SEMENTES EMPREGANDO PROCESSAMENTO DE IMAGENS E APRENDIZADO DE MÁQUINA

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ABSTRACT

Este estudo propõe a utilização da aprendizagem de máquina associada ao processamento de imagens para analisar amostras coletadas na área de condicionamento de sementes, após a máquina color sorter, com o objetivo de acelerar e melhorar o procedimento de regulagem periódica a máquina reduzindo o descarte de sementes boas junto ao rejeito. Desta forma, foi desenvolvido um conceito de solução de inspeção de amostras de sementes padronizada, facilitando o trabalho que hoje é feito de maneira manual e visual por inspetores treinados. Nesta abordagem as amostras foram dispostas em uma bandeja com 64 cavidades, manufaturada numa impressora 3D, e as imagens RGB capturadas por um smartphone em uma caixa amostradora iluminada por leds. Na sequência, o aplicativo realiza a segmentação das sementes, removendo a imagem de fundo, ou seja, da bandeja. A partir desta imagem segmentada, as sementes foram separadas em imagens individuais e carregadas no modelo de aprendizado de máquina pelo mesmo aplicativo, que faz sua predição de classe como boa ou com defeito e os resultados são apresentados. O dataset empregado para aprendizagem foi composto com 3.700 sementes, sendo 1851 classificadas como boas e 1849 com defeito. O dataset de validação deste treinamento ficou com 1010 sementes, sendo 473 classificadas como boas e 537 com defeito. A escolha do modelo de aprendizado de máquina adequado para o desenvolvimento desta solução levou em consideração alguns fatores como: a quantidade e natureza dos dados, o tipo de problema, a complexidade do modelo, o tempo de treinamento e os recursos computacionais disponíveis. Foram considerados os modelos VGG16, VGG19, ResNet50 e MobileNet. Os melhores resultados foram obtidos com o treinamento de 100 épocas de uma rede pré-treinada ResNet50, alcançando uma acurácia de 97%, sensibilidade de 99%, especificidade de 94%, precisão de 95% e F1-score de 97% e AUC de 97%, a partir de uma amostra teste composta de 548 sementes. Os resultados foram equivalentes aos alcançados pelos estudos mais recentes para este tipo de aplicação, com um diferencial que o processo toma em torno de 3 minutos entre a disposição da amostra e a apresentação dos resultados, sendo executado a partir de qualquer smartphone com sistema operacional Android ou IOS, enquanto o método tradicional requer em torno de 20 minutos e a acurácia é totalmente dependente da experiência do operador. Somado a isto, permite que amostragens e análises sejam realizadas em qualquer área do processo, inclusive nas lavouras, devido a portabilidade, custo da solução e não requerer operadores treinados. Por fim, este trabalho apresentou uma padronização dos critérios de análise, tornando-o uma opção com viabilidade para escala industrial.

Keywords: Processamento de imagens; Aprendizado de máquina; Visão de máquina; Milho; Sementes.

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REFINING THE PROMETHEE-SCORING METHOD: PROPOSITIONS AND AN ECONOMIC FREEDOM ASSESSMENT

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ABSTRACT

The recent PROMETHEE-Scoring approach offers a method for generating cardinal scores through an outranking procedure utilizing Stochastic Multicriteria Acceptability and σ - μ Analysis. In this paper, we illustrate some undesirable effects of this method and explore possible approaches to address them. First, we modify the original LP by inserting a new constraint that limits negative impacts caused by alternatives with low flow mean and standard deviation. Also, clustering is used to identify outliers in the decision matrix that may induce undesirable effects. A toy example demonstrates the issues and explores the proposed implementations. In addition, a numerical application is presented where a set of countries is ordered based on criteria from an economic freedom assessment. Both the numerical application and the toy example show that the propositions can improve the consistency of the results and prevent inconsistent outputs. The results include comparisons between the rank of alternatives when using purely the PROMETHEE-Scoring method, the proposed improvements, and the expected results from SMAA-PROMETHEE.

Keywords: Multiple criteria; PROMETHEE; Ranking; Composite indicators.

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UNDERSTANDING THE IMPACT OF PERFORMANCE VARIABILITY ON ACCESS TO HEALTHCARE: AN ANALYSIS OF REGIONAL REFERRAL CENTERS' RESILIENCE

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ABSTRACT

Objective. This study aims to identify and analyze performance variability in the public referral prioritization process for ambulatory care at the regional level in Rio de Janeiro state - Brazil. **Method.** Observation sessions and semi-structured interviews were conducted in three Regional Referral Centers (CREG) in Rio de Janeiro state - Brazil. After transcription of field notes and preliminary coding, the referral prioritization process was modeled and analyzed using the Functional Resonance Analysis Method (FRAM). **Findings.** 41 functions were described, of which eight were crucial for carrying out patient referrals. Completing the referral prioritization process depended on effectively managing variability in these eight critical functions. Among these eight functions, 13 potential instances of variability were identified, some outputs present in all three CREGs and others found in one or two CREGs. **Conclusion.** The results evidence the health system's vulnerability regarding the referral prioritization process. They show that emergent variability compels workers to devise compensation mechanisms, sometimes within coordinated actions, to successfully mitigate issues that may otherwise compromise access to care. **Key-words** Ergonomics; Resilience Engineering; public health; variability management; Functional Resonance Analysis Method.

Keywords: Ergonomics; Resilience Engineering; Public health; Variability management; Functional Resonance Analysis Method.

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DESAFIOS E PERSPECTIVAS NA MANUFATURA HÍBRIDA DE METAIS: UMA ANÁLISE SOBRE FABRICANTES DE MÁQUINAS, DESENVOLVEDORES DE SOFTWARE E PROFISSIONAIS

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ABSTRACT

A manufatura híbrida de metais (MHM) combina os processos de manufatura aditiva e subtrativa em um único sistema. Isso possibilita a criação de peças de metal com formatos complexos, alta precisão dimensional e propriedades mecânicas únicas. Esse método é uma inovação importante na indústria, tendo sucesso em diversas áreas ao proporcionar acabamentos impecáveis e precisão dimensional excepcional. Essa abordagem estimula a liberdade no design e na fabricação de peças com geometrias sofisticadas, sendo adaptada de maneira personalizada para atender às necessidades de cada setor. Essa estratégia resulta na redução de custos, tempo de produção e desperdício de material, o que colabora para aprimorar a eficiência e a precisão na produção. No entanto, o avanço dessa tecnologia envolve alguns desafios a serem superados, como a necessidade de os fabricantes desenvolverem equipamentos com tecnologia inovadora acessível ao mercado, o desenvolvimento de softwares específicos para essa aplicação e a capacitação de profissionais com as habilidades necessárias para sua implementação. Nesse sentido, este artigo tem como objetivo analisar o avanço dessa tecnologia, verificar direções atuais e fornecer insights sobre o futuro do MHM. Este estudo inferiu, por meio de uma revisão bibliográfica, a evolução dos equipamentos globalmente, a carência de softwares específicos e de instituições com ofertas para a formação de profissionais, observando que estes ainda são desafios críticos que merecem atenção para que a tecnologia seja implementada nas indústrias. Os resultados revelaram notáveis avanços no desenvolvimento de equipamentos, tornando a tecnologia mais eficaz e acessível. No entanto, existem poucas opções de softwares específicos para aplicação do MHM, além da falta de profissionais bem capacitados para operar o equipamento com conhecimento na aplicação dos materiais disponíveis. Este estudo apresenta insights importantes para alavancar a adoção dessa tecnologia, destacando as necessidades que fabricantes de equipamentos, desenvolvedores de software e instituições de ensino enfrentam para torná-la aplicável em um futuro próximo.

Keywords: Manufatura Híbrida de Metais; Desafios Tecnológicos; Formação Profissional.

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AVALIAÇÃO DO USO DE SERIOUS GAMES EM TREINAMENTO CORPORATIVO: UM CASE DE MONTADORA AUTOMOTIVA

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ABSTRACT

A metodologia ativa de ensino vem sendo explorada com certa frequência no mundo acadêmico, porém existe pouca literatura científica sobre seu uso no mundo corporativo. A educação e o treinamento incrementam o conhecimento como ativo competitivo no mundo corporativo. O objetivo desta pesquisa é avaliar o uso de serious games para melhorar o processo de educação e treinamento de profissionais da operação de uma montadora de veículos sobre conceitos de manufatura enxuta. A questão que norteou esta pesquisa é a seguinte: o uso de serious games melhora o processo de educação e treinamento em conceitos de manufatura enxuta numa montadora de veículos? A pesquisa é um estudo de caso em uma empresa montadora automotiva. Foram desenvolvidos cinco questionários para medir o nível de conhecimento antes e após os jogos, aplicação do instrumento IMMS, usado para medir nível de atenção, relevância, confiança e satisfação dos alunos após a aplicação dos jogos e o levantamento dos estilos de aprendizagem de cada participante. Foram realizadas 28 dinâmicas, sendo 14 do serious game analógico e 14 do serious game digital, totalizando 173 participantes dos 3 turnos de trabalho e variados perfis e áreas da empresa. Usando como critério a favorabilidade, os resultados obtidos com o uso de jogos em ambientes corporativos são compatíveis com o encontrado na literatura, motivam, geram engajamento e colocam o aluno como elemento ativo no processo ensino-aprendizagem. Não foi notada diferença significativa entre as atividades com jogo digital e jogo analógico. A satisfação dos participantes apresentou um Grau de Favorabilidade de 97% para ambas as dinâmicas, e numa primeira avaliação apenas 16,7% dos participantes tiraram nota acima de 7 enquanto 75,7% tiraram nota maior que 7 após a aplicação de serious games. Há a necessidade de investigações adicionais sobre o emprego de jogos sérios em diversos contextos corporativos, uma vez que no contexto de nossa pesquisa, todos os participantes estavam inseridos na indústria, contando com vários anos de experiência industrial. Sustentamos que a aplicação de jogos analógicos deve ser ainda muito explorada pois proporcionam objetos tangíveis e interação física e pessoal, motivação e experiência além de outros aspectos que podem ser mais propícios à aprendizagem humana.

Keywords: Aprendizagem ativa; Aprendizado baseado em jogos; Jogo de simulação; Jogos sérios; Serious Games.

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LEAN 4.0 IN OPERATIONAL PERFORMANCE ON HYDRAULIC SYSTEMS OF A STEEL PLANT FOR DECISION-MAKING SUPPORT

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ABSTRACT

Organizations tend towards identifying strategies to keep their businesses increasingly competitive, where the assets' operational reliability and maintenance planning control are strategically relevant keys to these corporations. The increasing deployment of high-precision operating functionalities in the steel industry makes hydraulic systems one of the most critical items that require greater attention. An assertive decision-making process by maintenance managers can play a valuable contribution to overcoming the main difficulties faced in handling these issues, allowing improvements in the quality and competitiveness of the company. The interaction of the Lean system and Industry 4.0, known as Lean 4.0, establishes significant synergies, focusing on continuous improvement in the organizations, thus making the quality of their products considerably better and at a lower price. In this context, this study aims to propose tools based on Lean 4.0 concepts for helping maintenance managers in their decision-making, aiming to enhance the operational performance of the hydraulic systems in a production line of a steel plant. We used the Action Research method, which made it possible to identify the principal problems associated with hydraulic systems and to carry out appropriate measures to reduce corrective maintenance. A survey of occurrences and maintenance services provided by an outsourced contract for seven years has been carried out, where the implementation of the Lean 4.0 concept has obtained a reduction of 58.95% in corrective maintenance, providing a R\$ 1,924,564.00 saving for the organization's production area. Through cash flow analysis and the Monte Carlo method, it became possible to perform a sensitivity analysis for insourcing hydraulic maintenance services, where a 99.9% probability of returning with a positive Net Present Value occurred. The concepts associated with Lean 4.0 selected from the current literature have significantly contributed to the development of data digitalization, making it possible to monitor parameters related to the operational performance of hydraulic systems in real-time, man-machine interaction, which improves the assets' availability, decrease in waste overall, and a considerably enhanced of the planning maintenance activities.

Keywords: Industry 4.0; Lean Systems; Maintenance of Hydraulic systems; Lean 4.0.

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A FRAMEWORK TO DEVELOP RESILIENCE BASED ON ARTIFICIAL INTELLIGENCE IN THE BRAZILIAN DEFENSE INDUSTRY'S SUPPLY CHAIN

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ABSTRACT

Industry 4.0 (I4.0) represents a profound technological advancement, fundamentally enhancing operational efficiency and resilience within Supply Chain Management (SCM), while also redefining competition across diverse economic sectors. At the heart of this transformative journey lies Artificial Intelligence (AI), offering strategic advantages for organizations eager to embrace innovation, notably within the defense sector. However, understanding AI's impact on operational performance and Triple-R capabilities (resilience, robustness, and responsiveness) is crucial amidst Black Swan events, such as that seen in pandemics and geopolitical conflicts, which underscore the urgency for adaptable supply chains. However, the dynamics of AI adoption within the defense industry remain underexplored, particularly concerning its implications for operational performance and the mastery of Triple-R capabilities. To address these gaps, our study provides a comprehensive framework that elucidates the interplay between AI adoption, operational performance, and Triple-R capabilities within the Brazilian defense industry context. Methodologically, we employ a mixed-method approach based on a systematic literature review, interviews and survey research with 215 respondents from the defense supply chain. Results suggest that AI utilization affects both operational performance and sociotechnical factors, with operational performance significantly influencing the capabilities mastering of the Triple-R. Furthermore, the study delves into AI adoption dynamics using paradox theory, providing practical recommendations for supply chain professionals in volatile environments and addressing a framework embedding elements and relationships that support military and defense supply chain managers towards efficient AI adoption. Through the lens of paradox theory, we seek to offer actionable insights and practical recommendations for supply chain professionals tasked with enhancing resilience and efficiency in uncertainty. In essence, our research endeavors to contribute to the burgeoning discourse on AI adoption within the defense sector, offering a nuanced understanding of its implications for operational excellence and resilience. By elucidating the complex interplay between technology, operational performance, and resilience, we aim to equip military and defense supply chain managers with the insights needed to navigate the challenges of an increasingly unpredictable world.

Keywords: Artificial Intelligence; Framework; Defense industry; Supply Chain Management; Triple-R.

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LEAN-CIRCULAR MATURITY MODEL (LCMM) FOR COMPANIES' SELF-ASSESSMENT IN TERMS OF PROCESS, PRODUCT AND LIFE CYCLE THINKING

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ABSTRACT

Rapidly diagnosing the status of resource efficiency and waste generation throughout the entire value chain is considered one of the key future advancements towards achieving more sustainable production. This study aimed to develop and implement a self-assessment tool to assist companies in decision-making processes for establishing circular flows based on the principles of Lean Manufacturing (LM) and Circular Economy (CE). The selfassessment tool employed a maturity model comprising several stages, which were designed through a combination of design science research and scenario planning. The Lean-Circular Maturity Model (LCMM) consisted of maturity levels ranging from 0 to 4, assessing strategies such as Resource Efficiency, Energy Management, Water and Wastewater Management, Materials and Solid Waste Management, and Chemicals and Emissions Management. The model was applied to nine companies varying in sector, size, region, and nationality. Their engagement in LM, and CE, differed, as did their strategy maturity metrics. Primary sector companies showed higher maturity in water-waste and chemical-emissions management. Larger enterprises focused on these strategies, with nuances based on region. The main findings indicated that 66% of the companies sought cleaner alternatives prior to mapping their production processes, which could lead to errors in planning and prioritizing improvement actions. Furthermore, 61% of the companies lacked sufficient training and employee awareness regarding the efficient utilization of resources. The absence of comprehensive actions to manage the life cycle of products throughout the value chain emerged as the primary barrier identified. To address these gaps, the LCMM offers a set of tailored recommendations for each company to enhance processes, products, and the value chain based on the final score obtained from utilizing the LCMM self-assessment tool.

Keywords: Lean management; Cradle-to-cradle; Sustainability; Maturity level; Circularity.

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UM SISTEMA DE IRRIGAÇÃO AUTOMATIZADO DE BAIXO CUSTO BASEADO NA TECNOLOGIA DE INTERNET DAS COISAS (IoT)

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ABSTRACT

Esta pesquisa foca na concepção e teste de um equipamento para automação de um sistema de irrigação de baixo custo, baseado na tecnologia de Internet das Coisas (IoT), para lavoura de frutas em uma agricultura familiar. O estudo foi conduzido em uma propriedade localizada em Vargem, interior do Estado de São Paulo, no cultivo de pêssegos, acerolas e goiabas. O objetivo geral da pesquisa é de otimizar e automatizar a gestão hídrica do cultivo de frutas. A abordagem metodológica adotada foi o Design Science Research, um método adequado ao desenvolvimento de artefatos capazes de solucionar problemas específicos. O sistema construído integra sensores de umidade do solo e sensores meteorológicos, que aliados a dispositivos controladores e atuadores, estabelecem uma rede interconectada por meio da tecnologia de Internet das Coisas (IoT) para automatizar o acionamento de uma bomba d'água dentro de uma faixa previamente definida de umidade do solo. Uma Prova de Conceito (PoC) foi realizada oportunamente no decorrer da pesquisa e despertou a oportunidade do desenvolvimento de um sistema que coleta dados em tempo real, que aliado à automação do processo de irrigação, permitiria ao agricultor um melhor aprendizado sobre o manejo hídrico das culturas. Os resultados dessa pesquisa revelaram benefícios significativos na adoção do sistema de irrigação automatizado. Além de ser de fácil interação com o agricultor, o dispositivo monitora e controla o suprimento hídrico do solo dentro de uma faixa parametrizada estabelecida, permite o monitoramento e registro em tempo real da umidade do solo, temperatura e umidade relativa do ar. Além disso, oferece o controle remoto do acionamento da bomba d'água, e desta forma pode contribuir para redução do desperdício de água, e promover maior sustentabilidade.

Keywords: Internet das Coisas; Sustentabilidade; Agricultura Inteligente; Sistema de Irrigação Automatizado; Prova de Conceito.

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SISTEMA DE APOIO A DECISÃO DO MÉTODO FITRADEOFF: COMBINANDO ELICITAÇÃO POR DECOMPOSIÇÃO E AVALIAÇÃO HOLÍSTICA EM UMA ABORDAGEM FLEXÍVEL

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ABSTRACT

Os métodos de apoio à decisão multicritério (MCDM/A) podem ser aplicados para solucionar esses problemas; no entanto, a resolução de problemas de decisão multicritério geralmente envolve uma série de etapas que apresentam certo grau de complexidade. Dentre os métodos (MCDM/A) têm-se o método FITradeoff que utiliza de informações parciais sobre as preferências do decisor, exigindo menos esforço cognitivo e menos tempo no processo de elicitação. Este método é operado por um Sistema de Apoio a Decisão (SAD). O novo SAD do método FITradeoff visa dar suporte ao processo de tomada de decisão, permitindo a elicitação flexível e interativa das preferências do decisor, bem como a solução de problemas nas quatro problemáticas: escolha, ordenação, classificação e portfólio. A flexibilidade do FITradeoff na modelagem de preferências reside na integração e combinação de dois paradigmas: elicitação por decomposição e avaliação holística. Essa combinação melhora o processo de modelagem de preferências, aumentando a eficiência e consistência do método, permitindo que o decisor escolha como deseja fornecer informações, além de reduzir o esforço cognitivo associado, ao requerer informações parciais. O SAD apresenta o design projetado com base em estudos de neurociência e está disponível online em: www.cdsid.org.br/fitradeoff, permitindo acesso ao público em geral. O método FITradeoff vem sendo utilizado para resolver problemas de decisão em diversos setores, tanto público quanto privado, incluindo seleção de fornecedores, seleção de modelos de maturidade, até priorização de operações policiais.

Keywords: FITradeoff; Sistema de apoio a decisão; Elicitação de preferências.

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FLOOD RISK INSURANCE AND FINANCE: A PROPOSITION DEVELOPED ACCORDING TO THE BRAZILIAN CONTEXT

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ABSTRACT

The number of disasters significantly increased over the last decades, especially the ones related to floods. Brazil is among the top ten countries facing this disaster type, which caused significant social impacts and economic losses in recent decades. Consequently, Disaster Risk Finance and Insurance (DRFI) has been pointed by researchers and practitioners as a relevant tool in this scenario. Therefore, this research aims to analyze the opportunities and challenges in developing a specific Flood Risk Finance and Insurance (FRFI) in Brazil. The research adopts the case study method considering Brazilian and international stakeholders' perspectives on DRFI and FRFI practices in Brazil. Results reveal the importance of engaging different stakeholders and the complexities in such relationships. The research also provides a framework that synthesizes these relationships and several associated concepts, which can be considered a guide for developing other analysis and actions by academics and practitioners engaged with FRFI. Future researches might discuss the validation of such framework and the challenges for FRFI in other countries, as well as risk insurance and finance for other disaster types.

Keywords: Disasters; Disaster insurance; Flood insurance; Case study; Brazil.

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IMPACTUS: SISTEMA DE INFORMAÇÃO PARA AVALIAÇÃO E MONITORAMENTO DO IMPACTO DE ATIVOS NOS PROCESSOS E ESTRATÉGIAS DE NEGÓCIO

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ABSTRACT

Os ativos são recursos organizacionais que contribuem para geração de bens e serviços, os quais podem ser classificados em ativos físicos, intangíveis, humanos, financeiros e informacionais. O nível de dependência da empresa com esses ativos e o nível de criticidade deste para as operações vem demandando novas formas de gerenciamento, principalmente a análise desses ativos à luz das estratégias da organização. Diante desse contexto, o sistema de informação IMPACTUS foi desenvolvido para atender atuais e novas demandas que vem surgindo em gestão de ativos (GA). Com funcionalidades organizadas por módulos, o IMPACTUS agrega diversas técnicas de gestão de manutenção, gestão de performance e gestão de risco, utilizando assim uma abordagem multidisciplinar para alcançar uma melhor entrega do valor do ativo ao negócio. Tradicionalmente, a área de manutenção é essencial para GA, assim o IMPACTUS possui o gerenciamento das ocorrências corretivas, como também fornece meios para estruturar e monitorar manutenções programadas. Embora o módulo de manutenção seja focado para trazer soluções para empresas intensivas em ativos físicos, o IMPACTUS fornece registro e acompanhamento de ativos que podem ser aplicados em vários contextos. Entre as suas funcionalidades tem-se o monitoramento da performance de ativo por meio de indicadores. Em uma perspectiva estratégica, o sistema oferece um módulo de processos de negócios, que permite além de registrar os processos e seus indicadores, os negócios e as diretrizes estratégicas da organização, propõe um modelo que utiliza dados quantitativos e qualitativos sobre a relação dos ativos com as estratégias, por meio de processos, para determinar a prioridade dos ativos com base no impacto destes nas estratégias do negócio. Com base nessas funcionalidades, as organizações podem alcançar melhores resultados organizacionais em termos de lucratividade e performance, melhorando aspectos ligados a confiabilidade e risco. Considerando resultados não financeiros, o IMPACTUS permite verificar a criticidade dos ativos no alcance das estratégias do negócio, que inclui fatores ligados à sustentabilidade ambiental. Destaca-se que por sua estrutura modularizada, é possível fazer uso de apenas parte do sistema, assim alguns dos módulos do IMPACTUS tem sido objeto de aplicação em empresas.

Keywords: Gestão estratégica de ativos; Sistema de informação; Criticidade do ativo.

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DECISION SUPPORT SYSTEM FOR SMART MAINTENANCE COMBINING MULTICRITERIA AND MACHINE LEARNING APPROACHES: CASE STUDY AT THE BRAZILIAN MINT

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ABSTRACT

Industry 4.0 (I4.0) and digital transformation are redefining the approach to industrial maintenance, pushing it towards Smart Maintenance (SM). This transition to Maintenance 4.0 enables decisions based on data and advanced analytics, increasing efficiency and reducing operating costs. However, managerial decision-making can be challenging due to the multiple criteria and points of view, such as trade-offs between functional teams. In this context, the need for a decision support system becomes important, combining multi-criteria decision making (MCDM) techniques and Machine Learning (ML) due to the complexity of the data and the variety of criteria involved in making maintenance decisions. An integrated ML-MCDM system can offer benefits such as increased operational efficiency and support for strategic decision-making, giving companies a competitive advantage in the market. The research proposes a technological product for this purpose and applies it to the Maintenance Department of the Brazilian Mint, with the aim of ranking assets. Methods such as AHP, MOORA, MULTIMORA and Borda Count are used, with qualitative and quantitative data. ML had the objective of inferring the assets that would have the most corrective maintenance and data analysis. The technological product was developed using the Python programming language, ultimately leading to the computer program being registered with the National Institute of Industrial Property (INPI). The research revealed that the combination of MCDM and ML can effectively improve decision-making in asset maintenance, considering the complexity of the data involved. The technological product developed is currently in use at the Brazilian Mint.

Keywords: Machine Learning; Industry 4.0; MCDM; Maintenance 4.0.

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WINDANALYZER: AN INTERACTIVE TOOL FOR WIND ENERGY REANALYSIS IN BRAZIL - JOINT MODELING OF WIND SPEED AND POWER VIA A NONPARAMETRIC APPROACH

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ABSTRACT

The energy generated by wind farms depends on the wind speed, air density, turbine rotor height and blade area, among many other technical and climatic characteristics. To simplify calculations, power curves estimate how the power output varies with the wind speed. However, this approximation is one of the sources of uncertainty in wind energy forecasting models because it assumes that the wind speed is distributed in fixed intervals and that a given wind speed will always generate the same power. Therefore, this paper proposes a new nonparametric method to better model the relationship between wind speed and the corresponding power generated. The steps of this proposal consist of using the K-means clustering technique to estimate the wind speed intervals, the kernel density estimation (KDE) method to define the probability density function (PDF) for each interval, and Monte Carlo simulation to infer the power output based on the PDF. We conducted tests of the proposed method through four approaches (single period, monthly, hourly, monthly-hourly) to ascertain its performance. The data came from the MERRA-2 database and five wind farms in northeast Brazil. The proposed method performed better than the conventional estimation technique.

Keywords: Wind Power; Wind Speed Clustering; Kernel density estimation; Power curve modeling.

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OTIMIZAÇÃO DO DIMENSIONAMENTO DE FROTA ALUGADA PARA DISTRIBUIÇÃO URBANA EM UMA EMPRESA DO SETOR ALIMENTÍCIO

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ABSTRACT

O transporte de carga é processo fundamental das empresas e garante a continuidade da cadeia de suprimentos, porém é também a maior fonte de custos, representando cerca de 60% dos custos logísticos. Dada essa representatividade, ineficiências do modal rodoviário e busca por redução de emissões, a pressão por aumento de eficiência e redução de custos é constante nas empresas brasileiras. Em empresas de alimentos, há também a necessidade do controle de lead-times e nível de serviço a fim de não comprometer a qualidade do produto. Desta forma, esse trabalho busca contribuir para redução de custos de frete por meio de otimização do dimensionamento de frota para distribuição de produto acabado, mesclando entre frota alugada e terceira, considerando diferentes perfis, custos e eficiências. Para isso, um estudo de caso foi realizado em uma empresa de alimentos, cuja fábrica localizada na cidade do Rio de Janeiro atende clientes localizados em todo o estado, os mesmos segregados por 6 regiões. A empresa em questão possui contrato de aluguel de veículos e de cessão de mão de obra, além de valor tabelado para frete terceiro. Utilizando o suplemento OpenSolver no MS Excel, foi criada uma ferramenta para otimização visando minimizar o custo, considerando a demanda semanal para cada região do estado, capacidade dos veículos, custos de aluguel, mão de obra e frota terceira. Foram analisados diferentes cenários, com restrições de perfis maiores na capital, e de disponibilidade geral de veículos contratados. Como resultado, há a oportunidade de redução entre 15 e 53% do custo de frete sem considerar restrições de perfil por regiões, apenas a possibilidade de revisão da frota contratada. Já considerando também a restrição de perfis na capital, há a oportunidade de redução entre 3 a 9% do custo total de frete.

Keywords: Problema de dimensionamento de frota; Otimização; Programação Inteira; Transporte de Carga; Distribuição Urbana.

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HIERARCHICAL TIME SERIES FORECAST FOR A RETAILER'S OMNICHANNEL

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ABSTRACT

Purpose: The transformation of the retail industry, reflecting contemporary consumer behaviours, has blurred the distinction between physical and digital markets. This shift underscores the significance of the Omnichannel experience, whose inherent potential hinges on more advanced decision-making support tools. This paper focuses, therefore, on the development and application of reliable statistical demand forecasting models within a retail company. The results are systematically compared and analysed to identify the model best suited for the company's context.

Design/methodology/approach: After meticulous data collection and pre-processing, three statistical learning models were applied for demand forecasting. Moreover, to achieve the coherency of predictions for hierarchical time series, a thorough reconciliation process was implemented. The results were finally subjected to a comprehensive comparison, wherein the models were ranked based on their respective error rates. This approach ensures systematic evaluation of their effectiveness in addressing the complexities of retail demand behaviour.

Findings: Results indicated that utilizing the SARIMAX forecasting model, combined with Bottom-up reconciliation, proved to be a viable approach for demand forecasting within the analysed hierarchical time series. This method demonstrated superior accuracy compared to the baseline and tested models, thereby establishing itself as a valuable tool for decision-making support in real-world retail businesses.

Originality/value: This study sheds light on the performance of HTS methods in the Omnichannel retail sector, a facet seldom explored in existing literature. Additionally, it innovates by comparing the performances of popular forecasting models within the context of HTS using Python.

Keywords: ARIMA; Demand; ETS; Omnichannel; Hierarchical Forecast; SARIMAX.

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SALES FORECAST USING META-LEARNING MODEL AS COMPLEMENTARY TO LEAN 4.0

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ABSTRACT

The discoveries about Lean 4.0 are far from exhausted, but only some studies still empirically expose the application of meta-learning models in this context. Therefore, this study aims to recognize the complementarity between prediction models based on meta-learning algorithms and Lean 4.0 and empirically evaluate their performance. For this purpose, a systematic literature review was conducted using the Systematic Search Flow (SSF) method, recognizing the strengths and weaknesses of meta-learning models in relation to complementarity with Lean 4.0. It was possible to identify that companies more committed to Lean are more likely to implement Industry 4.0 technologies, just as greater engagement from senior leadership increases the chance of success in implementing such technologies. The FFORMA model (Feature-based FORecast Model Averaging) was selected based on previously established criteria and applied to data from a company in the metallurgical segment in Southeast Brazil. Time series augmentation using autoregressive Gaussian mixture (MAR) models were used to train the meta-learning model, aiming to improve the model learning experience and, therefore, improve forecasting performance. The results related to the model's prediction error performance showed that the combined prediction was inferior compared to the individual prediction methods used in the combination. Out of the 19-time series, the combined model performed well in only two-time series. However, applying the meta-learning model proved interesting when a financial analysis of the impact on the inventory was conducted. Significant opportunities for reducing excesses by up to 94% of the inventory were observed, in addition to the relationship with the strengths and weaknesses in the literature review. This research aims to provide a solution for organizations with problems associated with sales forecasting, pricing strategy, storage space allocation, inventory management, distribution, and replacement plans in the metallurgical sector. They need sales forecasting as an integral part of the decision-making process and contribute as a theoretical reference related to Lean 4.0 and meta-learning models. Furthermore, the findings made it possible to create a technological product known as a conclusive technical report.

Keywords: Lean 4.0; FFORMA; Meta-learning; Forecast.

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