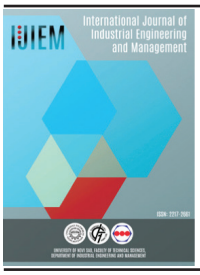

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Enhancing Agroforestry Residual Biomass Recovery: Developing and Validating a Supply Chain Management App-Based Model

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References

[1] O. González-Pelayo, S. A. Prats, A. Vieira, D. Vieira, P. Maia, and J. J. Keizer, "Impacts of barley (Hordeum vulgare L.) straw mulch on post-fire soil erosion and ground vegetation recovery in a strawberry tree (Arbutus unedo L.) stand," Ecol Eng, vol. 195, p. 107074, 2023, doi: 10.1016/j.ecoleng.2023.107074.

[2] J. Dias et al., "Monchique's Innovation Laboratory—A Space for Dialogue and Knowledge Sharing to Foster Community-Based Disaster Risk Reduction," Fire, vol. 7, no. 1, p. 1, 2023, doi: 10.3390/fire7010001.

[3] J. M. Fernández-Guisuraga and P. M. Fernandes, "Prescribed burning mitigates the severity of subsequent wildfires in Mediterranean shrublands," Fire Ecol, vol. 20, no. 1, pp. 1–17, 2024, doi: 10.1186/s42408-023-00233-z.

[4] J. V. Barbosa, R. A. O. Nunes, M. C. M. Alvim-Ferraz, F. G. Martins, and S. I. V. Sousa, "Health and economic burden of wildland fires PM2.5-related pollution in Portugal – A longitudinal study," Environ Res, vol. 240, p. 117490, 2024, doi: 10.1016/j.envres.2023.117490.

[5] N. Nitzsche, J. P. Nunes, and J. Parente, "Assessing post-fire water quality changes in reservoirs: Insights from a large dataset in Portugal," Sci Total Environ, vol. 912, p. 169463, 2024, doi: 10.1016/j.scitotenv.2023.169463.

[6] V. A. Bento et al., "The future of extreme meteorological fire danger under climate change scenarios for Iberia," Weather Clim Extrem, vol. 42, p. 100623, 2023, doi: 10.1016/j.wace.2023.100623.

[7] L. J. R. Nunes, M. A. M. Raposo, and C. J. Pinto Gomes, "A historical perspective of landscape and human population dynamics in Guimarães (Northern Portugal): Possible implications of rural fire risk in a changing environment," Fire, vol. 4, no. 3, p. 49, 2021, doi: 10.3390/fire4030049.

[8] M. R. Magalhães, N. S. Cunha, S. B. Pena, and A. Müller, "FIRELAN—An ecologically based planning model towards a fire resilient and sustainable landscape. A case study in center region of Portugal," Sustainability (Switzerland), vol. 13, no. 13, p. 7055, 2021, doi: 10.3390/su13137055.

[9] M. Méndez-López et al., "Mercury mobilization in shrubland after a prescribed fire in NE Portugal: Insight on soil organic matter composition and different aggregate size," Sci Total Environ, vol. 904, p. 167532, 2023, doi: 10.1016/j.scitotenv.2023.167532.

[10] F. Tedim et al., "Limitations and Opportunities of Spatial Planning to Enhance Wildfire Risk Reduction: Evidences from Portugal," Forests, vol. 14, no. 2, p. 303, 2023, doi: 10.3390/f14020303.
[11] L. J. R. Nunes, M. Casau, M. F. Dias, J. C. O. Matias, and L. C. Teixeira, "Agroforest woody residual biomass-to-energy supply chain analysis: Feasible and sustainable renewable resource exploitation for an alternative to fossil fuels," Results Eng, vol. 17, p. 101010, 2023, doi: 10.1016/j.rineng.2023.101010.
[12] P. Rijal, P. Bras, S. Garido, J. Matias, C. Pimentel, and H. Carvalho, "Residual Forestry Biomass Supply Chain: A Mapping Approach," Int J Ind Eng Manag, vol. 14, no. 3, pp. 244–256, 2023, doi: 10.24867/ijiem-2023-3-336.
[13] T. Bastos, L. C. Teixeira, J. C. O. Matias, and L. J. R. Nunes, "Agroforestry Biomass Recovery Supply Chain Management: A More Efficient Information Flow Model Based on a Web Platform," Logistics, vol. 7, no. 3, p. 56, 2023, doi: 10.3390/logistics7030056.
[14] T. Bastos, L. C. Teixeira, J. C. O. Matias, and L. J. R. Nunes, "Optimizing the agroforestry residual biomass supply chain: A disruptive tool for mitigating logistic costs and enhancing forest management," Results Eng, vol. 20, p. 101500, 2023, doi: 10.1016/j.rineng.2023.101500.
[15] V. Leone, M. Elia, R. Lovreglio, F. Correia, and F. Tedim, "The 2017 Extreme Wildfires Events in Portugal through the Perceptions of Volunteer and Professional Firefighters," Fire, vol. 6, no. 4, p. 133, 2023, doi: 10.3390/fire6040133.
[16] A. Rodrigues, A. Santiago, L. Laím, D. X. Viegas, and J. L. Zêzere, "Rural Fires—Causes of Human Losses in the 2017 Fires in Portugal," Appl Sci, vol. 12, no. 24, p. 12561, 2022, doi: 10.3390/app122412561.
[17] F. Piedra-Jimenez, A. I. Torres, and M. A. Rodriguez, "A robust disjunctive formulation for the redesign of forest biomass-based fuels supply chain under multiple factors of uncertainty," Comput Chem Eng, vol. 181, p. 108540, 2024, doi: 10.1016/j.compchemeng.2023.108540.
[18] L. J. R. Nunes, M. A. M. Raposo, C. I. R. Meireles, C. J. P. Gomes, and N. M. C. A. Ribeiro, "Energy recovery of shrub species as a path to reduce the risk of occurrence of rural fires: A case study in serra da estrela natural park (portugal)," Fire, vol. 4, no. 3, p. 33, 2021, doi: 10.3390/fire4030033.
[19] L. J. R. Nunes, M. Casau, J. C. O. Matias, and M. F. Dias, "Coal to Biomass Transition as the Path to Sustainable Energy Production: A Hypothetical Case Scenario with the Conversion of Pego Power Plant (Portugal)," Appl Sci, vol. 13, no. 7, p. 4349, 2023, doi: 10.3390/app13074349.
[20] L. J. R. Nunes, C. I. R. Meireles, C. J. P. Gomes, and N. M. C. A. Ribeiro, "Acacia dealbata Link. Aboveground Biomass Assessment: Sustainability of Control and Eradication Actions to Reduce Rural Fires Risk," Fire, vol. 5, no. 1, p. 7, 2022, doi: 10.3390/FIRE5010007.
[21] F. Basile, L. Pilotti, M. Ugolini, G. Lozza, and G. Manzolini, "Supply chain optimization and GHG emissions in biofuel production from forestry residues in Sweden," Renew Energy, vol. 196, pp. 405–421, 2022, doi: 10.1016/j.renene.2022.06.095.
[22] L. J. R. Nunes and S. Silva, "Optimization of the Residual Biomass Supply Chain: Process Characterization and Cost Analysis," Logistics, vol. 7, no. 3, p. 48, 2023, doi: 10.3390/logistics7030048.
[23] H. Paulo, X. Azcue, A. P. Barbosa-Póvoa, and S. Relvas, "Supply chain optimization of residual forestry biomass for bioenergy production: The case study of Portugal," Biomass Bioenergy, vol. 83, pp. 245–256, 2015, doi: 10.1016/j.biombioe.2015.09.020.
[24] L. Moretti, M. Milani, G. G. Lozza, and G. Manzolini, "A detailed MILP formulation for the optimal design of advanced biofuel supply chains," Renew Energy, vol. 171, pp. 159–175, 2021, doi: 10.1016/j.renene.2021.02.043.
[25] M. Hrouga and A. Sbihi, "Logistics 4.0 for supply chain performance: perspectives from a retailing case study," Bus Process Manag J, vol. 29, no. 6, pp. 1892–1919, 2023, doi: 10.1108/BPMJ-03-2023-0183.
[26] L. Gharaibeh, K. M. Eriksson, B. Lantz, S. Matarneh, and F. Elghaish, "Toward digital construction supply chain-based Industry 4.0 solutions: scientometric-thematic analysis," Smart Sustain Built Environ, vol. 13, no. 1, pp. 42–62, 2024, doi: 10.1108/SASBE-12-2021-0224.
[27] M. Kamariotou, F. Kitsios, C. Charatsari, E. D. Lioutas, and M. A. Talias, "Digital strategy decision support systems: Agrifood supply chain management in smes," Sensors, vol. 22, no. 1, p. 274, 2022, doi: 10.3390/s22010274.
[28] E. B. Hammond et al., "The development of a novel decision support system for regional land use planning for brownfield land," J Environ Manag, vol. 349, p. 119466, 2024, doi: 10.1016/j.jenvman.2023.119466.
[29] L. Morganti, M. Demutti, I. Fotoglou, E. A. Coscia, P. Perillo, and A. Pracucci, "Integrated Platform-Based Tool to Improve Life Cycle Management and Circularity of Building Envelope Components," Buildings, vol. 13, no. 10, p. 2630, 2023, doi: 10.3390/buildings13102630.
[30] L. Nonini, C. Schillaci, and M. Fiala, "Assessing logging residues availability for energy production by using forest management plans data and geographic information system (GIS)," Eur J For Res, vol. 141, no. 5, pp. 959–977, 2022, doi: 10.1007/s10342-022-01484-2.
[31] B. Maqbool and S. Herold, "Potential effectiveness and efficiency issues in usability evaluation within digital health: A systematic literature review," J Syst Softw, vol. 208, p. 111881, 2024, doi: 10.1016/j.jss.2023.111881.
[32] B. Witzel et al., "Digital game-based spelling intervention for children with spelling deficits: A randomized controlled trial," Learn Instr, vol. 89, p. 101842, 2024, doi: 10.1016/j.learninstruc.2023.101842.
[33] T. Bastos and L. Teixeira, "Digital Transition and Sustainable Development Goals: A Theoretical Reflection on the Impact of I4.0 Technologies," in International Conference on Flexible Automation and Intelligent Manufacturing, Springer, 2024, pp. 713–720. doi: 10.1007/978-3-031-38165-2_83.
[34] K. Aravindaraj and P. Rajan Chinna, "A systematic literature review of integration of industry 4.0 and warehouse management to achieve Sustainable Development Goals (SDGs)," Cleaner Logist Supply Chain, vol. 5, p. 100072, 2022, doi: 10.1016/j.clscn.2022.100072.
[35] E. G. Muñoz-Grillo et al., "Application of neural networks in the prediction of the circular economy level in agri-food chains," Int J Ind Eng Manag, vol. 15, no. 1, pp. 45–58, 2024, doi: 10.24867/IJIEM-2024-1-347.
[36] M. Hiloidhari, M. A. Sharno, D. C. Baruah, and A. N. Bezbaruah, "Green and sustainable biomass supply chain for environmental, social and economic benefits," Biomass Bioenergy, vol. 175, p. 106893, 2023, doi: 10.1016/j.biombioe.2023.106893.
[37] T. Bastos, J. Salvadorinho, and L. Teixeira, "UpSkill@Mgmt 4.0 - A digital tool for competence management: Conceptual model and a prototype," Int J Ind Eng Manag, 2022, doi: http://doi.org/10.24867/IJIEM-2022-4-315.