



Providing a framework based on decision-making methods to assess safety risk in construction projects

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References

- [1] M. Pavlović, U. Marjanović, S. Rakić, N. Tasić, and B. Lalić, "The Big Potential of Big Data in Manufacturing: Evidence from Emerging Economies," in *Advances in Production Management Systems. Towards Smart and Digital Manufacturing*, vol. 592, B. Lalic, V. Majstorovic, U. Marjanovic, G. von Cieminski, and D. Romero, Eds. Cham: Springer International Publishing, 2020, pp. 100–107. doi: 10.1007/978-3-030-57997-5_12.
- [2] A. Moshahedi and N. Mehranfar, "A Comprehensive Design for a Manufacturing System using Predictive Fuzzy Models," *Journal of Research in Science Engineering and Technology*, vol. 9, no. 3, pp. 1-23, 2021, doi: 10.24200/jrset.vol9iss03pp1-23
- [3] S. Rakić, I. Visnjic, P. Gaiardelli, D. Romero, and U. Marjanovic, "Transformation of Manufacturing Firms: Towards Digital Servitization," in *Advances in Production Management Systems. Artificial Intelligence for Sustainable and Resilient Production Systems*, vol. 631, A. Dolgui, A. Bernard, D. Lemoine, G. von Cieminski, and D. Romero, Eds. Cham: Springer International Publishing, 2021, pp. 153–161. doi: 10.1007/978-3-030-85902-2_17.
- [4] B. Lalic, U. Marjanovic, S. Rakić, M. Pavlovic, T. Todorovic, and N. Medic, "Big Data Analysis as a Digital Service: Evidence Form Manufacturing Firms," in *Proceedings of 5th International Conference on the Industry 4.0 Model for Advanced Manufacturing*, L. Wang, V. D. Majstorovic, D. Mourtzis, E. Carpanzano, G. Moroni, and L. M. Galantucci, Eds. Cham: Springer International Publishing, 2020, pp. 263–269. doi: 10.1007/978-3-030-46212-3_19.
- [5] A. Samimi, "Risk Management in Information Technology," *Prog. Chem. Biochem. Res.*, vol. 3, no. 2, pp. 130–134, May 2020, doi: 10.33945/SAMI/PCBR.2020.2.6.
- [6] R. Rahimian, "Providing Risk Management Strategies in Procurement and Supply Processes," *Adv. J. Chem. B*, vol. 2, no. 4, Nov. 2020, doi: 10.22034/ajcb.2020.114274.
- [7] M. Karami, A. Samimi, and M. Ja'fari, "Necessity to Study of Risk Management in Oil and Gas Industries," *Progress in Chemical and Biochemical Research*, vol. 3, no. 3, pp. 239-243, 2020, doi: 10.33945/SAMI/PCBR.2020.3.6
- [8] N. Medic, Z. Anisic, B. Lalic, U. Marjanovic, and M. Brezocnik, "Hybrid fuzzy multi-attribute decision making model for evaluation of advanced digital technologies in manufacturing: Industry 4.0 perspective," *Adv produc engineer manag*, vol. 14, no. 4, pp. 483–493, Dec. 2019, doi: 10.14743/apem2019.4.343.
- [9] A. Froughi and M. J. Esfahani, "A robust AHP-DEA method for measuring the relative efficiency: An application of airport industry," *MSL*, pp. 93–100, Jan. 2012, doi: 10.5267/j.msl.2011.09.018.
- [10] A. Froughi and M. H. Esfahani, "An empirical study for ranking risk factors using linear assignment: A case study of road construction," *MSL*, vol. 2, no. 2, pp. 615–622, Apr. 2012, doi: 10.5267/j.msl.2011.11.007.
- [11] Q. Luo, W. Li, H. Su, and X. Chen, "Evaluating Construction Risks of Modified Shield Machine Applicable to Soft Soils Based on Fuzzy Comprehensive Evaluation Method," *Mathematical Problems in Engineering*, vol. 2020, pp. 1–15, Oct. 2020, doi: 10.1155/2020/8861801.

- [12] F. Schutte and D. Edwards, "Business model innovation: reinventing the milkman," *International journal of business and management studies*, vol. 12, no. 2, pp. 1-15, 2020.
- [13] D. Nel, "Allocation of risk in public private partnerships in information and communications technology," *International Journal of eBusiness and eGovernment Studies*, vol. 12, no. 1, pp. 17-32, Jan. 2020, doi: 10.34111/ijeeg.202012102.
- [14] ISO, "The ISO 31000 standard Risk management: principles and guidelines," Geneva, 2009.
- [15] S. D. Digiesi et al., "Minimizing and Balancing Ergonomic Risk of Workers of an Assembly Line by Job Rotation: a MINLP Model," *Int J Ind Eng Manag*, vol. 9, no. 3, pp. 129-138, Sep. 2018, doi: 10.24867/IJIEEM-2018-3-129.
- [16] A. Clardy, "Toward an HRD Auditing Protocol: Assessing HRD Risk Management Practices," *Human Resource Development Review*, vol. 3, no. 2, pp. 124-150, Jun. 2004, doi: 10.1177/1534484304265102.
- [17] Lisbon Accounting and Business School, Lisbon Polytechnic Institute, Lisbon, Portugal, M. G. Antunes, P. R. Mucharreira, M. R. T. Justino, and J. Teixeira QuirÃ3s, "Total quality management and quality certification on services corporations," *International Journal for Quality Research*, vol. 14, no. 3, pp. 847-864, Aug. 2020, doi: 10.24874/IJQR14.03-13.
- [18] M. Dakovic, B. Lalic, M. Delic, N. Tasic, and D. Ciric, "Systematic mitigation of model sensitivity in the initiation phase of energy projects," *Adv produc engineer manag*, vol. 15, no. 2, pp. 217-232, Jun. 2020, doi: 10.14743/apem2020.2.360.
- [19] M. Kliment, P. Trebuna, M. Pekarcikova, M. Straka, J. Trojan, and R. Duda, "Production Efficiency Evaluation and Products' Quality Improvement Using Simulation," *Int. j. simul. model.*, vol. 19, no. 3, pp. 470-481, Sep. 2020, doi: 10.2507/IJSIMM19-3-528.
- [20] S. Rakic, M. Pavlovic, and U. Marjanovic, "A Precondition of Sustainability: Industry 4.0 Readiness," *Sustainability*, vol. 13, no. 12, p. 6641, Jun. 2021, doi: 10.3390/su13126641.
- [21] M. Meyer, G. Roodt, and M. Robbins, "Human resources risk management: Governing people risks for improved performance," *SA j. hum. resour. manag.*, vol. 9, no. 1, pp. 1-12, 2011, doi: 10.4102/sajhrm.v9i1.366.
- [22] N. Zivlak, S. Rakic, U. Marjanovic, D. Ciric, and B. Bogojevic, "The Role of Digital Servitization in Transition Economy: An SNA Approach," *Tehnicki vjesnik - Technical Gazette*, vol. 28, no. 6, pp. 1912-1919, 2021, doi: 10.17559/TV-20210325083229.
- [23] M. A. McDonald, H. J. Lipscomb, J. Bondy, and J. Glazner, "Safety is everyone's job: The key to safety on a large university construction site," *Journal of Safety Research*, vol. 40, no. 1, pp. 53-61, Jan. 2009, doi: 10.1016/j.jsr.2008.12.005.
- [24] O. Tsimer, V. Repeta, Ukrainian Academy of Printing, Faculty of Publishing, Printing and Information Technologies, Lviv, Ukraine, I. Myklushka, and Ukrainian Academy of Printing, Faculty of Publishing, Printing and Information Technologies, Lviv, Ukraine, "Analysis of quality factors for digitization process of old books," *J. Graph. Eng. Des.*, vol. 11, no. 2, pp. 5-9, Dec. 2020, doi: 10.24867/JGED-2020-2-005.
- [25] T. de Lemos, D. Eaton, M. Betts, and L. T. de Almeida, "Risk management in the Lusoponte concession—a case study of the two bridges in Lisbon, Portugal," *International Journal of Project Management*, vol. 22, no. 1, pp. 63-73, Jan. 2004, doi: 10.1016/S0263-7863(03)00013-9.
- [26] Y.-M. Wang and T. M. S. Elhag, "A fuzzy group decision making approach for bridge risk assessment," *Computers & Industrial Engineering*, vol. 53, no. 1, pp. 137-148, Aug. 2007, doi: 10.1016/j.cie.2007.04.009.
- [27] Jafarnejhad Ahmad and Yousefi Zenouz R., "A Fuzzy Model of Ranking Risks at Petropars Company's Excavation of Oil Well Projects," *Journal of Industrial Management*, vol. 1, no. 1, pp. 21-38.
- [28] S. M. H. Mojtahedi, S. M. Mousavi, and A. Makui, "Project risk identification and assessment simultaneously using multi-attribute group decision making technique," *Safety Science*, vol. 48, no. 4, pp. 499-507, Apr. 2010, doi: 10.1016/j.ssci.2009.12.016.
- [29] J. Zeng, M. An, and N. J. Smith, "Application of a fuzzy based decision making methodology to construction project risk assessment," *International Journal of Project Management*, vol. 25, no. 6, pp. 589-600, Aug. 2007, doi: 10.1016/j.ijproman.2007.02.006.
- [30] D. Tadic, M. DJapan, M. Misita, M. Stefanovic, and D. D. Milanovic, "A Fuzzy Model for Assessing Risk of Occupational Safety in the Processing Industry," *International Journal of Occupational Safety and Ergonomics*, vol. 18, no. 2, pp. 115-126, Jan. 2012, doi: 10.1080/10803548.2012.11076922.
- [31] I. Y. Wuni, G. Q. Shen, and B.-G. Hwang, "Risks of modular integrated construction: A review and future research directions," *Front. Eng. Manag.*, vol. 7, no. 1, pp. 63-80, Mar. 2020, doi: 10.1007/s42524-019-0059-7.
- [32] A. Qazi, A. Shamayleh, S. El-Sayegh, and S. Formanek, "Prioritizing risks in sustainable construction projects using a risk matrix-based Monte Carlo Simulation approach," *Sustainable Cities and Society*, vol. 65, p. 102576, Feb. 2021, doi: 10.1016/j.scs.2020.102576.
- [33] M. Weber and C. G. Chatzopoulos, "Digital customer experience: the risk of ignoring the non-digital experience," *Int J Ind Eng Manag*, vol. 10, no. 3, pp. 201-210, Sep. 2019, doi: 10.24867/IJIEEM-2019-3-240.
- [34] A. Carvalho Alves et al., "A symbiotic relationship between Lean Production and Ergonomics: insights from Industrial Engineering final year projects," *Int J Ind Eng Manag*, vol. 10, no. 4, pp. 243-256, Dec. 2019, doi: 10.24867/IJIEEM-2019-4-244.
- [35] A. Gialos and V. Zeimpekis, "Testing vision picking technology in warehouse operations: Evidence from laboratory experiments," *Int J Ind Eng Manag*, vol. 11, no. 1, pp. 19-30, 2020, doi: 10.24867/IJIEEM-2020-1-24.
- [36] L. Hudáková Stašová, "Evaluating the Use of the Activity Based Costing Method in the Construction Industry in the V4 Countries," *Int J Ind Eng Manag*, vol. 10, no. 4, pp. 257-268, 2019, doi: 10.24867/IJIEEM-2019-4-245.