



## Lean 4.0: An analytical approach for hydraulic system maintenance in a production line of a steel-making plant

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### References

- [1] A. Shahin, N. Aminsabouri, and K. Kianfar. "Developing a Decision Making Grid for Determining Proactive Maintenance Tactics: A Case Study in the Steel Industry." *Journal of Manufacturing Technology Management*, vol. 29, no. 8, pp. 1296-1315, 2018, doi:10.1108/JMTM-12-2017-0273.
- [2] J. Dai, J. Tang, S. Huang, & Y. Wang. "Signal-Based Intelligent Hydraulic Fault Diagnosis Methods: Review and Prospects." *Chinese Journal of Mechanical Engineering (English Edition)*, vol. 32, no. 1, 2019, doi:10.1186/s10033-019-0388-9.
- [3] N. Klačinja, N. Sremčev, D. Vukelić, N. Simeunović, & M. Lazarević. "Optimization of Cable Harness Assembly Systems Based on Lean Concept Application." *International Journal of Industrial Engineering and Management*, vol. 10, no. 1, pp. 115-123, 2019, doi:10.24867/IJEM-2019-1-115.
- [4] A. Bonamigo, and C. G. Frech. "Industry 4.0 in Services: Challenges and Opportunities for Value Co-Creation." *Journal of Services Marketing*, vol. 35, no. 4, pp. 412-427, 2020, doi:10.1108/JSM-02-2020-0073.
- [5] G. D. Bona, V. Cesarotti, G. Arcese, & T. Gallo. "Implementation of industry 4.0 technology: New opportunities and challenges for maintenance strategy". Paper presented at the *Procedia Computer Science*, vol. 180 pp. 424-429, 2021, doi:10.1016/j.procs.2021.01.258.
- [6] E. Nedjwa, R. Bertrand, and S. Sassi Boudemagh. "Impacts of Industry 4.0 Technologies on Lean Management Tools: A Bibliometric Analysis." *International Journal on Interactive Design and Manufacturing*, vol. 16, no. 1, pp. 135-150, 2022, doi:10.1007/s12008-021-00795-9.
- [7] L. S. Valamede, and A. C. S. Akkari. "Lean 4.0: A New Holistic Approach for the Integration of Lean Manufacturing Tools and Digital Technologies". *International Journal of Mathematical, Engineering and Management Sciences*, vol. 5, no. 5, pp. 854-868, 2020, doi:10.33889/IJMEMS.2020.5.5.066.
- [8] J. Mattioli, P. Perico, & P. Robic. "Improve total production maintenance with artificial intelligence". Paper presented at the *Proceedings - 2020 3rd International Conference on Artificial Intelligence for Industries, AII 2020*, pp. 56-59, doi:10.1109/AII49448.2020.00019.
- [9] M. Hermann, T. Pentek, & B. Otto. "Design principles for industrie 4.0 scenarios". Paper presented at the *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2016-March, pp. 3928-3937, doi:10.1109/HICSS.2016.488.
- [10] O. Salunkhe, & Å. F. Berglund. "Industry 4.0 enabling technologies for increasing operational flexibility in final assembly". *International Journal of Industrial Engineering and Management*, vol. 13(1), pp. 38-48, 2021, doi:10.24867/IJEM-2021-1-299.
- [11] Bauer, H., Brandl, F., Lock, C., & Reinhart, G. "Integration of industrie 4.0 in lean manufacturing learning factories. Paper presented at the *Procedia Manufacturing*, vol. 23, pp. 147-152, 2018, doi:10.1016/j.promfg.2018.04.008.
- [12] V. Tripathi, S. Chattopadhyaya, A. K. Mukhopadhyay, S. Sharma, C. Li, S. Singh, A. Mohamed. "A sustainable productive method for enhancing operational excellence in shop floor management for industry 4.0 using hybrid integration of lean and smart manufacturing: An ingenious case study". *Sustainability (Switzerland)*, vol.14(12), 2022, doi:10.3390/su14127452.
- [13] F. Dillinger, O. Bernhard, & G. Reinhart. "Competence requirements in manufacturing companies in the context of lean 4.0". Paper presented at the *Procedia CIRP*, vol. 106, pp. 58-63, 2022, doi:10.1016/j.procir.2022.02.155.
- [14] C. J. Yuik, & P. Puvanasvaran. "Development of lean manufacturing implementation framework in machinery and equipment SMEs". *International Journal of Industrial Engineering and Management*, vol. 11(3), pp. 157-169, 2020, doi:10.24867/IJEM-2020-3-261.
- [15] S. Kunnappadeelert, & K. Pitchayadejanant. "Analyzing the effect of supply chain strategies and collaboration on performance improvement using MIMIC model". *International Journal of Industrial Engineering and Management*, vol. 12(3), pp. 216-225, 2021, doi:10.24867/IJEM-2021-3-289.

- [16] M. S. Yahya, M. Mohammad, B. Omar, B., E. F. Ramly, & H. Atan. "Awareness, implementation, effectiveness and future use of lean tools and techniques in malaysia organisations: A survey". Paper presented at the Journal of Physics: Conference Series, vol. 1150(1), 2019 doi:10.1088/1742-6596/1150/1/012010.
- [17] I. A. Mouzani, & D. Bouami. "The integration of lean manufacturing and lean maintenance to improve production efficiency". International Journal of Mechanical and Production Engineering Research and Development, vol. 9(1), pp. 593-604, 2019, doi:10.24247/ijmperdfeb201957.
- [18] O. Duran, A. Capaldo, & P. A. D. Acevedo. "Lean maintenance applied to improve maintenance efficiency in thermoelectric power plants". Energies, vol. 10(10), 2017, doi:10.3390/en10101653.
- [19] K. Antosz, Ł. Paško, & A. Gola. "The use of artificial intelligence methods to assess the effectiveness of lean maintenance concept implementation in manufacturing enterprises". Applied Sciences (Switzerland), vol. 10(21), pp. 1-24, 2020, doi:10.3390/app10217922.
- [20] G. L. Tortorella, F. S. Fogliatto, P. A. Cauchick-Miguel, S. Kurnia, & D. Jurburg. "Integration of industry 4.0 technologies into total productive maintenance practices". International Journal of Production Economics, vol. 240, 2021 doi:10.1016/j.ijpe.2021.108224.
- [21] F. B. Georgise, & A. T. Mindaye. "Kaizen implementation in industries of southern ethiopia: Challenges and feasibility". Cogent Engineering, vol. 7(1), 2020, doi:10.1080/23311916.2020.1823157.
- [22] A. D. Makwana, & G. S. Patange. "Strategic implementation of 5S and its effect on productivity of plastic machinery manufacturing company". Australian Journal of Mechanical Engineering, vol. 20(1), pp. 111-120, 2022, doi:10.1080/14484846.2019.1676112.
- [23] J. C. Quiroz-Flores, & M. L. Vega-Alvites. "Review lean manufacturing model of production management under the preventive maintenance approach to improve efficiency in plastics industry smes: a case study". South African Journal of Industrial Engineering, vol. 33(2), pp. 143-156, 2022, doi:10.7166/33-2-2711.
- [24] I. S. Lopes, M. C. Figueiredo, & V. Sá. "Criticality evaluation to support maintenance management of manufacturing systems". International Journal of Industrial Engineering and Management, vol. 11(1), pp. 3-18, 2020, doi:10.24867/IJIEM-2020-1-248.
- [25] J. Lee, J. Ni, J. Singh, B. Jiang, M. Azamfar, & J. Feng. "Intelligent maintenance systems and predictive manufacturing". Journal of Manufacturing Science and Engineering, Transactions of the ASME, vol. 142(11), 2020, doi:10.1115/1.4047856.
- [26] L. M. Crisan, A. E. Crisan, D. Brebenariu, & I. Borza. "Optimize the maintenance activity with computer application". Paper presented at the Journal of Physics: Conference Series, vol. 1781(1), 2020, doi:10.1088/1742-6596/1781/1/012068.
- [27] J. Bokrantz, A. Skoogh, C. Berlin, T. Wuest, & J. Stahre. "Smart maintenance: An empirically grounded conceptualization". International Journal of Production Economics, vol. 223, 2020, doi:10.1016/j.ijpe.2019.107534.
- [28] K. Shukla, S. Nefti-Meziani, & S. Davis. "A heuristic approach on predictive maintenance techniques: Limitations and scope". Advances in Mechanical Engineering, vol. 14(6), 2021, doi:10.1177/1687813221101009.
- [29] A. Alenany, A. M. Helmi, & B. M. Nasef. "Comprehensive analysis for sensor-based hydraulic system condition monitoring". International Journal of Advanced Computer Science and Applications, vol. 12(6), pp. 133-140, 2021, doi:10.14569/IJACSA.2021.0120615.
- [30] B. Bajic, N. Suzic, N. Simeunovic, S. Moraca, & A. Rikalovic. "Real-time data analytics edge computing application for industry 4.0: The Mahalanobis-Taguchi approach". International Journal of Industrial Engineering and Management, vol. 11(3), pp. 146-156, 2020, doi:10.24867/IJIEM-2020-3-260.
- [31] C. Franciosi, B. Iung, S. Miranda, and S. Riemma. "Maintenance for sustainability in the industry 4.0 context: a scoping literature review". IFAC-PapersOnLine, vol. 51, pp. 903-908, 2018, doi:10.1016/j.ifacol.2018.08.459.
- [32] A. Korchagin, Y. Deniskin, I. Pocebneva, & O. Vasilyeva. "Lean maintenance 4.0: Implementation for aviation industry". Paper presented at the Transportation Research Procedia, vol. 63, pp. 1521-1533, 2022, doi:10.1016/j.trpro.2022.06.164.
- [33] C. Jaqin, A. Rozak, & H. H. Purba. "Case study in increasing overall equipment effectiveness on progressive press machine using plan-do-check-act cycle". International Journal of Engineering, Transactions B: Applications, vol. 33(11), pp. 2245-2251, 2020, doi:10.5829/ije.2020.33.11b.16.
- [34] C. R. Kothari, & G. Garg. "Research methodology methods and techniques". Nova Deli: New Age International, 4o ed, 2019.
- [35] R. Odebrecht de Souza, H. A. Ferenhof, & F. A. Forcellini. "Systematic for process improvement using cyber-physical systems and Toyota kata". IFIP Advances in Information and Communication Technology, vol. 639 IFIP, pp. 447-460, 2022, doi:10.1007/978-3-030-94335-6\_32.