

An innovative framework for sustainable and centralized material procurement management based on a full-domain set theory

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ABSTRACT

The purpose of this study is to propose a theoretical framework to solve the problem of insufficient data integrity, insufficient information circulation, and poor global data integration and linkage in the material procurement management subsystem. Based on the theory of full-domain set, this study proposes the conceptual framework, the full-domain linkage model, and the theoretical framework of centralized material procurement management. With the proposed innovative management framework, current problems such as insufficient data integrity, insufficient information circulation and data linkage in the procurement management system can be solved. This study provides reference significance for the construction of centralized material procurement management in the context of big data and offers theoretical guidance for large group enterprises to carry out centralized procurement management.

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References

- [1] Su, M., Zou, B., Liao, Q. (2018). Reflections on the construction of digital status data of the whole area, *Urban Planning*, Vol. 42, No. 1, 97-104, [doi: 10.11819/cpr20181316a](https://doi.org/10.11819/cpr20181316a).
- [2] Zhang, S. (2021). Collaborative analysis of data asset management in digital power grid enterprises across the domain, *Modern Marketing*, Vol. 31, 180-181, [doi: 10.19932/j.cnki.22-1256/F.2021.08.180](https://doi.org/10.19932/j.cnki.22-1256/F.2021.08.180).
- [3] Burgess, K., Singh, P.J., Koroglu, R. (2006). Supply chain management: A structured literature review and implications for future research, *International Journal of Operations & Production Management*, Vol. 26, No. 7, 703-729, [doi: 10.1108/01443570610672202](https://doi.org/10.1108/01443570610672202).
- [4] Choi, T.Y., Wu, Z., Ellram, L., Koka, B.R. (2002). Supplier-supplier relationships and their implications for buyer-supplier relationships, *IEEE Transactions on Engineering Management*, Vol. 49, No. 2, 119-130, [doi: 10.1109/TEM.2002.1010880](https://doi.org/10.1109/TEM.2002.1010880).

- [5] Villena, V.H., Revilla, E., Choi, T.Y. (2011). The dark side of buyer-supplier relationships: A social capital perspective, *Journal of Operations Management*, Vol. 29, No. 6, 561-576, doi: [10.1016/j.jom.2010.09.001](https://doi.org/10.1016/j.jom.2010.09.001).
- [6] Wu, Z., Choi, T.Y., Rungtusanatham, M.J. (2010). Supplier-supplier relationships in buyer-supplier-supplier triads: Implications for supplier performance, *Journal of Operations Management*, Vol. 28, No. 2, 115-123, doi: [10.1016/j.jom.2009.09.002](https://doi.org/10.1016/j.jom.2009.09.002).
- [7] Wu, Z., Choi, T.Y. (2005). Supplier-supplier relationships in the buyer-supplier triad: Building theories from eight case studies, *Journal of Operations Management*, Vol. 24, No. 1, 27-52, doi: [10.1016/j.jom.2005.02.001](https://doi.org/10.1016/j.jom.2005.02.001).
- [8] Spina, G., Caniato, F., Luzzini, D., Ronchi, S. (2013). Past, present and future trends of purchasing and supply management: An extensive literature review, *Industrial Marketing Management*, Vol. 42, No. 8, 1202-1212, doi: [10.1016/j.indmarman.2013.04.001](https://doi.org/10.1016/j.indmarman.2013.04.001).
- [9] Moretto, A., Ronchi, S., Patrucco, A.S. (2017). Increasing the effectiveness of procurement decisions: The value of big data in the procurement process, *International Journal of RF Technologies*, Vol. 8, No. 3, 79-103, doi: [10.3233/RFT-171670](https://doi.org/10.3233/RFT-171670).
- [10] Zhang, J., Simeone, A., Gu, P., Hong, B. (2018). Product features characterization and customers' preferences prediction based on purchasing data, *CIRP Annals*, Vol. 67, No. 1, 149-152, doi: [10.1016/j.cirp.2018.04.020](https://doi.org/10.1016/j.cirp.2018.04.020).
- [11] Zhang, L., Yan, Y., Xu, W., Sun, J., Zhang, Y. (2022). Carbon emission calculation and influencing factor analysis based on industrial big data in the "double carbon" era, *Computational Intelligence and Neuroscience*, Vol. 2022, Article ID 2815940, doi: [10.1155/2022/2815940](https://doi.org/10.1155/2022/2815940).
- [12] Borzooei, R.A., Rashmanlou, H. (2016). Semi global domination sets in vague graphs with application, *Journal of Intelligent & Fuzzy Systems*, Vol. 30, No. 6, 3645-3652, doi: [10.3233/IFS-162110](https://doi.org/10.3233/IFS-162110).
- [13] Cheng, X., Zhang, X. (2018). Several convex domains and their relations in multivariate complex spaces, *Journal of Jilin Normal University (Natural Sciences Edition)*, Vol. 39, No. 2, 40-44, doi: [10.16862/j.cnki.issn1674-3873.2018.02.009](https://doi.org/10.16862/j.cnki.issn1674-3873.2018.02.009).
- [14] Huang, L., Wu, W., Hu, X., Yang, S., Lin, Y., Wang, Y. (2021). Parallel acceleration and improvement of gravitational field optimization algorithm, *Tehnički Vjesnik – Technical Gazette*, Vol. 28, No. 2, 401-409, doi: [10.17559/TV-20191217030336](https://doi.org/10.17559/TV-20191217030336).
- [15] Xaviour, X.L., Chellathurai, S.R. (2020). On the upper geodesic global domination number of a graph, *Proyecciones (Antofagasta)*, Vol. 39, No. 6, 1627-1646, doi: [10.22199/issn.0717-6279-2020-06-0097](https://doi.org/10.22199/issn.0717-6279-2020-06-0097).
- [16] Li, X., Zhang, R. (2020). Innovative research to promote the development of key technologies for smart Beijing, *Journal of Beijing Union University (Humanities and Social Sciences Edition)*, Vol. 18, No. 3, 1-10, doi: [10.16255/j.cnki.11-5117c.2020.0031](https://doi.org/10.16255/j.cnki.11-5117c.2020.0031).
- [17] Kim, B.S., Kim, T.G., Choi, S.H. (2021). CoDEVs: An extension of DEVs for integration of simulation and machine learning, *International Journal of Simulation Modelling*, Vol. 20, No. 4, 661-671, doi: [10.2507/IJSIMM20-4-576](https://doi.org/10.2507/IJSIMM20-4-576).
- [18] Wang, Z., Ning, Y., Du, Y. (2020). Research on high-quality development and standardization of big data in book publishing based on the theory of full-domain set, *Science-Technology and Publishing*, Vol. 10, 25-29, doi: [10.16510/j.cnki.kjyeb.20201012.006](https://doi.org/10.16510/j.cnki.kjyeb.20201012.006).
- [19] Duan, R. (2021). Research on a group-level data management and sharing platform based on DCMM, *Power Big Data*, Vol. 24, No. 8, 68-75, doi: [10.19317/j.cnki.1008-083x.2021.08.009](https://doi.org/10.19317/j.cnki.1008-083x.2021.08.009).
- [20] Elouneq, A., Sutula, D., Chambert, J., Lejeune, A., Bordas, S.P.A., Jacquet, E. (2021). An open-source FEniCS-based framework for hyperplastic parameter estimation from noisy full-field data: Application to heterogeneous soft tissues, *Computers & Structures*, Vol. 255, Article No. 106620, doi: [10.1016/j.compstruc.2021.106620](https://doi.org/10.1016/j.compstruc.2021.106620).
- [21] Li, X., Li, X. (2018). Big data and its key technology in the future, *Computing in Science & Engineering*, Vol. 20, No. 4, 75-88, doi: [10.1109/MCSE.2018.042781329](https://doi.org/10.1109/MCSE.2018.042781329).
- [22] Zhang, Y., Song, J., Peng, W., Guo, D., Song, T. (2021). A machine learning classification algorithm for vocabulary grading in Chinese language teaching, *Tehnički Vjesnik – Technical Gazette*, Vol. 28, No. 3, 845-855, doi: [10.17559/TV-20210128043310](https://doi.org/10.17559/TV-20210128043310).
- [23] Mao, T. (2021). Progress, dilemmas and countermeasures of green supply chain management practices, *Environmental Protection*, Vol. 49, No. 2, 61-65, doi: [10.14026/j.cnki.0253-9705.2021.02.011](https://doi.org/10.14026/j.cnki.0253-9705.2021.02.011).
- [24] Kramar, D., Cica, Dj. (2021). Modeling and optimization of finish diamond turning of spherical surfaces based on response surface methodology and cuckoo search algorithm, *Advances in Production Engineering & Management*, Vol. 16, No. 3, 326-334, doi: [10.14743/apem2021.3.403](https://doi.org/10.14743/apem2021.3.403).
- [25] Riedel, A., Gerlach, J., Dietsch, M., Herbst, S., Engelmann, F., Brehm, N., Pfeifroth, T. (2021). A deep learning-based worker assistance system for error prevention: Case study in a real-world manual assembly, *Advances in Production Engineering & Management*, Vol. 16, No. 4, 393-404, doi: [10.14743/apem2021.4.408](https://doi.org/10.14743/apem2021.4.408).