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Optimization of a multi-objective location model of manufacturing base considering cooperative manufacturing capabilities and service benefits

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ABSTRACT

Improving customer satisfaction and shortening the manufacturing cycle have become common concerns of current manufacturers. This paper presents a multi-objective location model considering the maximization of collaborative manufacturing capabilities and service benefits. This method first uses the two dimensions of *customer share* and *market consumption* to segment customers, and identify the weight of various customer groups. Secondly, the space vector model (VSM) is used to calculate the matching between manufacturing capabilities and manufacturing requirements. Then build a multi-objective location model based on the two goals of collaborative manufacturing capabilities and service benefits. Finally, the model was tested with simulation data, which proved the validity and feasibility of the model. According to the simulation results, managers can accurately select the optimal manufacturing base from multiple candidate manufacturing bases with regard to less costs, shorter lead times, better manufacturing capabilities, better service benefits. In this paper, Fuzzy theory, Logit model and VSM are combined to salve the problem of manufacturing base location. Considering resources and service benefits of each manufacturing base, it is helpful to optimize the location of enterprises. From the academic and practical points, this study provides a new perspective for the location problem.

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References

[1] Ocampo, L.A., Himang, C.M., Kumar, A., Brezocnik, M. (2019). A novel multiple criteria decision-making approach based on fuzzy DEMATEL, fuzzy ANP and fuzzy AHP for mapping collection and distribution centers in reverse logistics, *Advances in Production Engineering & Management,* Vol. 14, No. 3, 297-322, doi: 10.14743/apem2019.3.329.

[2] Medic, N., Anisic, Z., Lalic, B., Marjanovic, U., Brezocnik, M. (2019). Hybrid fuzzy multi-attribute decision making model for evaluation of advanced digital technologies in manufacturing: Industry 4.0 perspective, *Advances in Production Engineering & Management,* Vol. 14, No. 4, 483-493, doi: 10.14743/apem2019.4.343.

[3] Marković, G., Zdravković, N., Karakašić, M., Kolarević, M. (2020). Modified PROMETHEE approach for solving multi-criteria location problems with complex criteria functions, *Tehnički Vjesnik – Technical Gazette*, Vol. 27, No. 1, 12-19, doi: 10.17559/TV-20190225151515.

[4] Fazlollahtabar, H. (2021). A DSS-based dynamic programming for finding optimal markets using neural networks and pricing, *Iranian Journal of Management Studies,* Vol. 14, No. 1, 87-106, doi: 10.22059/ijms.2020.269091.673397.

[5] Hajibaba, H., Grün, B., Dolnicar, S. (2019). Improving the stability of market segmentation analysis, *International Journal of Contemporary Hospitality Management,* Vol. 32, No. 4, 1393-1411, doi: 10.1108/IJCHM-02-2019-0137.
[6] Chen, Y. (2017). Integrated and intelligent manufacturing: Perspectives and enablers, *Engineering,* Vol. 3, No. 5, 588-595, doi: 10.1016/J.ENG.2017.04.009.
[7] Tan, C., Chung, H., Barton, K., Jack Hu, S., Freiheit, T. (2020). Incorporating customer personalization preferences in open product architecture design, *Journal of Manufacturing Systems,* Vol. 56, 72-83, doi: 10.1016/j.jmsy.2020.05.006.
[8] Wu, Q., Liao, K., Deng, X., Marsillac, E. (2020). Achieving automotive suppliers' mass customization through modlarity: Vital antecedents and the valuable role and responsibility of information sharing, *Journal of Manufacturing Technology Management,* Vol. 31, No. 2, 306-329, doi: 10.1108/JMTM-12-2018-0459.
[9] Han, S.Y. (2016). Convention Market Segmentation by the Attributes of Convention Site Selection – On the Subject of Professional Convention Organizers (PCO), Seoul Studies, Vol. 17, No, 4, 111-129.
[10] Zheng, X., Wu, C., He, S. (2020). Impacts of market segmentation on the over-capacity of the thermal electricity generation industry in China, *Journal of Environmental Management,* Vol. 279, Article No. 111761, doi: 10.1016/j.jenvman.2020.111761.
[11] Lee, H. (2019). Analysis of location and site planning preference of USFK residential housing, *Journal of the Korea Academia-Industrial cooperation Society,* Vol. 20, No. 12, 822-827, doi: 10.5762/KAIS.2019.20.12.822.
[12] Ghorui, N., Ghosh, A., Algehyne, E.A., Mondal, S.P., Saha, A.K. (2020). AHP-TOPSIS inspired shopping mall site selection problem with fuzzy data, *Mathematics,* Vol. 8, No. 8, Article No. 1380, doi: 10.3390/math8081380.
[13] Jelokhani-Niaraki, M., Malczewski, J. (2015). A group multicriteria spatial decision support system for parking site selection problem: A case study, *Land Use Policy,* Vol. 42, 492-508, doi: 10.1016/j.landusepol.2014.09.003.
[14] Yoseph, F., Malim, N.H.A.H., Heikkilä, M., Brezulianu, A., Geman, O., Rostam, N.A.P. (2020). The impact of big data market segmentation using data mining and clustering techniques, *Journal of Intelligent & Fuzzy Systems,* Vol. 38, No. 5, 6159-6173, doi: 10.3233/JIFS-179698.
[15] Samani, Z.N., Karimi, M., Alesheikh, A.A. (2018). A novel approach to site selection: Collaborative multi-criteria decision making through geo-social network (Case study: Public parking), *ISPRS International Journal of Geo-Information,* Vol. 7, No. 3, Article No. 82, doi: 10.3390/ijgi7030082.
[16] Wang, P., Liu, W., Lin, Z., Wen, F., Dong, Z., Zheng, Y., Zhang, R. (2017). Scenario analysis based collaborative site selection planning of wind farms and power-to-gas plants, *Automation of Electric Power Systems,* Vol. 41, No. 6, 20-29, doi: 10.7500/AEPS20161012007.
[17] Au, K.F., Wong, W.K., Zeng, X.H. (2006). Decision model for country site selection of overseas clothing plants, *International Journal of Advanced Manufacturing Technology,* Vol. 29, No. 3-4, 408-417, doi: 10.1007/s00170-005-2505-4.
[18] García, J.L., Alvarado, A., Blanco, J., Jiménez, E., Maldonado, A.A., Cortés, G. (2014). Multi-attribute evaluation and selection of sites for agricultural product warehouses based on an Analytic Hierarchy Process, *Computers and Electronics in Agriculture,* Vol. 100, 60-69, doi: 10.1016/j.compag.2013.10.009.
[19] Cai, T., Wang, S., Xu, Q. (2015). Monte Carlo optimization for site selection of new chemical plants, *Journal of Environmental Management,* Vol. 163, 28-38, doi: 10.1016/j.jenvman.2015.08.002.
[20] Habibi, F., Asadi, E., Sadjadi, S.J., Barzinpour, F. (2017). A multi-objective robust optimization model for site-selection and capacity allocation of municipal solid waste facilities: A case study in Tehran, *Journal of Cleaner Production,* Vol. 166, 816-834, doi: 10.1016/j.jclepro.2017.08.063.
[21] Awaga, A.L., Xu, W., Liu, L., Zhang, Y. (2020). Evolutionary game of green manufacturing mode of enterprises under the influence of government reward and punishment, *Advances in Production Engineering & Management*, Vol. 15, No. 4, 416-430, doi: 10.14743/apem2020.4.375.
[22] Li, H.-Y., Xu, W., Cui, Y., Wang, Z., Xiao, M., Sun, Z.-X. (2020). Preventive maintenance decision model of urban transportation system equipment based on multi-control units, *IEEE Access,* Vol. 8, 15851-15869, doi: 10.1109/ACCESS.2019.2961433.
[23] Shapiro, A.F., Koissi, M.-C. (2017). Fuzzy logic modifications of the analytic hierarchy process, *Insurance: Mathematics and Economics,* Vol. 75, 189-202, doi: 10.1016/j.insmatheco.2017.05.003.
[24] Guadagni, P.M., Little, J.D.C. (2008). Commentary – A logit model of brand choice calibrated on scanner data: A 25th anniversary perspective, *Marketing Science,* Vol. 27, No. 2, 26-28, doi: 10.1287/mksc.1070.0345.
[25] Shao, W., Ding, H., Tang, J., Peng, S. (2018). A data-driven optimization model to collaborative manufacturing system considering geometric and physical performances for hypoid gear product, *Robotics and Computer-Integrated Manufacturing,* Vol. 54, 1-16, doi: 10.1016/j.rcim.2018.05.004.
[26] Jian, J., Wang, M., Li, L., Su, J., Huang, T. (2019). A partner selection model for collaborative product innovation from the viewpoint of knowledge collaboration, *Kybernetes,* Vol. 49, No. 6, 1623-1644, doi: 10.1108/K-05-2018-0266.