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Are Livestock Effluent Standards of Vietnam Feasible?

Insights from Land Use of Wastewater Treatment Plants in Pig Farms

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Abstract

Purpose: This study evaluates the feasibility of implementing livestock effluent standards in Vietnam, a developing country experiencing rapid growth in pig production alongside severe environmental pollution problems.

Design/methodology/approach: This study surveyed 118 pig farms, collecting wastewater samples from their waste treatment systems. Through multiple regression analysis, this study modeled the relationship between pollutant levels and land area used for different treatment facilities.

Findings: The study revealed that meeting Level B of Vietnam's National Livestock Effluent Standards requires a waste treatment area of 6.09 m²/pig for standalone biogas digesters and 3.61 m²/pig for systems combining biogas digesters with bioponds. However, the surveyed farms allocated only 0.64 m²/pig and 1.16 m²/pig for these respective systems, demonstrating that compliance with the current standards is practically unachievable. Additionally, the results indicate that the combined system (biogas + biopond) achieves higher treatment efficiency than biogas digesters alone.

Practical implications: This finding highlights critical shortcomings in Vietnam's agricultural land policies, including restrictive land quotas, land fragmentation, and short leasing terms for public agricultural land. These constraints discourage enterprises and large-scale farms from investing in infrastructure and waste treatment systems. To enable livestock farms to comply with effluent standards, policymakers should prioritize land consolidation, longer leasing terms for public agricultural land, and stricter enforcement of environmental regulations.

Originality/value: This is the first study in Vietnam to examine the feasibility of livestock wastewater standards in the aspect of land-use, one of the increasingly constrained resources in Vietnam.

Keywords: effluent standard, livestock, land use, wastewater treatment plant

JEL classifications: Q12, Q15, Q28

References

- ACI. (2017). *Annual reports of Low Carbon Agricultural Support Project* (LCASP/2017/02/24/01). http://lcasp.org.vn/uploads/kien-thuc/2017_04/131326556632985253_lcasp-lic-annual-rep.pdf
- Alexandratos, N., & Bruinsma, J. (2012). World food and agriculture to 2030/50: the 2012 revision. *FAO, Rome*, 32.
- Breusch, T. S., & Pagan, A. R. (1979). A Simple Test for Heteroscedasticity and Random Coefficient Variation. *Econometrica*, 47(5), 1287-1294. <https://doi.org/10.2307/1911963>
- Dinh, T. T. U., Soda, S., Nguyen, T. A. H., Nakajima, J., & Cao, T. H. (2020). Nutrient removal by duckweed from anaerobically treated swine wastewater in lab-scale stabilization ponds in Vietnam. *Science of The Total Environment*, 722, 137854. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2020.137854>
- Dinh, T. X. (2017). *An Overview of Agricultural Pollution in Vietnam: The Livestock Sector 2017*. <http://documents.worldbank.org/curated/en/203891516788731381/pdf/122935-WP-P153343-PUBLIC-Vietnam-livestock-ENG.pdf>
- Duan, J., Geng, C., Li, X., Duan, Z., & Yang, L. (2015). The treatment performance and nutrient removal of a garden land infiltration system receiving dairy farm wastewater. *Agricultural Water Management*, 150, 103-110. <https://doi.org/https://doi.org/10.1016/j.agwat.2014.12.003>
- Exchange-Rates.org. (2024). *US Dollar (USD) To Vietnamese Dong (VND) Exchange Rate History for 2024*. <https://www.exchange-rates.org/exchange-rate-history/usd-vnd-2024>
- General Statistics Office of Vietnam. (2022). *Statistical Year Book of Vietnam 2022*.
- General Statistics Office of Vietnam. (2023). *Statistical Year Book of Vietnam 2023*.
- Giang, N. T. H., An, N. T., Huong, L. T. T., Yabe, M., Thang, N. T., Hieu, V. N., & Son, C. T. (2021). Recycling Wastewater in Intensive Swine Farms: Selected Case Studies in Vietnam. *Journal-Faculty of Agriculture Kyushu University*, 66, 115-121. <https://doi.org/10.5109/4363559>
- Hai, L. T., Schnitzer, H., van Thanh, T., Thao, N. T. P., & Braunegg, G. (2016). An integrated eco-model of agriculture and small-scale industry in craft villages toward cleaner production and sustainable development in rural areas – A case study from Mekong delta of Viet Nam. *Journal of Cleaner Production*, 137, 274-282. <https://doi.org/10.1016/j.jclepro.2016.06.146>
- Hernandez-Sancho, F., Molinos-Senante, M., & Sala-Garrido, R. (2011). Cost modelling for wastewater treatment processes. *Desalination*, 268(1), 1-5. <https://doi.org/https://doi.org/10.1016/j.desal.2010.09.042>
- Ho, T. L. T., Cao, T. S., Nguyen, H. N., & Bui, P. K. H. (2016). Comparison of Two Pig-Farming Systems in Impact on The Quality of Surface and Groundwater in Hanoi, Vietnam. *International Journal of Agriculture Innovations and Research*, 5(1). https://ijair.org/administrator/components/com_jresearch/files/publications/IJAIR_1996_FINAL.PDF
- Huong, L. Q., Madsen, H., Anh, L. X., Ngoc, P. T., & Dalsgaard, A. (2014). Hygienic aspects of livestock manure management and biogas systems operated by small-scale pig farmers in Vietnam. *Science of The Total Environment*, 470-471, 53-57. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2013.09.023>

- Huong, L. T. T., Takahashi, Y., Duy, L. V., Chung, D. K., & Yabe, M. (2023). Development of Livestock Farming System and Technical Efficiency: A Case Study on Pig Production in Vietnam.
- Huong, L. T. T., Takahashi, Y., Nomura, H., Son, C. T., Kusudo, T., & Yabe, M. (2020). Manure management and pollution levels of contract and non-contract livestock farming in Vietnam. *Science of The Total Environment*, 710, 136200. <https://doi.org/https://doi.org/10.1016/j.scitotenv.2019.136200>
- ISO. (1997). Water quality — Determination of suspended solids by filtration through glass-fibre filters. In *ISO 11923:1997*. Geneva, Switzerland
- ISO. (2019). Water quality — Determination of biochemical oxygen demand after n days (BOD_n). In *ISO 5815-1:2019*. Geneva, Switzerland.
- Kleinbaum, D. G., Kupper, L. L., Nizam, A., & Rosenberg, E. S. (2013). *Applied regression analysis and other multivariable methods*. Nelson Education.
- Makara, A., & Kowalski, Z. (2018). Selection of pig manure management strategies: Case study of Polish farms. *Journal of Cleaner Production*, 172, 187-195. <https://doi.org/https://doi.org/10.1016/j.jclepro.2017.10.095>
- Mendieta-Pino, C. A., Ramos-Martin, A., Perez-Baez, S. O., & Brito-Espino, S. (2019). Management of slurry in Gran Canaria Island with full-scale natural treatment systems for wastewater (NTSW). One year experience in livestock farms. *Journal of Environmental Management*, 232, 666-678. <https://doi.org/https://doi.org/10.1016/j.jenvman.2018.11.073>
- Ministry of Agriculture and Rural Development. (2022). *Circular No. 28/2022/TT-BNNPTNT of the Ministry of Agriculture and Rural Development: Promulgating the National Technical Regulation on Livestock Wastewater for Crop Irrigation*. Hanoi
- Ministry of Natural Resource and Environment, V. (2016). National Technical Regulation on the effluent of livestock. In.
- Ministry of Natural Resources and Environment. (2016). *Circular No. 04/2016 / TT-BTNMT of the Ministry of Natural Resources and Environment: Promulgating national technical regulations on environment*. Hanoi Retrieved from http://vanban.chinhphu.vn/portal/page/portal/chinhphu/hethongvanban?class_id=1&_page=1&mode=detail&document_id=185256
- Nga, N. T. D., Ninh, H. N., Van Hung, P., & Lapar, M. (2014). *Smallholder pig value chain development in Vietnam: Situation analysis and trends*. https://cgspace.cgiar.org/bitstream/handle/10568/53935/pr_situation_analysis_vietnam_web.pdf?sequence=7&isAllowed=y
- Ogishi, A., Zilberman, D., & Metcalfe, M. (2003). Integrated agribusinesses and liability for animal waste. *Environmental Science & Policy*, 6(2), 181-188. [https://doi.org/https://doi.org/10.1016/S1462-9011\(03\)00007-8](https://doi.org/https://doi.org/10.1016/S1462-9011(03)00007-8)
- Pham-Thanh, L., Magnusson, U., Can-Xuan, M., Nguyen-Viet, H., Lundkvist, Å., & Lindahl, J. (2020). Livestock Development in Hanoi City, Vietnam—Challenges and Policies [Policy and Practice Reviews]. *Frontiers in Veterinary Science*, Volume 7 - 2020. <https://doi.org/10.3389/fvets.2020.00566>
- Ragas, A. M. J., Scheren, P. A. G. M., Konterman, H. I., Leuven, R. S. E. W., Vugteveen, P., Lubberding, H. J., Niebeek, G., & Stortelder, P. B. M. (2005). Effluent standards for

- developing countries: combining the technology- and water quality-based approach. *Water Science and Technology*, 52(9), 133-144. <https://doi.org/10.2166/wst.2005.0304>
- Roubík, H., Mazancová, J., Banout, J., & Verner, V. (2016). Addressing problems at small-scale biogas plants: a case study from central Vietnam. *Journal of Cleaner Production*, 112, 2784-2792. <https://doi.org/10.1016/j.jclepro.2015.09.114>
- Roubík, H., Mazancová, J., Phung, L. D., & Banout, J. (2018). Current approach to manure management for small-scale Southeast Asian farmers - Using Vietnamese biogas and non-biogas farms as an example. *Renewable Energy*, 115, 362-370. <https://doi.org/https://doi.org/10.1016/j.renene.2017.08.068>
- Thien Thu, C. T., Cuong, P. H., Hang, L. T., Chao, N. V., Anh, L. X., Trach, N. X., & Sommer, S. G. (2012). Manure management practices on biogas and non-biogas pig farms in developing countries – using livestock farms in Vietnam as an example. *Journal of Cleaner Production*, 27, 64-71. <https://doi.org/10.1016/j.jclepro.2012.01.006>
- Tsarakakis, K. P., Mara, D. D., & Angelakis, A. N. (2003). Application of Cost Criteria for Selection of Municipal Wastewater Treatment Systems. *Water, Air, and Soil Pollution*, 142(1), 187-210. <https://doi.org/10.1023/A:1022032232487>
- Tu, V. H., Kopp, S. W., Trang, N. T., Hong, N. B., & Yabe, M. (2021). Land accumulation: An option for improving technical and environmental efficiencies of rice production in the Vietnamese Mekong Delta. *Land Use Policy*, 108, 105678. <https://doi.org/https://doi.org/10.1016/j.landusepol.2021.105678>
- USDA. (2025). *Top Producing Countries*. US Retrieved from <https://fas.usda.gov/data/production/commodity/0113000>
- Vietnamese Government. (2016a). *Decree No. 154/2016/ND-CP of the Vietnamese Government: On charges for wastewater*. Retrieved from http://vanban.chinhphu.vn/portal/page/portal/chinhphu/hethongvanban?class_id=1&_page=1&mode=detail&document_id=187188
- Vietnamese Government. (2016b). *Decree No. 155/2016/NĐ-CP on the penalties for violations in the environmental sector*. Hanoi
- WEPA. (2017). WEPA Group Workshop on Pig Wastewater Management in Asia. In: Water Environment Partnership in Asia.
- Yin, Z., Chen, Q., Zhao, C., Fu, Y., Li, J., Feng, Y., & Li, L. (2020). A new approach to removing and recovering phosphorus from livestock wastewater using dolomite. *Chemosphere*, 255, 127005. <https://doi.org/https://doi.org/10.1016/j.chemosphere.2020.127005>