

DAFTAR PUSTAKA

- Abbass, K., Qasim, M. Z., Song, H., Murshed, M., Mahmood, H., & Younis, I. (2022). A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environmental Science and Pollution Research*, 29(28), 42539–42559. <https://doi.org/10.1007/s11356-022-19718-6>
- Abdallah, A. H. (2016). Agricultural credit and technical efficiency in Ghana: is there a nexus? *Agricultural Finance Review*, 76(2), 309–324. <https://doi.org/10.1108/AFR-01-2016-0002>
- Abedullah, A., Khuda Bakhsh, K. B., & Ahmad, B. (2006). Technical Efficiency and its Determinants in Potato Production, Evidence from Punjab, Pakistan. *The Lahore Journal of Economics*, 11(2), 1–22. <https://doi.org/10.35536/lje.2006.v11.i2.a1>
- Abedullah, Kouser, S., & Mushtaq, K. (2010). Environmental Efficiency Analysis of Basmati Rice Production in Punjab , Pakistan : Implications for Sustainable Agricultural Development. *The Pakistan Development Review*, 49(1), 57–72.
- Addharu, E., Barus, B., & Kinseng, R. A. (2021). Land suitability evaluation for Pepper (piper nigrum L.) in West Lampung regency. *IOP Conference Series: Earth and Environmental Science*, 694, 1–10. <https://doi.org/10.1088/1755-1315/694/1/012055>
- Adegbite, O., & Adeoye, I. B. (2015). Technical Efficiency of Pineapple Production in Osun State , Nigeria Agris on-line Papers in Economics and Informatics Technical Efficiency of Pineapple Production in Osun State , Nigeria Keywords : *Agris On-Line Papers in Economics and Informatics*, VII(1), 1–12. <https://doi.org/10.7160/aol.2015.070101>
- Adiyoga, W. (1999). Beberapa Alternatif Pendekatan untuk Mengukur Efisiensi atau In-efisiensi dalam Usahatani. *Informatika Pertanian*, 8(Desember), 488–496.
- Afriat, S. N. (1972). Efficiency Estimation of Production Functions. *International Economic Review*, 13(3), 568. <https://doi.org/10.2307/2525845>
- Agussabti, A., Romano, R., Rahmaddiansyah, R., & Isa, R. M. (2020). Factors affecting risk tolerance among small-scale seasonal commodity farmers and strategies for its improvement. *Heliyon*, 6(July), 1–8. <https://doi.org/10.1016/j.heliyon.2020.e05847>
- Aigner, D. J., & Chu, S. F. (1968). On estimating the industry production function. *American Economic Association*, 58(4), 826–839.
- Aigner, D., Lovell, C. A. K., & Schmidt, P. (1977). Formation and Estimation of Stochastic Frontier Production Function Models. *Journal Of Econometrics*, 6, 21–37. [https://doi.org/10.1016/0304-4076\(77\)90052-5](https://doi.org/10.1016/0304-4076(77)90052-5)
- Ajapnwa, A., Bidogeza, J. C., Minkoua N, J. R., & Afari-Sefa, V. (2017). Efficiency and productivity analysis of vegetable farming within root and tuber-based systems

in the humid tropics of Cameroon. *Journal of Integrative Agriculture*, 16(8), 1865–1873. [https://doi.org/10.1016/S2095-3119\(17\)61662-9](https://doi.org/10.1016/S2095-3119(17)61662-9)

Alboghdady, M. A. (2014). Nonparametric Model for Measuring Impact of Inputs Density on Egyptian Tomato Production Efficiency. *International Journal of Food and Agricultural Economics*, 2(4), 81–90.

Alder, J., Zeller, D., Pitcher, T., & Sumaila, R. (2002). A method for evaluating marine protected area management. *Coastal Management*, 30(2), 121–131. <https://doi.org/10.1080/089207502753504661>

Ali, I., Xue-xi, H. U. O., Khan, I., Ali, H., Baz, K., & Khan, S. U. (2019). Technical efficiency of hybrid maize growers : A stochastic frontier model approach. *Journal of Integrative Agriculture*, 18(10), 2408–2421. [https://doi.org/10.1016/S2095-3119\(19\)62743-7](https://doi.org/10.1016/S2095-3119(19)62743-7)

Ali, Q., Ashfaq, M., Khan, M. T. I., Bakhsh, K., & Waseem, M. (2017). An Efficiency Analysis of Off-Season Tomato Production in Punjab: A Data Envelopment Analysis Approach. *Pakistan Journal of Life and Social Sciences*, 15(3), 169–177. www.pjlss.edu.pk

Amandasari, M. (2014). *Efisiensi Teknis Usahatani Jagung Manis Di Kecamatan Tenjolaya Kabupaten Bogor: Pendekatan Data Envelopment Analysis*. Institut Pertanian Bogor.

Andani, A., Irham, I., Jamhari, J., & Suryantini, A. (2022). Multifaceted social and environmental disruptions impact on smallholder plantations' resilience in Indonesia. *Scientific World Journal*, 2022. <https://doi.org/10.1155/2022/6360253>

Andaregie, A., Worku, A., & Astatkie, T. (2020). Analysis of economic efficiency in charcoal production in Northwest Ethiopia: A Cobb-Douglas production frontier approach. *Trees, Forests and People*, 2(May), 100020. <https://doi.org/10.1016/j.tfp.2020.100020>

Asadullah, M. . dan S. R. (2005). Farm Productivity and Efficiency in Rural Bangladesh: the role of Education revisited. *CSAE WPS/2005-10*.

Ascarya, & Yumanita, D. (2006). Analisis Efisiensi Perbankan Syariah di Indonesia. *TAZKIA Islamic Finance and Business Review*, 1(2), 2–27.

Asnawi, R., Arifin, B., Zakaria, W. A., Banuwa, I. S., Abidin, Z., Lampung, B., Lampung, B., & Lampung, B. (2020). Analysis of Key Variables For Rice Farming Sustainability In The Downstream Of Sekampung Watershed : An Application Of Micmac Method. *Plant Archives*, 20(2), 7895–7904.

Assouto, A. B., Houensou, D. A., & Semedo, G. (2020). Price risk and farmers' decisions: A case study from Benin. *Scientific African*, 8, 1–11. <https://doi.org/10.1016/j.sciaf.2020.e00311>

Azam Md, S., & Shaheen, M. (2019). Decisional factors driving farmers to adopt organic farming in India : a cross-sectional study. *International Journal Of Social Economics*, 46(4), 562–580. <https://doi.org/10.1108/IJSE-05-2018-0282>

- Azwar, S. (2019). *Reliabilitas dan Validitas Edisi 4*. Pustaka Pelajar.
- Badan Pusat Statistik. (2008). *Hasil Pencacahan Lengkap Sensus Penduduk Indonesia Menurut Propinsi dan Kabupaten*. Badan Pusat Statistik Indonesia.
- Badan Pusat Statistik. (2023a). *Galing Kecamatan Galing Dalam Angka 2023*. Badan Pusat Statistik Kabupaten Sambas.
- Badan Pusat Statistik. (2023b). *Kabupaten Bengkayang Dalam Angka 2023*. Badan Pusat Statistik Kabupaten Bengkayang.
- Badan Pusat Statistik. (2023c). *Kabupaten Sanggau Dalam Angka 2023*. Badan Pusat Statistik Kabupaten Sanggau.
- Badan Pusat Statistik. (2023d). *Kecamatan Sekayam Dalam Angka 2023*. Badan Pusat Statistik Kabupaten Sanggau.
- Badan Pusat Statistik. (2023e). *Kecamatan Seluas Dalam Angka 2023*. Badan Pusat Statistik Kabupaten Bengkayang.
- Badan Pusat Statistik. (2023f). *Provinsi Kalimantan Barat Dalam Angka 2023*. Badan Pusat Statistik Kalimantan Barat.
- Badan Pusat Statistik. (2023g). *Statistik Daerah Kabupaten Sambas*. Badan Pusat Statistik Kabupaten Sambas.
- Bakri, B., Rustiadi, E., Fauzi, A., & Adiwibowo, S. (2016). *Assessment of Regional Sustainable Development in Indonesia*. 6(11), 191–200.
- Bakrie, B., Sirnawati, E., Rohaeni, E. S., Hutahaeen, L., & Santoso, A. D. (2023). *International Journal of Sustainable Development and Planning Sustainability Analysis of Intensive Duck Farming System in Sliyeg District , Indonesia : MDS and MICMAC Analysis Approach*. 18(10), 3181–3193.
- Banker, R., Emrouznejad, A., Vargas, F., & Flores, P. (2014). Sustainable Development and Performance Measurement. *Proceedings of the International DEA Workshop, September 17-19*. <https://doi.org/10.13140/RG.2.1.1387.2169>
- Bartzas, G., & Komnitsas, K. (2020). An integrated multi-criteria analysis for assessing sustainability of agricultural production at regional level. *Information Processing in Agriculture*, 7(2), 223–232. <https://doi.org/10.1016/j.inpa.2019.09.005>
- Baser, U., & Bozoglu, M. (2020). Chestnut blight and technical efficiency in chestnut production: Case study of Aydin Province , Turkey. *Scientia Horticulturae*, 263(August 2019), 1–7. <https://doi.org/10.1016/j.scienta.2019.109048>
- Bashir, M. K., & Mehmood, Y. (2010). Institutional credit and rice productivity: A case study of District Lahore, Pakistan. *China Agricultural Economic Review*, 2(4), 412–419. <https://doi.org/10.1108/17561371011097722>
- Battese, G. E., & Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics*, 20(2), 325–332. <https://doi.org/10.1007/BF01205442>

- Bavorova, M., Ponkina, E. V., & Imamverdiyev, N. (2020). Effect of adoption of sustainable crop production systems on farm economics. *Environment, Development and Sustainability*, 22(7), 6961–6984. <https://doi.org/10.1007/s10668-019-00522-1>
- Benedetti, I., Branca, G., & Zucaro, R. (2019). Evaluating input use efficiency in agriculture through a stochastic frontier production : An application on case study in Apulia (Italy). *Journal of Cleaner Production*, 236, 117609. <https://doi.org/10.1016/j.jclepro.2019.117609>
- Benjumea-arias, M. L., & Arias, A. V. (2016). Structural Analysis of Strategic Variabel Through MICMAC Use : Case Study. *Mediterranean Journal of Social Sciences MCSER Publishing*, 7(4), 2039–9340. <https://doi.org/10.5901/mjss.2016.v7n4p>
- Birachi, E. A., Ochieng, J., Wozemba, D., Ruraduma, C., & Ochieng, D. (2011). Factors influencing small-holder farmers' bean production and supply to market in Burundi. *African Crop Science Journal*, 19(4), 335–342.
- Biswas, R., Molla, M. M. U., Faisal-E-Alam, M., Zonayet, M., & Castanho, R. A. (2023). Profitability analysis and input use efficiency of maize cultivation in selected areas of Bangladesh. *Land*, 12(23), 1–23. <https://doi.org/10.3390/land12010023>
- Bopp, C., Engler, A., Poortvliet, P. M., & Jara-Rojas, R. (2019). The role of farmers' intrinsic motivation in the effectiveness of policy incentives to promote sustainable agricultural practices. *Journal of Environmental Management*, 244(May), 320–327. <https://doi.org/10.1016/j.jenvman.2019.04.107>
- Bosetti, V., & Buchner, B. (2009). Data Envelopment Analysis of different climate policy scenarios. *Ecological Economics*, 68(5), 1340–1354. <https://doi.org/10.1016/j.ecolecon.2008.09.007>
- Bosetti, V., & Locatelli, G. (2011). A Data Envelopment Analysis Approach to the Assessment of Natural Parks' Economic Efficiency and Sustainability. The Case of Italian National Parks. *SSRN Electronic Journal*, 1. <https://doi.org/10.2139/ssrn.718621>
- Bozoğlu, M., & Ceyhan, V. (2007). Measuring the technical efficiency and exploring the inefficiency determinants of vegetable farms in Samsun province, Turkey. *Agricultural Systems*, 94(3), 649–656. <https://doi.org/10.1016/j.agsy.2007.01.007>
- Bravo-ureta, B. E., Higgins, D., & Arslan, A. (2020). Irrigation infrastructure and farm productivity in the Philippines: A stochastic Meta-Frontier analysis. *World Development*, 135, 105073. <https://doi.org/10.1016/j.worlddev.2020.105073>
- Bravo-Ureta, B. E., & Pinheiro, A. E. (1993). Efficiency Analysis of Developing Country Agriculture: A Review of the Frontier Function Literature. *Agricultural and Resource Economics Review*, 22(1), 88–101. <https://doi.org/10.1017/s1068280500000320>
- Bravo-Ureta, B. E., Solís, D., Moreira López, V. H., Maripani, J. F., Thiam, A., & Rivas, T. (2007). Technical efficiency in farming: A meta-regression analysis. *Journal of Productivity Analysis*, 27(1), 57–72. <https://doi.org/10.1007/s11123-006-0025-3>

- Cahyono, Y. E., & Widyawati, N. (2023). Pengaruh Jenis Pupuk Kandang Dalam Media Tanam Terhadap Pertumbuhan Stek Batang Tanamn Lada (*Piper Nigrum* L.) Varietas Natar. *Agrisainfika Jurnal Ilmu-Ilmu Pertanian*, 7(2), 179–183.
- Castoldi, N., & Bechini, L. (2010). Integrated sustainability assessment of cropping systems with agro-ecological and economic indicators in northern Italy. *European Journal of Agronomy*, 32(1), 59–72. <https://doi.org/10.1016/j.eja.2009.02.003>
- Cecchini, L., Venanzi, S., Pierri, A., & Chiorri, M. (2018). Environmental efficiency analysis and estimation of CO2 abatement costs in dairy cattle farms in Umbria (Italy): A SBM-DEA model with undesirable output. *Journal of Cleaner Production*, 197, 895–907.
- Chandio, A. A., Jiang, Y., Tezera, A., & Dunya, R. (2019). The Nexus of Agricultural Credit , Farm Size and Technical Efficiency in Sindh , Pakistan : A Stochastic Production Frontier Approach. *Journal of the Saudi Society of Agricultural Sciences*, 18(3), 348–354. <https://doi.org/10.1016/j.jssas.2017.11.001>
- Changthom, C., Chaikul, S., & Sukhumpinij, P. (2017). Effect of Pole Types and NPK Fertilizer Rates on the Early Growth of Black Pepper (*Piper nigrum* Linn .) following , summer season (Febuary - May), rainy season (May - October) and experiment start was shown in Table 1 . The experiment was conducted. *International Journal Of Agricultural Technology*, 13, 1547–1557.
- Coelli, T. ., Rao, D. S. P., & Battese, G. E. (1998). *An introduction to efficiency and productivity analysis*. Springer Science+Business Media, LLC.
- Coelli, T. J. (1996). Centre for Efficiency and Productivity Analysis. *CEPA Working Papers*, 7, 1–33.
- Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An Introduction To Efficiency And productivity Analysisi* (Second Edi). Kluwer Academic Publisher.
- Creswell, J. W. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications.
- Dampa, Y. (2003). *Dampak Pengembangan Kakao Bagi Ekonomi Rumah Tangga Tani Arfak di Kabupaten Manokwari*. Universitas Gadjah Mada.
- Dang, H. Le, Li, E., Nuberg, I., & Bruwer, J. (2019). Factors influencing the adaptation of farmers in response to climate change: a review. *Climate and Development*, 11(9), 765–774. <https://doi.org/10.1080/17565529.2018.1562866>
- Danso-Abbeam, G., Ehiakpor, D. S., & Aidoo, R. (2018). Agricultural extension and its effects on farm productivity and income: Insight from Northern Ghana. *Agriculture and Food Security*, 7(1), 1–10. <https://doi.org/10.1186/s40066-018-0225-x>
- Dantsis, T., Douma, C., Giourga, C., Loumou, A., & Polychronaki, E. A. (2010). A methodological approach to assess and compare the sustainability level of agricultural plant production systems. *Ecological Indicators*, 10(2), 256–263.

<https://doi.org/10.1016/j.ecolind.2009.05.007>

- David, J. (2016). Percepatan Pengembangan Lada Sebagai Komoditas Strategis di Kalimantan Barat. *Prosiding Seminar Nasional Agriinovasi Spesifik Lokasi Untuk Ketahanan Pangan Pada Era Masyarakat Ekonomi ASEAN*, 1335–1364.
- Debertin, D. L. (1986). *Agricultural Production Economics* (Second Edi). Mcmillan Publishing Company.
- Defidelwina. (2020). *Efisiensi, Risiko Produksi Dan Perilaku Petani Terhadap Risiko Pada Usahatani Padi Sawah Irigasi Di Kabupaten Rokan Hulu*. Universitas Gajah Mada, Yogyakarta.
- Deng, F., Liu, C., & Liang, X. (2017). Measurement of regional agricultural sustainable development system based on dissipative structure theory: A case study in Sichuan Province, China. *Sustainability (Switzerland)*, 9(11), 1–19. <https://doi.org/10.3390/su9112047>
- Dhungana, B. R., Nuthall, P. L., & Nartea, G. V. (2004). Measuring the economic inefficiency of Nepalese rice farms using data envelopment analysis. *Australian Journal of Agricultural and Resource Economics*, 48(2), 347–369. <https://doi.org/10.1111/j.1467-8489.2004.00243.x>
- Direktorat Jenderal Perkebunan. (2021). *Statistik Perkebunan Nasional 2019-2021*. Direktorat Jenderal Perkebunan dan Kementerian Pertanian Republik Indonesia.
- Direktorat Jenderal Perkebunan. (2023). *Statistik Perkebunan Unggulan Nasional 2021-2023*. Direktorat Jenderal Perkebunan Kementerian Pertanian Republik Indonesia.
- Doll, J. P., & Orazem, F. (1984). *Production Economics: Theory with Applications*. John Wiley & Sons.
- Dolorosa, E. (2015). *Analisis Keberlanjutan Usaha Perikanan Tambak Polikultur Bandeng - Udang Windu Di Sekitar Kawasan Mangrove Kabupaten Sambas*. Disertasi Program Doktor Pasca Sarjana Fakultas Pertanian Universitas Gadjah Mada.
- Dong, F., Mitchell, P. D., & Colquhoun, J. (2015). Measuring farm sustainability using data envelope analysis with principal components : The case of Wisconsin cranberry. *Journal of Environmental Management*, 147, 175–183. <https://doi.org/10.1016/j.jenvman.2014.08.025>
- Eder, A., Salhofer, K., & Scheichel, E. (2021). Land tenure , soil conservation , and farm performance : An eco-efficiency analysis of Austrian crop farms. *Ecological Economics*, 180(August 2020), 106861. <https://doi.org/10.1016/j.ecolecon.2020.106861>
- Edison. (2022). The Determinants of Farmers' Technical Efficiency in Corn Production: Empirical Evidence from Jambi Province. *IOP Conference Series: Earth and Environmental Science*, 1097(1). <https://doi.org/10.1088/1755-1315/1097/1/012010>

- Ekanayake, S. A. B., & Jayasuriya, S. K. (1987). Firm-specific technical efficiency: a comparison of methods. *Journal of Agricultural Economics*, 38(1), 115–122.
- Elahi, E., Abid, M., Zhang, L., ul Haq, S., & Sahito, J. G. M. (2018). Agricultural advisory and financial services; farm level access, outreach and impact in a mixed cropping district of Punjab, Pakistan. *Land Use Policy*, 71, 249–260. <https://doi.org/10.1016/j.landusepol.2017.12.006>
- Elkington, J. (1994). Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California Management Review*, 90–100.
- Erlinda, N. (2016). Kebijakan Pembangunan Wilayah Berkelanjutan Di Provinsi Jambi Melalui Pendekatan Model Flag. *Jurnal Ekonomi Dan Kebijakan Publik*, 7(1), 1. <https://doi.org/10.22212/jekp.v7i1.416>
- Erlinda, N., Fauzi, A., Sutomo, S., & Kumala Putri, E. I. (2016). Assessment of Sustainable Regional Development Policies: A Case Study of Jambi Province, Indonesia. *Economics World*, 4(5), 224–237. <https://doi.org/10.17265/2328-7144/2016.05.003>
- Erny. (2020). *Efisiensi dan Perilaku Petani terhadap Risiko Produksi pada Usahatani Bawang Varietas Lembah Palu Di Kabupaten Sigi*. Disertasi Program Doktor Pasca Sarjana Fakultas Pertanian Universitas Gadjah Mada, Yogyakarta.
- Evizal, R., & Prasmatiwi, F. E. (2021). Farmers' perception to climate change and adaptation to sustain black pepper production in North Lampung, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 739(1), 1–8. <https://doi.org/10.1088/1755-1315/739/1/012019>
- Evizal, Rusdi. (2023). *Pengelolaan Perkebunan Lada*. Pusaka Media.
- FAO. (2015). Sustainable agriculture A tool to strengthen food security and nutrition in Latin America and the Caribbean. In *Food And Agriculture Organization*.
- Farrel, M. J. (1957). The Measurement of Productive Efficiency. *Journal of The Royal Statistical Society*, 120(3), 253–290.
- Fauzi, A. (2019). *Teknis Analisis Keberlanjutan*. PT Gramedia.
- Fauzi, A., & Anna, S. (2002). Evaluasi Status Keberlanjutan Pembangunan Perikanan : Aplikasi Pendekatan RAPFISH (Studi Kasus Pesisir DKI Jakarta). *Jurnal Pesisir Dan Lautan*, 4(3), 43–55.
- Fauzi, A., & Anna, S. (2005). *Pemodelan sumber daya perikanan dan lautan untuk analisis kebijakan*. Gramedia Pustaka Utama.
- Ferreira, M. D. P., & Féres, J. G. (2020). Land Use Policy Farm size and Land use efficiency in the Brazilian Amazon. *Land Use Policy*, 99(July), 104901. <https://doi.org/10.1016/j.landusepol.2020.104901>
- Galán-Martín, Á., Guillén-Gosálbez, G., Stamford, L., & Azapagic, A. (2016). Enhanced data envelopment analysis for sustainability assessment: A novel

methodology and application to electricity technologies. *Computers and Chemical Engineering*, 90, 188–200.
<https://doi.org/10.1016/j.compchemeng.2016.04.022>

- Gerdessen, J. C., & Pascucci, S. (2013). Data envelopment analysis of sustainability indicators of european agricultural systems at regional level. *Agricultural Systems*, 118, 78–90. <https://doi.org/10.1016/j.agsy.2013.03.004>
- Ghimire, B., Dhakal, S. C., Marahatta, S., & Bastakoti, R. C. (2023). Technical efficiency and its determinants on lentil (*Lens culunaris*) production in Nepal. *Farming System*, 1(3), 100045. <https://doi.org/10.1016/j.farsys.2023.100045>
- Gibson, R. B., Hassan, S., Holtz, S., Tansey, J., & Whitelaw, G. (2005). *Sustainable Assessment Criteria and Processes*. Earthscan from Routledge.
- Godet, M. (1994). *From Anticipation To Action. A handbook of strategic prospective*. UNESCO Publishing.
- Godet, M. (2006). *Creating Future : Scenario Planning As A Strategic Management Tool*. London: Economica.
- Greene, W. H. (1993). *The Econometric Approach to Efficiency Analysis*, in H. O. Fried, C. A. K. Lovell and S. S. Schmidt (eds). *The Measurement of Productive Efficiency: Techniques and Applications*. Oxford University Press.
- Gusta, A. R., & Same, M. (2021). The effect of organic fertilizer and NPK on the growth of the master pepper plants. *IOP Conference Series: Earth and Environmental Science*, 1012, 1–7. <https://doi.org/10.1088/1755-1315/1012/1/012028>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis (7th Edition)*. Pearson Prentice Hall.
- Hallam, D., & Machado, F. (1996). Comment on "Efficiency analysis with panel data: A study of Portuguese dairy farms." *European Review of Agricultural Economics*, 23, 79–93. <https://doi.org/10.1093/erae/25.2.259>
- Hermanides, G., & Nijkamp, P. (1998). *Multicriteria evaluation of sustainable agricultural land use: a case study of Lesvos*. 61–78. https://doi.org/10.1007/978-94-015-9058-7_5
- Herrera, B., Gerster-Bentaya, M., & Knierim, A. (2016). Stakeholder's perception of sustainability measurement at farm level. *Agricultural Economics*, 118, 131–137.
- Hoque, F., Afrin, S., Akter, A., Khatun, M., Beg, T. H., Afrin, T., & Yoezer, K. (2021). Measuring technical efficiency of the cauliflower cultivation in Bangladesh: A case study on Dhaka district. *Journal of Applied Horticulture*, 23(1), 54–58. <https://doi.org/10.37855/jah.2021.v23i01.11>
- Hoque, F., Akter, A., & Rungsuriyawiboon, S. (2019). Measuring technical efficiency of bottle gourd and brinjal farming in Dhaka district of Bangladesh: Stochastic frontier approach. *Journal of Applied Horticulture*, 21(3), 182–188. <https://doi.org/10.37855/jah.2019.v21i03.31>

- Huppess, G., & Ishikawa, M. (2005). A Framework for Quantified Eco-Efficiency Analysis. *Journal of Industrial Ecology*, 9(4), 25–41.
- Imelda, Mulyo, J. H., Suryantini, A., & Masyhuri. (2023). Understanding farmers' risk perception and attitude: A case study of rubber farming in West Kalimantan, Indonesia. *AIMS Agriculture and Food*, 8(1), 164–186. <https://doi.org/10.3934/AGRFOOD.2023009>
- Indah, L. S. M., Arifin, B., Ambya, & Syahidah, N. B. (2023). Economic Transformation of Pepper Farmer ' s Households in Lampung Province. *IOP Conference Series: Earth and Environmental Science*, 1–8. <https://doi.org/10.1088/1755-1315/1153/1/012010>
- Irawan, A. (2021). Adaptation strategy to climate change among white pepper smallholder farmers in Bangka-Belitung, Indonesia. *Cuadernos de Desarrollo Rural*, 18, 1–11. <https://doi.org/10.11144/JAVERIANA.CDR18.ASCC>
- Islam, S., Mitra, S., & Khan, M. A. (2023). Technical and cost efficiency of pond fish farms: Do young educated farmers bring changes? *Journal of Agriculture and Food Research*, 12(January), 100581. <https://doi.org/10.1016/j.jafr.2023.100581>
- Jambo, I. J., Groot, J. C. J., Descheemaeker, K., Bekunda, M., & Tiftonell, P. (2019). Motivations for the use of sustainable intensification practices among smallholder farmers in Tanzania and Malawi. *NJAS - Wageningen Journal of Life Sciences*, 89, 1–10. <https://doi.org/10.1016/j.njas.2019.100306>
- Jondrow, J., Knox Lovell, C. A., Materov, I. S., & Schmidt, P. (1982). On the estimation of technical inefficiency in the stochastic frontier production function model. *Journal of Econometrics*, 19(2–3), 233–238. [https://doi.org/10.1016/0304-4076\(82\)90004-5](https://doi.org/10.1016/0304-4076(82)90004-5)
- Junaidi, E., Jamhari, & Masyhuri. (2023). Comparative Analysis of Contract Farming Effect on Technical Efficiency of Broiler Chicken Farms in. *Journal of World's Poultry Research*, 13(2), 223–232. <https://dx.doi.org/10.36380/jwpr.2023.25>
- Kadiri, F. A., Eze, C. ., Orebiyi, J. S., Lemchi, J. I., Ohajianya, D. O., & Nwaiwu, I. U. (2014). Technical Efficiency In Paddy Rice Production In Niger Delta Region Of Nigeria. *European Centre For Reseach Training And Development UK*, 2(2), 33–43.
- Key, N., Prager, D. L., & Burns, C. B. (2018). The income volatility of U.S. Commercial farm households. *Applied Economic Perspectives and Policy*, 40(2), 215–239. <https://doi.org/10.1093/AEPP/PPY006>
- Khan, N. A., Ali, M., Ahmad, N., Abid, M. A., & Kusch-Brandt, S. (2022). Technical Efficiency Analysis of Layer and Broiler Poultry Farmers in Pakistan. *Agriculture (Switzerland)*, 12(10). <https://doi.org/10.3390/agriculture12101742>
- Khumbakar, S., & Lovell, C. A. K. (2000). *Stochastic Frontier Analysis*. Cambridge University Press.
- Kibona, C. A., Yuejie, Z., & Tian, L. (2022). Factors that influence beef meat production in Tanzania. A Cobb-Douglas production function estimation

approach. *PLoS ONE*, 17(8 August), 1–13.
<https://doi.org/10.1371/journal.pone.0272812>

Kodde, D. A., & Palm, F. C. (1986). Wald Criteria for Jointly Testing Equality and Inequality Restrictions. *Econometrica*, 54(5), 1243–1248.

Korgitet, H. S., & Biru, M. W. (2019). The effect of farmers education on farm productivity: Evidence from small - scale maize producing farmers in North Bench District, Bench Maji zone. *Research on Humanities and Social Sciences*, 9(17), 26–34. <https://doi.org/10.7176/rhss/9-17-04>

Kuhlman, T., & Farrington, J. (2010). What is sustainability? *Sustainability*, 2(11), 3436–3448. <https://doi.org/10.3390/su2113436>

Kuhn, L., Balezentis, T., Hou, L., & Wang, D. (2020). China Economic Review Technical and environmental efficiency of livestock farms in China: A slacks-based DEA approach. *China Economic Review*, 62(5), 101213. <https://doi.org/10.1016/j.chieco.2018.08.009>

Kumar, A., Rohila, A. K., & Pal, V. K. (2018). Profitability and resource use efficiency in vegetable cultivation in Haryana: Application of Cobb-Douglas production model. *Indian Journal of Agricultural Sciences*, 88(7), 153–157. <https://doi.org/10.56093/ijas.v88i7.81601>

Kumar, B. M., Sasikumar, B., & Kunhamu, T. K. (2021). Agroecological aspects of black pepper (*Piper nigrum* L.) cultivation in kerala: A review. *Agrivita*, 43(3), 648–664. <https://doi.org/10.17503/agrivita.v43i3.3005>

Lancker, E., & Nijkamp, P. (2000). A policy scenario analysis of sustainable agricultural development options: A case study for Nepal. *Impact Assessment and Project Appraisal*, 18(2), 111–124. <https://doi.org/10.3152/147154600781767493>

Latruffe, L., Davidova, S., & Balcombe, K. (2008). Application of a double bootstrap to investigation of determinants of technical efficiency of farms in Central Europe. *Journal of Productivity Analysis*, 29(2), 183–191. <https://doi.org/10.1007/s11123-007-0074-2>

Lau, L. J., & Yotopoulos, P. a. (1971). A test for relative efficiency and application to Indian agriculture. *The American Economic Review*, 61(1), 94–109.

Leavy, P. (2017). *Research Design. Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches*. The Guilford Press.

Li, C. (2023). Climate change impacts on rice production in Japan: A Cobb-Douglas and panel data analysis. *Ecological Indicators*, 147, 110008. <https://doi.org/10.1016/j.ecolind.2023.110008>

Lipsey, R. ., Steiner, P. ., & Purvis, D. . (1987). *Economics. Eight Edition*. Harper dan Row Publishers.

Listiana, I., Yanfika, H., Bursan, R., Jimad, H., Riantini, M., Widyastuti, R. A. D.,

- Mutolib, A., & Rahmat, A. (2022). Farmers perception of climate change on Pepper (*Pipper nigrum* L.) productivity of in East Lampung district. *IOP Conference Series: Earth and Environmental Science*, 1027, 1–6. <https://doi.org/10.1088/1755-1315/1027/1/012021>
- Mahananto, Sutrisno, S., & Ananda, C. (2009). Faktor- Faktor yang Mempengaruhi Produksi Padi Studi Kasus di Kecamatan Nogosari, Boyolali, Jawa Tengah. *Wacana*, 12 No.1(1), 179–191. <http://wacana.ub.ac.id/index.php/wacana/article/view/181>
- Mahmood, N., Arshad, M., Kächele, H., Ullah, A., & Müller, K. (2020). Economic efficiency of rainfed wheat farmers under changing climate: Evidence from Pakistan. *Environmental Science and Pollution Research*, 27(27), 34453–34467. <https://doi.org/10.1007/s11356-020-09673-5>
- Mappa, S. R., Jamil, M. H., & Saadah. (2023). Effectiveness of agricultural counseling methods during the covid-19 pandemic to increasing rice production in Maros District. *IOP Conference Series: Earth and Environmental Science*, 1230, 1–5. <https://doi.org/10.1088/1755-1315/1230/1/012037>
- Mawarnita, C. (2013). *Analisis Kelayakan Usaha Lada (Piper nigrum L.) Di Desa Kundi Kecamatan Simpang Teritip Kabupaten Bangka Barat* (Skripsi. I). IPB Repository.
- Meeusen, W., & Broeck, J. Van Den. (1977). Economics Department of the University of Pennsylvania Institute of Social and Economic Research. *International Economic Review*, 18(2), 435–444.
- Milonda, Evahelda, & Muntoro. (2023). Perilaku Petani Pada Produksi Lada Putih Di Desa Delas , Kecamatan Airgegas , Kabupaten Bangka Selatan. *Journal of Global Sustainable Agriculture*, 4(1), 15–22.
- Mirza, F. M., Najam, N., Mehdi, M., & Ahmad, B. (2015). Determinans Of Technical Efficiency Of Wheat Farm In Pakistan. *Journal of Agriculture and Social Sciences (Pakistan)*, 52(2), 565–570.
- Mohammed, S. T., Bila, Y., & Amaza, P. . (2013). Application of stochastic Frontier function in estimating production efficiency : a dual approach. *Global Journal Of Biodiversity Science And Management*, 3(1), 11–19.
- Msuya, E. E., Hisano, S., & Nariu, T. (2008). Explaining Productivity Variation among Smallholder Maize Farmers in Tanzania. *Rural Sociology of the International Rural Sociology Association, Goyang, Korea 2008*, 81(0), 1–33.
- Mulyani, A., Darwanto, D. H., Widodo, S., & Masyhuri. (2020). Production efficiency of Inpago Unsoed-1 and Situbagendit rice farming in Central Java, Indonesia. *Biodiversitas*, 21(7), 3276–3286. <https://doi.org/10.13057/biodiv/d210751>
- Munasinghe, M. (2004). International Society for Ecological Economics Internet Encyclopaedia of Ecological Economics Sustainomics : A Trans-disciplinary Framework for Making Development More Sustainable. *International Society for Ecological Economics*, December, 18.

- Munda, G., & Saisana, M. (2011). Methodological considerations on regional sustainability assessment based on multicriteria and sensitivity analysis. *Regional Studies*, 45(2), 261–276. <https://doi.org/10.1080/00343401003713316>
- Murillo-Zamorano, L. R. (2004). Economic efficiency and frontier techniques. *Journal of Economic Surveys*, 18(1), 33–77. <https://doi.org/10.1111/j.1467-6419.2004.00215.x>
- Musyafak, A. (2012). *Optimasi Usahatani Berkelanjutan Berbasis Crop Livestock System Dan Ketahanan Pangan Rumah Tangga Petani Di Lahan Pasang Surut Kalimantan Barat. Disertasi Program Doktor*. Universitas Gadjah Mada.
- Nabuuma, D., Ekesa, B., Faber, M., & Mbhenyane, X. (2021). Community perspectives on food security and dietary diversity among rural smallholder farmers : A qualitative study in central Uganda. *Journal of Agriculture and Food Research*, 5, 100183. <https://doi.org/10.1016/j.jafr.2021.100183>
- Nahraeni, W. (2012). Efisiensi dan Nilai Keberlanjutan Usahatani Sayuran Dataran Tinggi di Provinsi Jawa Barat [Institut Pertanian Bogor]. In *Disertasi S3, Sekolah Pascasarjana, Institut Pertanian Bogor*. <http://repository.ipb.ac.id/jspui/bitstream/123456789/61310/1/2012wna.pdf>
- Nakano, Y., Tsusaka, T. W., Aida, T., & Pede, V. O. (2018). Is farmer-to-farmer extension effective? The impact of training on technology adoption and rice farming productivity in Tanzania. *World Development*, 105, 336–351. <https://doi.org/10.1016/j.worlddev.2017.12.013>
- Nijkamp, P., & Vreeker, R. (2000). Sustainability assessment of development scenarios: Methodology and application to Thailand. *Ecological Economics*, 33(1), 7–27. [https://doi.org/10.1016/S0921-8009\(99\)00135-4](https://doi.org/10.1016/S0921-8009(99)00135-4)
- Nikmah, A., Fauziyah, E., & Rum, M. (2013). Analisis produktivitas usahatani jagung hibrida di Kabupaten Sumenep. *Agriekonomika*, 2(2), 96–107.
- Nysanth, N. S., Divya, S., Nair, C. B., Anju, A. B., Praveena, R., & Anith, K. N. (2022). Biological control of foot rot (*Phytophthora capsici* Leonian) disease in black pepper (*Piper nigrum* L.) with rhizospheric microorganisms. *Rhizosphere*, 23(February), 100578. <https://doi.org/10.1016/j.rhisph.2022.100578>
- O'raye, D. O., Daniel, C. O., & Chukwuji, C. O. (2012). Efficiency of Resource Use by Rice Farmers in Ebonyi State, South East Nigeria: A Data Envelopment Analysis. *Asian Journal of Agriculture and Rural Development*, 2(2), 149–154.
- Obare, G. A., Nyagaka, D. O., Nguyo, W., & Mwakubo, S. M. (2010). Are Kenyan smallholders allocatively efficient? Evidence from Irish potato producers in Nyandarua North district. *Journal of Development*, 2(3), 78–85. [http://www.academicjournals.org/jdae/PDF/Pdf2010/Mar/Obare et al.pdf](http://www.academicjournals.org/jdae/PDF/Pdf2010/Mar/Obare%20et%20al.pdf)
- Ogundari, K., & Ojo, S. O. (2006). an Examination of Technical , Economic and Allocative Efficiency of Small Farms : the Case Study of Cassava Farmers in Osun State of Nigeria. *Central European Agriculture*, 7(3), 423–432.
- Omar, Z., & Fatah, F. A. (2021). Determinants of technical efficiency among coconut

smallholder production in Johor, Malaysia: A cobb douglas stochastic frontier production approach. *IOP Conference Series: Earth and Environmental Science*, 757(1). <https://doi.org/10.1088/1755-1315/757/1/012013>

Osti, R., Rizwan, M., Assefa, A. K., Zhou, D., & Bhattarai, D. (2017). Analysis of resource-use efficiency in monsoon and spring rice production in Nepal. *Pakistan Journal of Nutrition*, 16(5), 314–321. <https://doi.org/10.3923/pjn.2017.314.321>

Ozcan, Y. A. (2014). *Health Care Benchmarking and Performance Evaluation An Assessment using Data Envelopment Analysis (DEA)* (Second). Springer.

Paltasingh, K. R., & Goyari, P. (2018). Impact of farmer education on farm productivity under varying technologies: case of paddy growers in India. *Agricultural and Food Economics*, 6(7), 1–19. <https://doi.org/10.1186/s40100-018-0101-9>

Paul, S., & Shankar, S. (2018). On estimating efficiency effects in a stochastic frontier model. *European Journal of Operational Research*, 271(2), 769–774. <https://doi.org/10.1016/j.ejor.2018.05.052>

Piña, W. H. A., & Martínez, C. I. P. (2016). Development and urban sustainability: An analysis of efficiency using data envelopment analysis. *Sustainability (Switzerland)*, 8(2), 1–15. <https://doi.org/10.3390/su8020148>

Pitcher, T. J., & Preikshot, D. (2001). RAPFISH: A rapid appraisal technique to evaluate the sustainability status of fisheries. *Fisheries Research*, 49(3), 255–270. [https://doi.org/10.1016/S0165-7836\(00\)00205-8](https://doi.org/10.1016/S0165-7836(00)00205-8)

Prayoga, G. I., Ropalia, Aini, S. N., Mustikarini, E. D., & Rosalin, Y. (2020). Diversity of black pepper plant (*Piper nigrum*) in Bangka Island (Indonesia) based on agro-morphological characters. *Biodiversitas*, 21(2), 652–660. <https://doi.org/10.13057/biodiv/d210230>

Prihtanti, T. M. (2014). *Kinerja Dan Multifungsionalitas Usahatani Padi Organik dan Konvensional Di Provinsi Jawa Tengah. Disertasi Ilmu-ilmu Petanian UGM*. Universitas Gadjah Mada.

Priyatno, D. (2009). *SPSS untuk Analisis Korelasi, Regresi dan Multivariate*. Penerbit Gawa Media.

Puryantoro, & Mayangsari, A. (2020). Analysis Of The Households Prosperity Of Mango Farmers In Situbondo Through The Good Service Ratio Approach. *Sustainable Business Practices In Digital Environment*, 943–950.

Puspitasari, Kiloes, A. M., & Syah, J. A. (2021). Factors affecting sustainability of increasing mango export: An application of MICMAC method. *IOP Conference Series: Earth and Environmental Science*, 892, 1–8. <https://doi.org/10.1088/1755-1315/892/1/012101>

Rahmawati, N. (2017). *Pengaruh Karakter Kewirausahaan Petani terhadap Efisiensi, Risiko dan Perilaku Risiko Usahatani Semi-Organik di Kabupaten Bantul*. Universitas Gajah Mada, Yogyakarta.

Ranjan, P., Church, S. P., Floress, K., & Prokopy, L. S. (2019). Synthesizing

conservation motivations and barriers: What have we learned from qualitative studies of farmers' behaviors in the United States? *Society and Natural Resources*, 32(11), 1171–1199.
<https://doi.org/10.1080/08941920.2019.1648710>

Rao, I. V. Y. R. (2011). Estimation of Efficiency , Sustainability and Constraints in SRI (System of Rice Intensification) vis-a-vis Traditional Methods of Paddy Cultivation in North Coastal Zone of Andhra Pradesh. *Agricultural Economics Research Review*, 24(December), 325–331.

Rasul, G., & Thapa, G. B. (2004). Sustainability of ecological and conventional agricultural systems in Bangladesh: An assessment based on environmental, economic and social perspectives. *Agricultural Systems*, 79(3), 327–351.
[https://doi.org/10.1016/S0308-521X\(03\)00090-8](https://doi.org/10.1016/S0308-521X(03)00090-8)

Ratnasari, E. D., Susilowati, I., & Maria, N. S. B. (2023). Small-Scale Vannamei Shrimp Farm Business Sustainability Analysis With Micmac: A Study On Kebumen Coastal Area, Indonesia. *International Journal Of Professional. Business Review*, 8(2), 1–23.

Reinhard, S., Knox Lovell, C. A., & Thijssen, G. J. (2000). Environmental efficiency with multiple environmentally detrimental variables; estimated with SFA and DEA. *European Journal of Operational Research*, 121(2), 287–303.
[https://doi.org/10.1016/S0377-2217\(99\)00218-0](https://doi.org/10.1016/S0377-2217(99)00218-0)

Ren, C., Liu, S., Grinsven, H. Van, Reis, S., Jin, S., Liu, H., & Gu, B. (2019). The impact of farm size on agricultural sustainability. *Journal of Cleaner Production*, 220(12), 357–367. <https://doi.org/10.1016/j.jclepro.2019.02.151>

Rini, C. R., & Remya, J. (2020). Management of Phytophthora capsici infection in Black Pepper (Piper nigrum L.) using new generation fungicides and biopesticide. *International Journal of Agriculture Environment and Biotechnology*, 13(1), 71–74. <https://doi.org/10.30954/0974-1712.1.2020.9>

Rubeda, K., Pujiati, A., & Prasetyo, P. E. (2012). Tingkat Efisiensi Bank Umum Di Indonesia. *Dinamika Akuntansi Keuangan Dan Perbankan*, 1(2), 175–200.

Saptana. (2012). Konsep Efisiensi Usahatani Pangan dan Implikasinya Bagi Peningkatan Produktivitas. *Forum Penelitian Agro Ekonomi*, 30(2), 109–128.

Saptana, N., Daryanto, A., Daryanto, H. K., & Kuntjoro, N. (2016). Analisis Efisiensi Teknis Produksi Usahatani Cabai Merah Besar dan Perilaku Petani dalam Menghadapi Risiko. *Jurnal Agro Ekonomi*, 28(2), 153–188.
<https://doi.org/10.21082/jae.v28n2.2010.153-188>

Semerici, A. (2012). Productivity analysis of sunflower cultivations in Turkey. *Bulgarian Journal of Agricultural Science*, 18(6), 873–882.

Soekartawi. (1994). *Teori Ekonomi Produksi dengan Pokok Bahasan Analisis Cobb-Douglas*. PT. Raja Grafindo Persada.

Soekartawi. (1995). *Analisis Usahatani*. UI-Press.

- Soekartawi. (2002). *Prinsip Dasar Ekonomi Pertanian. Teori dan Aplikasi* (Edisi Revi). PT. Raja Grafindo Persada.
- Suek, J. (2018). *Risiko, Inefisiensi Dan keberlanjutan Sistem Wanatani Mamar Di Wilayah Timor Barat*. Universitas Gajah Mada, Yogyakarta.
- Sulok, K. M. T., Ahmed, O. H., Khew, C. Y., & Zehnder, J. A. M. (2018). Introducing Natural Farming in Black Pepper (*Piper nigrum* L.) Cultivation. *International Journal of Agronomy*, 2018, 1–7. <https://doi.org/10.1155/2018/9312537>
- Sumane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., Rios, I. des I., Rivera, M., Chebach, T., & Ashkenazy, A. (2018). Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies*, 59, 232–241. <https://doi.org/10.1016/j.jrurstud.2017.01.020>
- Suratiyah, K. (2015). *Ilmu Usahatani*. Penebar Swadaya.
- Surmaini, E., Sarvina, Y., Susanti, E., Widiarta, I. N., Misnawati, M., Suciantini, S., Fanggidae, Y. R., Rahmini, R., & Dewi, E. R. (2023). Climate change and the future distribution of Brown Planthopper in Indonesia: A projection study. *Journal of the Saudi Society of Agricultural Sciences*, August, 1–12. <https://doi.org/10.1016/j.jssas.2023.10.002>
- Suwarto. (2016). *Lada Produksi 2 ton/ha*. Penebar Swadaya.
- Suyatno, A. (2015). *Efisiensi Dan Keberlanjutan Usahatani Pada Berbagai Agroekosistem Di Kabupaten Mompowah*. Disertasi Program Doktor Pasca Sarjana Fakultas Pertanian Universitas Gadjah Mada.
- Syam, N., Boceng, A., Jufri, N., & Suharman. (2019). Effect of trichoderma and organic fertilizers on vegetatif growth of black Pepper (*Piper nigrum* L.) under field condition. *IOP Conference Series: Earth and Environmental Science*, 260, 1–8. <https://doi.org/10.1088/1755-1315/260/1/012174>
- Syam, Netty, Hidrawati, Sabahannur, S., & Nurdin, A. (2021). Effects of Trichoderma and Foliar Fertilizer on the vegetative growth of Black Pepper (*Piper nigrum* L.) seedlings. *International Journal of Agronomy*, 2021. <https://doi.org/10.1155/2021/9953239>
- Tadesse, B., Tilahun, Y., Bekele, T., & Mekonen, G. (2021). Assessment of challenges of crop production and marketing in Bench-Sheko, Kaffa, Sheka, and West-Omo zones of southwest Ethiopia. *Heliyon*, 7(6), e07319. <https://doi.org/10.1016/j.heliyon.2021.e07319>
- Tamirat, N., & Tadele, S. (2023). Determinants of technical efficiency of coffee production in Jimma Zone, Southwest Ethiopia. *Heliyon*, 9(4), e15030. <https://doi.org/10.1016/j.heliyon.2023.e15030>
- Tao, Z., & Bao, D. X. (2005). Environmental Efficiency Analysis of China's Vegetable Production. *Biomedical And Environmental Sciences*, 18, 21–30.
- Taylor, T. G., Drummond, H. E., & Gomes, A. T. (1986). Agricultural Credit Programs

and Production Efficiency : An Analysis of Traditional Farming in Southeastern Minas Gerais, Brazil. *American Journal Agricultural Economics*, 68, 110–119.

Teklewold, H., Kassie, M., & Shiferaw, B. (2013). Adoption of multiple sustainable agricultural practices in rural Ethiopia. *Journal of Agricultural Economics*, 64(3), 597–623. <https://doi.org/10.1111/1477-9552.12011>

Tim Karya Tani Mandiri. (2017). *Rahasia Sukses Bertanam Lada*. Nuansa Aulia.

Trang Anh, T., Bao Linh, T., Vu Phong, N., Lan Thanh Bien, T., Thi Nha Tram, T., & Dinh Don, L. (2018). Expression of Proteins Related to Phytophthora capsici Tolerance in Black Pepper (*Piper nigrum* L.). *International Journal of Agriculture Innovations and Research*, 6(4), 2319–1473.

Triyono. (2018). *Efisiensi dan keberlanjutan Usahatani Padi Di Daerah Istimewa Yogyakarta*. Disertasi Program Doktor Pasca Sarjana Fakultas Pertanian Universitas Gadjah Mada.

Tun, Y., & Kang, H.-J. (2015). An Analysis on the Factors Affecting Rice Production Efficiency in Myanmar. *East Asian Economic Review*, 19(2), 167–188. <https://doi.org/10.11644/kiep.jeai.2015.19.2.295>

Upton, M. (1979). the Unproductive Production Function. *Journal of Agricultural Economics*, 30(2), 179–194. <https://doi.org/10.1111/j.1477-9552.1979.tb01494.x>

Van Passel, S., Van Huylenbroeck, G., Lauwers, L., & Mathijs, E. (2009). Sustainable value assessment of farms using frontier efficiency benchmarks. *Journal of Environmental Management*, 90(10), 3057–3069. <https://doi.org/10.1016/j.jenvman.2009.04.009>

Vandana, V. V., Bhai, S., & Azeez, S. (2014). Biochemical defense responses of black pepper (*Piper nigrum* L.) lines to Phytophthora capsici. *Physiological and Molecular Plant Pathology*, 88, 18–27. <https://doi.org/10.1016/j.pmpp.2014.06.003>

Vandana, V. V., Suseela Bhai, R., & Azeez, S. (2014). Biochemical defense responses of black pepper (*Piper nigrum* L.) lines to Phytophthora capsici. *Physiological and Molecular Plant Pathology*, 88, 18–27. <https://doi.org/10.1016/j.pmpp.2014.06.003>

Verma, D. K., Singh, H., & Meena, G. L. (2021). Factors Affecting Production of Cereal Crops in Rajasthan: The Cobb-Douglas Analysis. *Economic Affairs*, 66(2), 195–200. <https://doi.org/10.46852/0424-2513.2.2021.3>

Vilchis, A. V., Gallardo-lópez, F., & López-romero, G. (2020). *MicMac structural analysis to determine the strategic variables of the sugar agribusiness in Mexico*. 11(6), 1325–1335.

Wadud, A., & White, B. (2010). Farm household efficiency in Bangladesh: A comparison of stochastic frontier and DEA methods. *Applied Economics*, 32(13), 1665–1673. <https://doi.org/10.1080/000368400421011>

- Wadud, M. D. A. (1999). *Farm efficiency in Bangladesh*. New Castle University.
- Wahyudi, E. (2014). *Analisis Keberlanjutan Usahatani Padi di Sekitar Batubara Kabupaten Kutai Kartanegara*. Disertasi Program Doktor. Universitas Gadjah Mada.
- Waney, N. F. ., Soemarno, Yuliaty, Y., & Polii, B. (2014). Developing Indicators of Sustainable Agriculture at Farm Level. *Journal of Agriculture and Veterinary Science*, 7(2), 42–53.
- Wang, T., Sun, C., & Yang, Z. (2023). Heliyon Climate change and sustainable agricultural growth in the sahel region : Mitigating or resilient policy response ? *Heliyon*, 9(9), e19839. <https://doi.org/10.1016/j.heliyon.2023.e19839>
- Widarjono, A. (2005). *Ekonometrika: Teori dan Aplikasi untuk Ekonomi dan Bisnis*. Penerbit Ekonisia Fakultas Ekonomi UII.
- Widarjono, A. (2015). *Analisis Multivariat Terapan dengan Program SPSS, AMOS dan SMARTPLS*. UPP STIM YKPN.
- Widarjono, A. (2018). *Analisis Regresi dengan SPSS*. UPP STIM YKPN.
- Wijayanti, I. K. E. (2019). *Efisiensi, risiko, dan daya saing usaha tani stroberi di Kabupaten Purbalingga*. Disertasi Program Doktor Pasca Sarjana Fakultas Pertanian Universitas Gadjah Mada, Yogyakarta.
- Wohlenberg, J., Hoeltz, M., Schaefer, J. L., Nara, O. B., Benitez, G. B., & Schneider, R. C. S. (2022). Sustainability In Agriculture : Analysing The Environmental And Social Aspects Of The Family Farmers' Economy. *Journal of Sustainability Science and Management*, 17(8), 247–257.
- Workneh, W. M., & Kumar, R. (2023). The technical efficiency of large-scale agricultural investment in Northwest Ethiopia: A stochastic frontier approach. *Heliyon*, 9(9), 1–10. <https://doi.org/10.1016/j.heliyon.2023.e19572>
- Wossen, T., Abdoulaye, T., Alene, A., Haile, M. G., Feleke, S., Olanrewaju, A., & Manyong, V. (2017). Impacts of extension access and cooperative membership on technology adoption and household welfare. *Journal of Rural Studies*, 54, 223–233. <https://doi.org/10.1016/j.jrurstud.2017.06.022>
- Wossen, T., Berger, T., Haile, M. G., & Troost, C. (2018). Impacts of climate variability and food price volatility on household income and food security of farm households in East and West Africa. *Agricultural Systems*, 163, 7–15. <https://doi.org/10.1016/j.agry.2017.02.006>
- Wulandari, S., & Ardana, I. K. (2021). *Model of agricultural extension service system to accelerate technology adoption for vanilla smallholder*. 03012, 1–8.
- Yang, T. Y., Chiang, T. F., & Liu, W. H. (2022). Small-scale fishers' catch production in Taiwanese coastal areas. *Marine Policy*, 143(March), 105182. <https://doi.org/10.1016/j.marpol.2022.105182>
- Yusuf, E. S., Ariningsih, E., Ashari, Gunawan, E., Purba, H. J., Suhartini, S. H.,

- Tarigan, H., Syahyuti, Hestina, J., Saputra, Y. H., Wulandari, S., Ilham, N., & Ariani, M. (2022). Sustainability of Arabica coffee business in West Java, Indonesia: A multidimensional scaling approach. *Open Agriculture*, 7, 820–836. <https://doi.org/10.1515/opag-2022-0144>
- Zamora, O. (2009). Sustainable Agriculture Education and Research at the University of the Philippines Los Banos: Status, Challenges, and Needs. *Journal of Developments in Sustainable Agriculture*, 4(1), 41–49. <https://doi.org/10.11178/jdsa.4.41>
- Zhang, Q., Dong, W., Wen, C., & Li, T. (2020). Study on factors affecting corn yield based on the Cobb-Douglas production function. *Agricultural Water Management*, 228(2519), 105869. <https://doi.org/10.1016/j.agwat.2019.105869>
- Zhen, L., Routray, J. K., Zoebisch, M. A., Chen, G., Xie, G., & Cheng, S. (2005). Three dimensions of sustainability of farming practices in the North China Plain A case study from Ningjin County of Shandong Province , PR China. *Agriculture, Ecosystems and Environment* 105, 105, 507–522. <https://doi.org/10.1016/j.agee.2004.07.012>
- Zhen, L., Zoebisch, M. A., Chen, G., & Feng, Z. (2006). Sustainability of farmers' soil fertility management practices: A case study in the North China Plain. *Journal of Environmental Management*, 79(4), 409–419. <https://doi.org/10.1016/j.jenvman.2005.08.009>
- Zhou, H., Yang, Y., Chen, Y., & Zhu, J. (2018). Data envelopment analysis application in sustainability: The origins, development and future directions. *European Journal of Operational Research*, 264(1), 1–16. <https://doi.org/10.1016/j.ejor.2017.06.023>
- Zozimo, T. M., Kawube, G., & W. Kalule, S. (2023). The role of development interventions in enhancing technical efficiency of sunflower producers. *Journal of Agriculture and Food Research*, 14(November 2022), 100707. <https://doi.org/10.1016/j.jafr.2023.100707>
- Zulfiqar, F., Shang, J., Nasrullah, M., & Rizwanullah, M. (2020). Allocative efficiency analysis of wheat and cotton in district Khanewal, Punjab, Pakistan. *GeoJournal*, 0123456789. <https://doi.org/10.1007/s10708-020-10228-x>