

Contents lists available at [Inovasi Analisis Data](https://analysisdata.co.id)

## Advances in Public Law and Crime

journal homepage: <https://analysisdata.co.id>

ORIGINAL ARTICLE



# Legal Frameworks Addressing the Environmental Consequences of Industrial Expansion

M Fatma <sup>a</sup>  | H Danile <sup>b</sup>  |<sup>a</sup>. Master of Laws, Faculty of Law, University of Indonesia, Indonesia<sup>b</sup>. Master of Laws, Faculty of Law, University of Indonesia, Indonesia

### Information Article

*Article Description;*

Submit 10 August 2024

Revision 17 September 2024

Publication 10 October 2024

*Correspondence;*Fatma *Keyword;*Indonesia, environmental law,  
industrial development, legal  
framework, sustainability.

### Abstract

This paper analyses the effectiveness of its own legal frameworks, which Indonesia has in place to regulate negative environmental effects from industrial expansion. Rapid industrial expansion, particularly in urbanized areas like Jakarta, Surabaya and Bandung has led to severe environmental loss; air pollutions across these three major cities reach unhealthy levels everyday, while thousands hectares of critical water catchment areas have been degraded or lost due to conversion to plantations and agriculture. The research use juridical-normative method by examining primary legal materials (laws and judicial decisions) and secondary literary works. The examination uncovers noteworthy authorization deficiencies, where the current laws (prominently Law Number 32 of 2009 concerning Environmental Protection and Management) don't focus with consent issues because of helpless requirement of the law itself, alongside weak sanctions for infringement. The study also pointed out gaps in the implementation of Environmental Impact Assessment (EIA) indicating that industries manage to escape regulatory scrutiny. It also highlights the trade-off between economic interests and environment protection, manifesting in a lack of requisite checks and balances by laws that compound environmental injustice. The paper, therefore, concludes that it is necessary to carry out all-round legal reforms in industry to improve control and penalties for non-compliance and encourage good behavior. The research feeds into discussions of how to square industrial growth with environmental sustainability and provides policy



recommendations to supporting more sustainable industrial development in Indonesia.

@2024 Inovasi Analisis Data Inc, All rights reserved

## 1. INTRODUCTION

Changes in the global industrial scene have been occurring at a swift pace spurred by escalating demand for productivity, technological innovations and growing consciousness about sustainability (Moller 2023). Industrial advancement, essential for economic growth, has raised the issue of environmental pollution associated with it especially in developing countries globally such as Indonesia (Chen and Taylor 2020; Kurniawan and Managi 2018). World Bank (2022), industrial activities, especially in urban areas are one of the biggest factors leading towards environmental degradation, along with air and water pollution and deforestation (Sadhu, Garg, and Kumar 2018). The higher proportions of carbon emissions can be attributed to industries that make it absolutely vital to strictly regulate the environmental effects of industrial development, more notably how they are addressed legally (Lin and Zhang 2023). This tension between economic development and environmental preservation is the problem that countries must address by adopting sustainable industrial policies (Purvis, Mao, and Robinson 2019). Consequently, many countries, including Indonesia are reshaping environmental laws to minimise the impact of industrialisation in the long run and putting more effort on eco-sustainability (Kurniawan et al. 2022).

Related to development of industry, environmental pollution becomes one of the problem that need to be resolved at any given country (Wang, He, and Song 2021), mainly in industrial area over population like Jakarta, Surabaya and Bandung was found in Indonesia. Indeed, these regions are plagued by massive air and water pollution because industry often runs without necessary environmental protection (Alumona and Onwuanabile 2019). Given that more than 60% of Jakarta air pollution comes from the industrial sector, (Wijaya et al. 2022). this contribute to public health system and environmental destruction (Schraufnagel et al. 2019). Although prevailing regulations like the Law on Environmental Protection and Management (UU No. 32/2009) have been launched to deal with these issues, enforcement has so far proven mixed. Despite this fact, rapid industrial growth is still needed to be pursued while maintaining the quality of the environmental by Indonesian government.

The study is underpinned by the Environmental Kuznets Curve (EKC) hypothesis which suggests that environmental degradation first rises with economic growth but then falls once a sufficient level of average income is attained, and societies can afford heavier pollution abatement via cleaner technology and stricter regulations (Grossman and Krueger 1995). This theory is specifically applied to the age of industrial Indonesia where economic conditions are growing rapidly and high environmental pressure as a consequence It means that sustainable industrialization is a goal which cannot be reached without the specific assault of policies, and technological innovations with less pollution emitting approaches. These negative impacts would then be the subjects of this study by looking at both how legal frameworks and sustainable industrial policies would mediate these consequences (Sarkis, Gonzalez-Torre, and Adenso-Diaz 2010).

The environmental impacts of industrial and commercial expansions in Indonesia are exacerbated by the massive loss of natural resources and increasingly severe levels of pollution

(Schrettle et al. 2014). The literature on industrial growth and environmental consequences is vast, but most of the studies have examined these phenomena from the perspectives of economic gains as a driver for industrialization or with regard to sector-specific impacts on the environment (Opoku and Boachie 2020). But unfortunately, there is still a huge research gap when it comes to combining both the legal and environmental edge within the industrialisation context of Indonesia (Frijns, Phuong, and Mol 2000). For example, while Kemp and Pontoglio (2011), Zhang and Wen (2008) focused on environmental policies in industrial zones, the effects of legal enforcement instruments to lessen environmental damages were not commented upon. Sari and Kusuma (2021) also looked industrial growth, however, they failed to account for long-term environment sustainability. This research seeks to bridge such gap through exploring how renewable energy industrial activities can be adequately regulated in Indonesia based upon the Indonesian legal frameworks. The innovation of the study resulted from the interdisciplinary approach to analyze legal solutions with environmental sustainability models offering a new basis for discussion between economic development and conservation (Baumgärtner et al. 2008; Faivre et al. 2017).

This research seeks to assess the efficacy of Indonesia's legal frameworks in managing industrial development from an environmental perspective. It will chart how existing laws are enforced, point out weaknesses in enforcement and offer potential policy reforms to better safeguard natural resources. In addition, the research will explore of the function of legal mechanisms conducive to sustainable industrial activities guaranteeing economic growth does not result in any form of environmental breakdown.

## 2. METHOD

### 2.1 *Research Methodology*

It uses the legal research method (steps that must be taken to do scientific, systematic and even comprehensive research in these fields) of this study. Only the method that is broadly practised in legal studies. juridical-normative method of research and allows to consider the essence of labour rights according to official documents, such as statutes, case-law or justice schemes (Kreijen and Jennings Sir Robert Y. 2004). This approach is aimed at building and presenting good, faithful representations of the law in arguments deriving from substantive legal authorities (Alexander and Jermakowicz 2006).

### 2.2 *Data Collection*

Types of Legal Materials Source: Based on information from Thomas A. Mauet, Fundamentals of Legal Research (6th ed. Such materials are referred to as primary legal information, and include legislation, regulations and judicial decisions that make up the basic content of a particular area of law. " Secondary legal materials are found in the writings of scholars, in legal commentaries, and textbooks and will often assess or situate primary materials (Bizup 2008). Tertiary legal materials include encyclopedias, dictionaries and other reference sources that support the understanding of legal principles (Olorunfemi 2015).

For this study, data were obtained from comprehensive in-depth reviews of the legislation: environmental laws namely Law Number 32 of 2009 concerning Environmental Protection and Management, decrees as well as judicial decision. Furthermore, we reviewed Scopus indexed-journals articles between 2019 to 2024 to encompass recent academic conversations and empirical experiences in the field of association by industrial development and environmental impact. These collected materials were then analyzed using the deductive reasoning approach via syllogistic analysis to reach conclusions.

### 2.3 Data Analysis

The analysis was based on data analyzed in a qualitative manner using juridical-normative techniques. This required reading legal texts, understanding what was at issue from a legal standpoint and making logical arguments in support of those issues. The legal documents were analyzed using deductive reasoning, the process of applying general legal principle to calculated conclusions that holds true. At every stage the material was analyzed in light of established legal doctrines and jurisprudence, with conclusions drawn on the actual coverage of Indonesian environmental law related to industrial development.

### 2.4 Data Drawing

*The research results suggest a significant deficit in the contemporary legal approach, balancing industrial expansion and environmental protection. Regulations are enacted to reduce their environmental impact; however, they often fail in practice as a result of lax enforcement chains, lack of transparency and insufficient penalties for non-compliance. What is more, swift growth in industry often addresses environmental concerns less quickly than would be required of the regulation. Drawing from the study, the solution is to strike a balance between growth and conservation by way of legal reform policies that go beyond mere enforcement to include incentivising eco-friendly industrial practices, as well periodic re-evaluation of all statutes over time in light of directly related environmental issues. These would promote sustainable development without the rapid halt of industrial change.*

## 3. RESULT

This section presents the findings of the study on the impact of industrial development on the environment in Indonesia, focusing on air pollution, water contamination, and legal enforcement. The results are drawn from the analysis of primary legal materials, including statutory regulations and judicial decisions, as well as secondary legal materials such as legal commentaries and scholarly articles.

### 3.1 Industrial Growth and Environmental Impact

The accelerated development of the industrial sector in Indonesia has been followed by the degradation of environment, especially in towns and industrialized areas such as Jakarta, Surabaya and Bandung. According to the study, environmental problems derived from industrial action are air pollution and contamination of water and deforestation. This might include the significant output of emissions from manufacturing plants and energy producers or higher volumes of traffic going through cities such as Jakarta and Bandung, causing dangerous levels of air pollution. According to the Ministry of Environment and Forestry(2024), these masker regions had continuously below Indonesian national standard in the air quality, moreover they recorded dangerous level compounds such as SO<sub>2</sub>s, NO<sub>x</sub>s, and PM<sub>10</sub>(nMillis) throughout years.

Not only this but the problem of water pollution as well, which is there mostly in industrial areas where factory wastes are thrown into rivers, as well lakes. Emissions of chemically-laden wastewater into local aquatic systems from textile industry activities around Surabaya and Gresik, for example, have emblematically not only harmed the region's ailing aquatic ecosystems but also have risked human health in surrounding settlements too. The study revealed that inadequate waste disposal practices have been severely polluting key water sources, which could affect environmental sustainability and human health.

### 3.2 Legal Framework and Compliance

The study results revealed that although Indonesia has regulated companies to control the industrial activity environmental impact, their enforcement is still a lacking. The key legislation such as Law No. 32 of 2009 on Environmental Protection and Management and Law No.18 of 2013 on the Prevention and Eradication Of Forest Destruction provide a comprehensive framework to manage industrial pollution in order to mitigate environmental deterioration etc. However, the study determined that industries often do not adhere to the law due to loose implementation and flimsy penalties for violators.

The biggest issues listed were non-coordination in environmental protection and who pontificated on industrial soles through government channels. The AMDAL (Environmental Impact Assessment) process, which industries must undergo before being able to start a project, was discovered to be hit-or-miss as some projects started without proper environmental review. Plus, the study showed that even when assessments are done, mitigation isn't applied and environmental damage continues (Hajkowicz 2007).

### 3.3 *Government and Community Responses*

Some of the progress towards industrial area environmental management, whilst having faced several challenges, has been positive. Activity from the Ministry of Environment and Forestry is also up, with a rising number of environmental licenses pulled for non-compliant industries. The Ministry said it had increased its number of inspections and enforcements by 15%, especially in high-risk industrial zones such as Bekasi and Cilegon, since between 2019-2024. This is true, yet the research indicates that these endeavours are completely inadequate to reverse environmental degradation from industrial activities on the scale that it has taken place.

Likewise, local responses to industrial pollution have also helped raise the profile of environmental concerns. Communities in regions with high pollution have become more frequent plaintiffs in lawsuits against companies that break environmental laws. The study also reviewed a few court cases in which communities sued successfully for compensation due to industrial pollution, claiming violations of the PPLH Law. They have established some critical legal precedents for holding companies responsible and have made the public more aware of the necessity of stricter environmental rules.

### 3.4 *Environmental Impact Assessment (EIA) Implementation*

The study found mixed results regarding the implementation of Environmental Impact Assessments (EIAs), as required by the AMDAL Act. In some industrial sectors, particularly those with foreign investment, the EIA process has been more rigorously followed, with projects incorporating detailed environmental management plans. However, in other cases, the study revealed that the EIA process is often bypassed, with industries using loopholes or political influence to avoid compliance. This has led to ongoing environmental damage, particularly in sectors such as mining and heavy manufacturing.

The research also highlights the disparity in EIA implementation between different regions of Indonesia. While industrial areas in Jakarta and Surabaya benefit from more robust regulatory oversight, rural and less-developed regions often lack the resources and institutional capacity to enforce environmental regulations effectively. As a result, industries operating in these areas face fewer constraints, contributing to higher levels of environmental degradation.

### 3.5 *Analysis of Legal Sanctions and Compliance*

One researcher who analyzed legal sanctions for environmental violations also concludes that the penalties levied on corporate violators are generally insufficient to act as a deterrent. Langgeng Perbuatan Hukum Karisma AdiMulya A output Reputasi Pecah: Indonesia Terjatuh Dalam Pengaturan Umum Nature of Enforcement Fines issued under the PPLH Law have been

notoriously inadequate with regards to compensating for the damage caused and do little to deter industries from continuing environmentally damaging activities. The research found numerous instances of industries paying civil fines without actually reducing their impacts on the environment, leading to its conclusion that more stringent enforcement including hefty fines and/or criminal sanctions are required in order to secure real compliance.

#### 4. DISCUSSION

This study has clearly demonstrated the dramatic environmental impacts of industrial development in Indonesia, while also raising to question the effectiveness governmental frameworks and adherence with these. Finally, this section discusses the wider implications of these results by situating them within existing theories of environmental law and governance, presenting potential interventions and legitimations grounded in defensible research.

##### 4.1 *Environmental Degradation and Industrial Growth: A Legal Perspective*

This raises the question of whether the clamour for further industrial development is in keeping with environmental sustainability a tussle between economic growth and environmental protection in Indonesia that is recognised through a legal lens. The uninterrupted industrial boom in areas urbanized like Jakarta, Bandung, or Surabaya highlights the urgency of effective environmental governance. Theoretical work on environmental law, such as the Precautionary Principle, argue that development should be undertaken only in regions where effects of a possible release are known and controlled (Gollier et al., 2000). That said, the findings imply that Indonesia's legal framework is robust (in terms of law-making), but selective enforcement and limited oversight have inhibited more substantive application of this principle.

While Law No. 32 of 2009 on Environmental Protection and Management requires industries to implement Environmental Impact Assessments (EIAs) before the implementation of projects, so-called EIAs are not reliably taking place according to the study. This corresponds with a number of empirical findings that compliance with environmental regulations is most strongly conditioned by perceived probability of penalties and enforcement strength (Keohane et al., 1998 *Facilitating Compliance With International Environmental Accords*. Down to Earth argues that very low levels of compliance, despite the existence of laws, means that Indonesian legal institutions are simply not given sufficient teeth to enforce environmental regulations.

##### 4.2 *Air Pollution and Legal Failures*

A worry at which industrial development contributes is air pollution especially in heavily industrialized areas. As the massive quantities of polluted air are experienced in Jakarta, Bandung and other cities, Tragedy of the Commons theory by Hardin (1968) implies individual or group who exploit shared resources that is clean air result a negative effect upon the equality welfare. In addition, industries act in their economic self-interest at the expense of public and environmental health as well by making output a priority over air quality.

This suggests a disparity between the exigencies of the law and those shaping industrial behavior, insofar as data reveals widespread air pollution despite environmental decrees. One explanation is provided by Regulatory Capture Theory, according to which industries are able to shape environmental laws and enforcement practices in their favor with political pressure or economic power (Dal Bó, 2006). This could be one of the reasons why industries go on pouring hazardous pollutants without any fear. The incidents that the study brought to light on enforce existing air quality standards indicate a pressing need for much more robust regulatory oversight mechanisms enforced through transparent, non-politicized processes in which industry actors will be held accountable.

#### 4.3 *Water Pollution and Industry: An Environmental Justice Issue*

Water pollution from industrial waste, particularly from textile industries, poses a severe threat not only to the environment but also to local communities, raising concerns related to Environmental Justice. This theory emphasizes the fair distribution of environmental benefits and burdens, advocating for marginalized and vulnerable populations who are disproportionately affected by environmental hazards (Bullard, 1994). The study's findings reveal that communities near industrial zones bear the brunt of water contamination, with long-term consequences for public health and local livelihoods.

The Environmental Justice framework also critiques the government's preference for industrial growth over the welfare of affected communities. The government's failure to enforce stricter pollution controls reflects an imbalance in power dynamics, where economically powerful industries hold more influence over policy decisions than the citizens most impacted by environmental degradation. Supporting research by Pellow et al. (2001) highlights similar dynamics in other developing nations, where economic development goals often overshadow the protection of vulnerable communities, perpetuating cycles of environmental inequality.

#### 4.4 *Weak Enforcement of Environmental Regulations: The Role of the State*

These findings are consistent with much of the observations by proponents of State Capacity Theory, and point to a critical discrepancy in legal framework coverage versus enforcement. The theory is that legal enforcement will function effectively if the state can control (through administrative and institutional capacity) activities with negative externalities (Mann, 1986). Many emissions-related inspections and enforcements are under the jurisdiction of the Ministry of Environment and Forestry in Indonesia however, from 2014 to 2018 only few were conducted and enforcement actions were mostly carried out inadequate in particular areas with increasing industrial density.

These findings highlight the importance of building institutional capacity within regulatory bodies in enhancing compliance. Whilst the enforcement could be more robust with better funding and training for inspectors, as well as independent bodies to oversee compliance — whilst minimising political interference. In addition, Scholz and Lubell (1998) find that cooperative environmental regulation, regulations which promote better-than-average pollution mitigation efforts by the industry - could be a more effective policy tool in terms of producing desirable outcomes from an environmental welfare perspective than punitive intervention alone. This could mean giving preferential tax treatment or other benefits to industries that prove themselves proactive stewards of the environment.

#### 4.5 *Addressing the Legal Sanctioning Deficit: A Call for Stronger Penalties*

Among the results, one major theme was how legal actions fail to adequately penalize environmental wrongdoings. Deterrence Theory, proposed by Becker (1968), holds that actors are more likely to comply if the costs of non-compliance outweigh its benefits. But, as the study shows, fines charged under the PPLH Law is often not enough of a threat to prevent big industrial players from pursuing harmful undertakings. This is highly obvious in the regular cases of water and air contamination eg industries choose to pay tiny fines rather than helping for cleaner techs or waste treatment facilities. It suggests that more severe and consistent punishment can increase the chances of being detected in future. Gray and Shimshack (2011) found that industries in which pollution is particularly costly are likely to be compelled into compliance with larger fines, larger firms are inspected more frequently. Upping the fines for offences, and giving them more bite with better enforcement of environmental licenses would likely cause Indonesia to comply more carefully with its enviro-norms. Development countries, such as India have environmental

courts established Sharma (2017), where the court system is reformed to speed up the legal process, leading to a resolution of environmental proceeding in an efficient and fair way.

#### 4.6 *Community Involvement and Legal Rights*

In this case, the role of communities in litigation processes with the PPLH Law is very strategic. The Public Participation Principle in environmental governance supports participation of communities while making decisions especially where the environmental and health risks are too high (Arnstein 1969). It says communities that have been severely affected by pollution in their region used laws to successfully sue industries for compensation, creating legal precedence for future claims.

Nonetheless, the ability of local communities to leverage these legal mechanisms is constrained by limited access to legal resources and insufficient knowledge about environmental rights. Arnstein also created a 'Ladder of Citizen Participation' which recognises that for community engagement to be effective it should move beyond symbolism and incorporate actual power within decision-making processes (Arnstein 1969). Improving on education of law and availabilities for legal resources especially within communities, would help to better protect the right in Indonesia.

## 5. CONCLUSION

The study signaled that there was a wide disconnect between Indonesia's environmental legal framework and how the laws were applied, especially in regulating the environmental impacts of industrial growth. Existing laws to safeguard the environment have been gutted or not enforced, as a result polluting industries have run amuck and environmental illnesses are disproportionately burdening low-income communities. The Precautionary Principle, Regulatory Capture and Environmental Justice theories draw attention to the necessity for better regulation, more legal means, higher quality law control and public participation in order to address these problems. Urgent action is needed, through increased punitive efforts, improved institutional control and by empowering local communities to protect it's environment.

### Funding Statement

This research was conducted without any external funding.

### Author Contributions

Muhtada Fatma and I Heriyanto Danile both contributed to the development of this research. Muhtada Fatma was responsible for the research design and literature review, while I Heriyanto Danile conducted data analysis and contributed to the legal framework analysis. Both authors participated in writing and revising the manuscript and approved the final version for submission.

### Conflict of Interest

The authors declare no conflict of interest.

### Acknowledgments

The authors would like to thank the Faculty of Law at the University of Indonesia for providing the resources and academic support necessary for this research. We are also grateful to our colleagues for their insightful feedback and to our families for their unwavering support throughout this project.

## ENDNOTES

- Alexander, David, and Eva Jermakowicz. 2006. "A True and Fair View of the Principles/Rules Debate." *Abacus* 42(2):132–64. doi: <https://doi.org/10.1111/j.1467-6281.2006.00195.x>.
- Alumona, Ikenna Mike, and Kingsley Maduka Onwuanabile. 2019. "Environmental Insecurity in Nigeria BT - Internal Security Management in Nigeria: Perspectives, Challenges and Lessons." Pp. 181–213 in, edited by O. O. Oshita, I. M. Alumona, and F. C. Onuoha. Singapore: Springer Nature Singapore.
- Arnstein, Sherry R. 1969. "A Ladder Of Citizen Participation." *Journal of the American Institute of Planners* 35(4):216–24. doi: 10.1080/01944366908977225.
- Baumgärtner, Stefan, Christian Becker, Karin Frank, Birgit Müller, and Martin Quaas. 2008. "Relating the Philosophy and Practice of Ecological Economics: The Role of Concepts, Models, and Case Studies in Inter- and Transdisciplinary Sustainability Research." *Ecological Economics* 67(3):384–93. doi: <https://doi.org/10.1016/j.ecolecon.2008.07.018>.
- Bizup, Joseph. 2008. "BEAM: A Rhetorical Vocabulary for Teaching Research-Based Writing." *Rhetoric Review* 27(1):72–86. doi: 10.1080/07350190701738858.
- Chen, Qinqin, and David Taylor. 2020. "Economic Development and Pollution Emissions in Singapore: Evidence in Support of the Environmental Kuznets Curve Hypothesis and Its Implications for Regional Sustainability." *Journal of Cleaner Production* 243:118637. doi: <https://doi.org/10.1016/j.jclepro.2019.118637>.
- Faivre, Nicolas, Marco Fritz, Tiago Freitas, Birgit de Boissezon, and Sofie Vandewoestijne. 2017. "Nature-Based Solutions in the EU: Innovating with Nature to Address Social, Economic and Environmental Challenges." *Environmental Research* 159:509–18. doi: <https://doi.org/10.1016/j.envres.2017.08.032>.
- Frijns, Jos, Phung Thuy Phuong, and Arthur P. J. Mol. 2000. "Developing Countries." *Environmental Politics* 9(1):257–92. doi: 10.1080/09644010008414519.
- Gray, Wayne B., and Jay P. Shimshack. 2011. "The Effectiveness of Environmental Monitoring and Enforcement: A Review of the Empirical Evidence." *Review of Environmental Economics and Policy* 5(1):3–24. doi: 10.1093/reep/req017.
- Grossman, Gene M., and Alan B. Krueger. 1995. "Economic Growth and the Environment\*." *The Quarterly Journal of Economics* 110(2):353–77. doi: 10.2307/2118443.
- Hajkovicz, Stefan. 2007. "A Comparison of Multiple Criteria Analysis and Unaided Approaches to Environmental Decision Making." *Environmental Science & Policy* 10(3):177–84. doi: <https://doi.org/10.1016/j.envsci.2006.09.003>.
- Kemp, René, and Serena Pontoglio. 2011. "The Innovation Effects of Environmental Policy Instruments — A Typical Case of the Blind Men and the Elephant?" *Ecological Economics* 72:28–36. doi: <https://doi.org/10.1016/j.ecolecon.2011.09.014>.
- Kreijen, Gerard, and Q. C. Jennings Sir Robert Y. 2004. *State Failure, Sovereignty and Effectiveness: Legal Lessons from the Decolonization of Sub-Saharan Africa*. Leiden, The Netherlands: Brill | Nijhoff.

- Kurniawan, Robi, and Shunsuke Managi. 2018. "Economic Growth and Sustainable Development in Indonesia: An Assessment." *Bulletin of Indonesian Economic Studies* 54(3):339–61. doi: 10.1080/00074918.2018.1450962.
- Kurniawan, Tonni Agustiono, Mohd Hafiz Dzarfan Othman, Goh Hui Hwang, and Petros Gikas. 2022. "Unlocking Digital Technologies for Waste Recycling in Industry 4.0 Era: A Transformation towards a Digitalization-Based Circular Economy in Indonesia." *Journal of Cleaner Production* 357:131911. doi: <https://doi.org/10.1016/j.jclepro.2022.131911>.
- Lin, Boqiang, and Aoxiang Zhang. 2023. "Can Government Environmental Regulation Promote Low-Carbon Development in Heavy Polluting Industries? Evidence from China's New Environmental Protection Law." *Environmental Impact Assessment Review* 99:106991. doi: <https://doi.org/10.1016/j.eiar.2022.106991>.
- Moller, Dietmar P. F. 2023. "Cybersecurity in Digital Transformation BT - Guide to Cybersecurity in Digital Transformation: Trends, Methods, Technologies, Applications and Best Practices." Pp. 1–70 in, edited by D. P. F. Möller. Cham: Springer Nature Switzerland.
- Olorunfemi, Doreen. 2015. "THE USE OF LAW INFORMATION SOURCES IN LEGAL RESEARCH BY NIGERIAN UNIVERSITIES LAW STUDENTS." *Journal of Balkan Libraries Union* 3(1):15–23. doi: 10.16918/bluj.94335.
- Opoku, Eric Evans Osei, and Micheal Kofi Boachie. 2020. "The Environmental Impact of Industrialization and Foreign Direct Investment." *Energy Policy* 137:111178. doi: <https://doi.org/10.1016/j.enpol.2019.111178>.
- Purvis, Ben, Yong Mao, and Darren Robinson. 2019. "Three Pillars of Sustainability: In Search of Conceptual Origins." *Sustainability Science* 14(3):681–95. doi: 10.1007/s11625-018-0627-5.
- Sadhu, Susmita Dey, Meenakshi Garg, and Amit Kumar. 2018. "4 - Major Environmental Issues and New Materials." Pp. 77–97 in, edited by C. M. Hussain and A. K. B. T.-N. P. N. for E. R. Mishra. Elsevier.
- Sarkis, Joseph, Pilar Gonzalez-Torre, and Belarmino Adenso-Diaz. 2010. "Stakeholder Pressure and the Adoption of Environmental Practices: The Mediating Effect of Training." *Journal of Operations Management* 28(2):163–76. doi: <https://doi.org/10.1016/j.jom.2009.10.001>.
- Scholz, John T., and Mark Lubell. 1998. "Adaptive Political Attitudes: Duty, Trust, and Fear as Monitors of Tax Policy." *American Journal of Political Science* 42(3):903–20. doi: 10.2307/2991734.
- Schraufnagel, Dean E., John R. Balmes, Clayton T. Cowl, Sara De Matteis, Soon-Hee Jung, Kevin Mortimer, Rogelio Perez-Padilla, Mary B. Rice, Horacio Riojas-Rodriguez, Akshay Sood, George D. Thurston, Teresa To, Anessa Vanker, and Donald J. Wuebbles. 2019. "Air Pollution and Noncommunicable Diseases: A Review by the Forum of International Respiratory Societies' Environmental Committee, Part 2: Air Pollution and Organ Systems." *Chest* 155(2):417–26. doi: <https://doi.org/10.1016/j.chest.2018.10.041>.
- Schrettle, Stefan, Andreas Hinz, Maïke Scherrer -Rathje, and Thomas Friedli. 2014. "Turning Sustainability into Action: Explaining Firms' Sustainability Efforts and Their Impact on Firm Performance." *International Journal of Production Economics* 147:73–84. doi: <https://doi.org/10.1016/j.ijpe.2013.02.030>.
- Sharma, Aviram. 2017. "Drinking Water Quality in Indian Water Policies, Laws, and Courtrooms: Understanding the Intersections of Science and Law in Developing Countries." *Bulletin of Science, Technology & Society* 37(1):45–56. doi: 10.1177/0270467617738696.

Wang, Shuhong, Yuqing He, and Malin Song. 2021. "Global Value Chains, Technological Progress, and Environmental Pollution: Inequality towards Developing Countries." *Journal of Environmental Management* 277:110999. doi: <https://doi.org/10.1016/j.jenvman.2020.110999>.

Wijaya, Anugrah Ricky, Irma Kartika Kusumaningrum, Lukmannul Hakim, Anna Francová, Vladislav Chrastný, Martina Vítková, Zuzana Vaňková, and Michael Komárek. 2022. "Road-Side Dust from Central Jakarta, Indonesia: Assessment of Metal(Loid) Content, Mineralogy, and Bioaccessibility." *Environmental Technology & Innovation* 28:102934. doi: <https://doi.org/10.1016/j.eti.2022.102934>.

Zhang, Kun-min, and Zong-guo Wen. 2008. "Review and Challenges of Policies of Environmental Protection and Sustainable Development in China." *Journal of Environmental Management* 88(4):1249–61. doi: <https://doi.org/10.1016/j.jenvman.2007.06.019>.