

# Mapping The Public-Private Partnerships Researches in Waste Management: A Bibliometric Analysis

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## Abstract

The increasing societal demands for effective waste management have compelled the government to provide optimal services in accordance with established standards, while carefully considering various relevant aspects. Public-Private Partnerships (PPP) have emerged as a conceptual framework to address these challenges. This article aims to comprehensively analyze and map the existing literature on public-private partnerships in the context of waste management. The mapping of this literature offers valuable insights into the theoretical foundations, practical implications, and potential future directions policy development in this field. Through bibliometric analysis and the application of the PICO Spider framework, a citation review was conducted based on the number of citations and journal sources. Co-authorship analysis was also performed based on authors and countries, while co-occurrence analysis was carried out based on all keywords. Furthermore, the analysis and visualization were conducted using the VOSviewer application. The utilization of VOSviewer facilitates the visualization of these findings, allowing for a more intuitive understanding and interpretation of the bibliometric analysis results. At the partnership level, the government needs to have full involvement, while higher-level government entities (such as provinces and central government) also play a role in indirectly supporting waste management programs. Private entities, on the other hand, can engage in waste processing using established technologies. However, if this is not feasible, privatization of waste management through independent Small and Medium Enterprises (SMEs) can serve as a new source of assistance for the government.

**Keywords:** Bibliometric analysis, Public-private partnerships, Waste management



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Received: 30-06-2023 | Revised: 15-07-2023 | Accepted: 24-07-2023 | Published: 31-07-2023

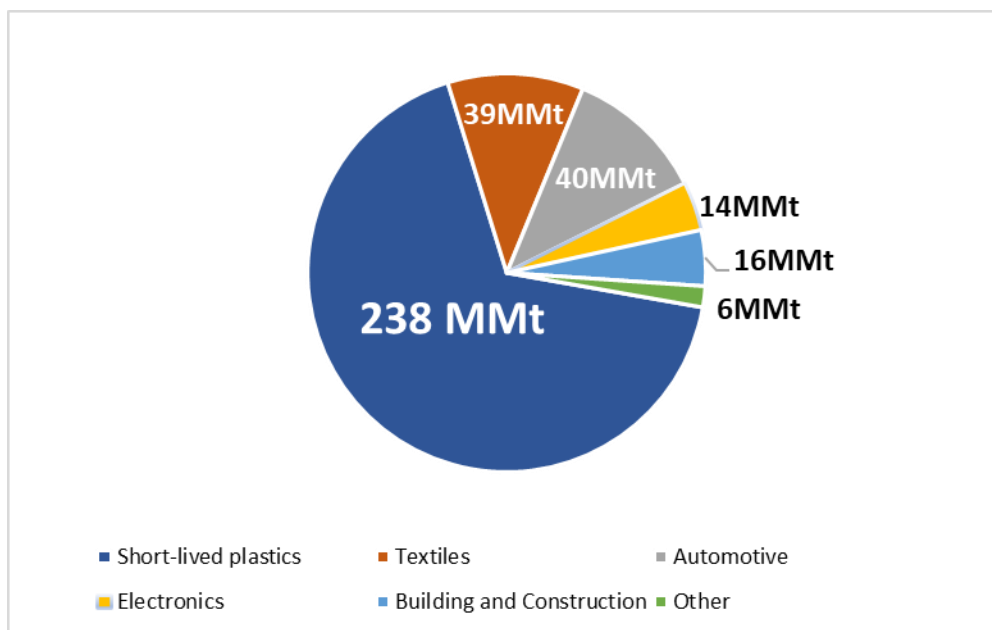
DOI: <https://doi.org/10.26905/jtragos.v1i2.10462>

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Published by the Department of Public Administration, Faculty of Social and Political Sciences, University of Merdeka Malang, Indonesia.

## Introduction

The unmanaged wastes scattered on the streets, clogging drains, and accumulating downstream in rivers pose a major health risk to the community (Bhuiyan, 2010). According to the OECD (2022), global plastic waste production reached an estimated 353 million metric tons in 2019. Out of this total, 67% comprised short-lived or single-use plastic waste. Most of the short-lived plastic waste is generated in urban areas (United Nations Environmental Programme, 2023). It is not just plastic waste; other types of waste also pose urgent issues that governments worldwide need to address promptly, given the increasing volume year by year.



Source: OECD (2023).

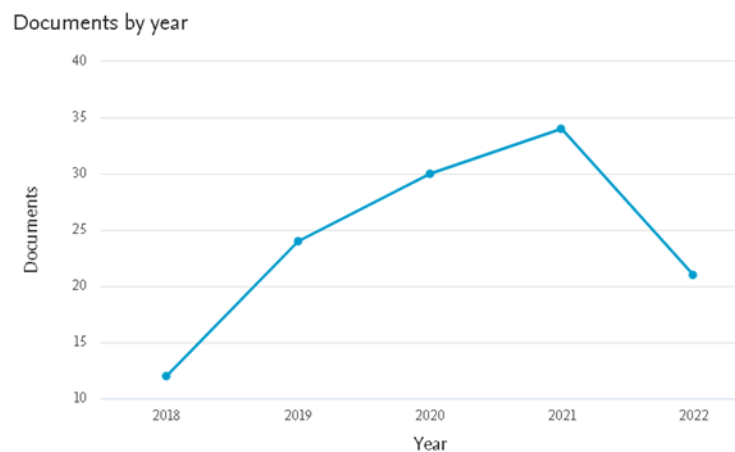
**Figure 1.** Estimation of Global Plastic Waste Quantity

In the case of waste management, particularly in urban areas, the commonly encountered issues are related to the location of the final disposal or treatment facilities, known as Landfill/TPA in Indonesia (Mulasari et al., 2014). The most commonly used waste management method is landfilling (Ma & Hipel, 2016). However, this method has consequences regarding land limitations due to the continuous waste distribution (Song et al., 2013). Therefore, an effective waste management system requires capacity encompassing knowledge, cost, human resources, and, most importantly, advanced technology. However, the bureaucracy tends to exhibit inefficiencies in cost and human resource utilization, ineffective work mechanisms due to the prevalence of corruption, and limitations in knowledge and technology (Chang et al., 2003). The characteristics of government bureaucracy in waste management have implications for environmental degradation in the surrounding areas of landfill sites (Xu et al., 2015).

In the discourse of public bureaucracy, a notable trend since the 1990s has been the increasing involvement of the private sector as a solution to the limitations, pathologies, and inefficiencies within the public bureaucracy (Osborne & Gaebler, 1992). This inclusion of the private sector is particularly relevant in the context of waste management. One prominent scheme utilized is the Public-Private Partnership (PPP), which holds the potential to enhance the efficiency of waste management (Chen & Chen, 2012). In advanced European countries, private-sector collaboration in waste management has been prevalent since the 1990s. Major cities such as Paris, Copenhagen, and Stockholm have successfully engaged the private sector in waste collection and final processing. Notably, Scharff's research (1994) indicates that this approach has not only spurred positive changes in public behavior toward waste reduction but has also facilitated recycling efforts. In the case of developing countries, Bhuiyan's study (2010) conducted in Bangladesh reveals that PPP has played a significant role in improving waste management effectiveness. Consequently, this has had a substantial impact on the realization of Good Urban Governance. In China, the PPP scheme has facilitated the adoption of Incineration technology, allowing waste to be converted into energy (Song et al., 2013).

Behind the benefits of PPP, as described earlier, it is important to note that PPP is not a panacea for all the complexities of public issues, whether in the general sector or specifically in waste management. In academic debates, the concept of PPP also has its limitations. According to Bel's research (2006), PPP does not have a significant impact on reducing government waste management costs. Additionally, Ohlsson's study (2003) found that public-sector waste management services were 6% cheaper compared to the private sector. These findings highlight the need for a nuanced understanding of PPP and careful consideration of its potential drawbacks and limitations in the context of waste management. It is crucial to weigh the benefits against the potential costs and ensure that PPP arrangements are implemented with proper oversight and accountability.

The author argues that the public sector cannot continue with a business-as-usual approach. The challenges encountered by the public sector in waste management, as previously discussed, cannot be disregarded. Hence, PPP remains a viable option to address the government's limitations in waste management. This conclusion is drawn from the implications of recent trends in PPP research based on the Scopus database over the past five years.



Source: Based on the Scopus database using the keywords "Public-Private Partnership" and "Waste Management" (Accessed on June 26, 2023)

**Figure 2.** Trends in PPP Research on Waste Management in the Last Five Years

Based on the graph above, it can be concluded that there have been numerous research studies on PPP in waste management, although there was a declining trend in 2022. However, a bibliometric analysis is still needed to provide a comprehensive overview of relevant and significant literature in studying issues related to waste management through public-private partnership approaches. Bibliometric analysis was initially applied in the field of library science but has now expanded to various research fields (Ralph & Arora, 2022). Therefore, this study aims to provide a literature mapping of PPP in the field of waste management globally. This study will assist future research in identifying important studies in this field. Instead of having to search through various journals and explore time-consuming websites, this study can save time for researchers interested in the topic of PPP in waste management.

## Literature Review

### a) Waste Management

In urban areas, solid waste originates from various sources, including households, commercial enterprises, and public and private institutions. In many Asian countries, regulations are in place to categorize solid waste into specific types. However, in practice, the responsibility for managing all types of waste disposed of by residents falls on local governments. According to the United Nations Environment Programme (UNEP), Municipal Solid Waste (MSW) encompasses domestic waste, non-hazardous waste from the commercial and institutional sectors, waste from street sweeping activities, and construction debris. Some countries also classify wastes such as sewage, ash from incinerators, septic tank sludge, and sludge from wastewater treatment plants as components of solid waste management. Treatment methods for these wastes vary depending on their hazardous characteristics (Shekdar, 2009).

Several studies have identified factors that influence various elements of waste management systems. For instance, research conducted by Sujauddin et al. (2008) elucidates that waste generation is influenced by education level, monthly income, and family size. Other factors, such as gender, land area, household location, and membership in environmental organizations, can also affect household waste usage and segregation behaviors (Ekere et al., 2009). Household attitudes towards waste segregation activities are also influenced by active government support and community organization involvement in terms of public participation and waste collection service costs (Scheinberg et al., 2011; Zhuang et al., 2008).

The European Commission has established a consensus on the basic principles of waste management. These principles include waste reduction at the source, reuse/recycling, recovery, and disposal (Arbulú et al., 2016). Furthermore, efficient management of waste systems should aim to minimize the generation of solid waste as the primary goal. However, for existing waste, processing can be carried out to prevent accumulation. There are various waste processing methods available, such as landfilling, incineration, composting, land spreading, etc. Each method has environmental implications (Giusti, 2009). Hence, it is important to wisely evaluate the waste processing method that will be used.

**Table 1.** Environmental Impact of Various Waste Processing Methods

Main environmental impact of municipal solid waste management.

	Water	Air	Soil	Landscape	Climate
Activity					
Landfilling	Leachate (heavy metals, synthetic organic compounds)	CO <sub>2</sub> , CH <sub>4</sub> , odour, noise, VOCs	Heavy metals, synthetic organic compounds	Visual effect, vermin	Worst option for greenhouse gases emission <sup>a</sup>
Incineration	Fall-out of atmospheric pollutants	SO <sub>2</sub> , NO <sub>x</sub> , N <sub>2</sub> O, HCl, HF, CO, CO <sub>2</sub> , dioxins, furans, PAHs, VOCs, odour, noise	Fly ash, slags	Visual effect	Greenhouse gases <sup>a</sup>
Composting	Leachate	CO <sub>2</sub> , CH <sub>4</sub> , VOCs, dust, odour, bioaerosols	Minor impact	Some visual effect	Small emissions of greenhouse gases <sup>a</sup>
Landspreading	Bacteria, viruses, heavy metals	Bioaerosols, dust, odour	Bacteria, viruses, heavy metals, PAHs, PCBs	Vermin, insects	Small emissions of greenhouse gases.
Recycling	Wastewater	Dust, noise	Landfilling of residues		Minor emissions
Waste transportation	Spills	CO <sub>2</sub> , SO <sub>2</sub> , NO <sub>x</sub> , dust, odour, noise, spills	Spills		Significant contribution of CO <sub>2</sub>

CO<sub>2</sub> = carbon dioxide; CH<sub>4</sub> = methane; VOCs = volatile organic compounds; SO<sub>2</sub> = sulphur dioxide; NO<sub>x</sub> = nitrogen oxides; N<sub>2</sub>O = nitrous oxide; HCl = hydrochloric acid; HF = hydrofluoric acid, CO = carbon monoxide; and PAHs = polycyclic aromatic hydrocarbons.

<sup>a</sup> Assuming no energy recovery.

Source: Giusti (2009).

One of the most effective waste processing methods is waste-to-energy, which utilizes technologies such as incineration and anaerobic digestion (Xu et al., 2015). Anaerobic digestion involves the breakdown and stabilization of organic matter within an oxygen-deprived container using microorganisms, resulting in the generation of biogas (a combination of carbon dioxide and methane, serving as a renewable energy source) and microbial biomass (Dewanti et al., 2020; Kelleher et al., 2002). The process of anaerobic digestion occurs within an

anaerobic digester tank after waste sorting to segregate organic and inorganic waste fractions. Organic waste undergoes a series of treatments, including maceration and blending, ultimately transforming it into a slurry that is introduced into the anaerobic digester tank. Biodegradable organic waste undergoes decomposition, giving rise to gas production and the formation of humus (compost material). Conversely, non-biodegradable organic waste is expelled as residue. Inorganic waste that cannot be repurposed, along with the residue, is subjected to incineration in a specialized facility. Incineration entails the combustion of waste materials, with the resulting steam being converted into usable energy. This technology offers the advantage of diminishing landfill volume and harnessing steam to generate electricity.

### **b) Public-Private Partnership (PPP)**

In its development, waste management has become a complex challenge for the public sector. The complexity of the issue is no longer solely due to the increasing volume and diversity of waste generated, but also the escalating resource requirements needed for effective management (Sholahuddin et al., 2022). Therefore, a governance framework capable of addressing these challenges is necessary, and one such framework is Public-Private Partnership (PPP). According to Grimsey and Lewis (2004). PPP is defined as:

*"An arrangement between a public sector entity and a private sector entity, where both parties collaborate to provide public services or infrastructure. This collaboration involves sharing risks, responsibilities, and resources to achieve common objectives."*

The partnership between the government and the private sector is a step that can be taken to address the limitations faced by the government in providing public waste management services. The limitations of the government extend beyond financial constraints and also include limitations in terms of manpower, expertise, and experience. Therefore, to overcome these limitations, and as long as it is following the applicable laws and regulations, the government can involve the private sector in the provision of waste management services. By partnering with the private sector, the government can leverage the resources, expertise, and efficiency of private companies to enhance the delivery of waste management services. The private sector brings with it a range of skills, innovative technologies, and operational experience that can complement the government's efforts. This collaboration allows for the sharing of risks, responsibilities, and costs, leading to more effective and sustainable waste management practices.

Furthermore, regarding the anticipated benefits of partnerships in integrated and sustainable waste management within the government's jurisdiction, they include the following:

- 1) Through partnerships between different levels of government and/or private entities, waste management operations and maintenance can become more efficient and cost-effective;
- 2) Partnerships between different levels of government and/or private entities enable corporations to exhibit greater flexibility and effectiveness in handling waste management systems;
- 3) Partnerships between different levels of government and/or private entities facilitate technology transfer, allowing for the adoption of advanced waste management practices;
- 4) Partnerships between different levels of government and/or private entities allow corporations to provide initial investment and specific concessions for sustainable funding;
- 5) Partnerships between different levels of government and/or private entities enable profit-sharing arrangements that mutually benefit all parties involved in the management of waste systems.

These benefits highlight the advantages of partnerships in achieving integrated and sustainable waste management within the government's jurisdiction.

However, it is important to ensure that such partnerships are based on clear agreements, comply with legal and regulatory frameworks, and prioritize the public interest, environmental sustainability, and social welfare. Effective governance, monitoring mechanisms, and performance evaluations should be in place to ensure the transparency, integrity, and accountability of these partnership efforts.

## Method

This study examines the literature on Public-Private Partnerships (PPP) in solid waste management using bibliometric analysis. Due to the nature of the research design, which employs bibliometric analysis, an inductive approach is utilized rather than a deductive one. Therefore, specific hypotheses are not generated, but rather, the data is based on the identification of patterns and the level of relationships between keywords, author trends, citations, and emerging concepts. In terms of methodology, this article employs bibliometric analysis to examine trends in co-authorship, country-based articles, and keywords from the Scopus database. A quantitative approach and statistical information are utilized to analyze publication trends within the Scopus literature corpus. As Thanuskodi (2010) states, "Researchers use bibliometric evaluation methods to determine the impact of an author or to describe relationships between two or more authors or works." In this study, there are five stages in the analysis process as proposed by Zupic and Čater (2015), which are as follows:

- 1) Study design: In designing this study, we applied the PICO SPIDER (Cooke et al., 2012) framework by establishing inclusion and exclusion criteria for the literature.

**Table 2.** Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Articles Type	Peer-reviewed Final Stage journal articles	Prosiding, Book Section, Book
Language	English	Except for English
Publication Stage	Final	Article in Press

Source: PICO SPIDER Adaptation (Cooke et al., 2012).

- 2) Data collection and extraction: In this stage, the article search process was conducted on the Scopus database using the following Boolean key string: (TITLE-ABS-KEY ("public-private partnership") OR TITLE-ABS-KEY ("public-private partnership") AND TITLE-ABS-KEY ("waste Management")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) From this search, Scopus displayed a total of 205 articles. All articles were then downloaded and extracted into CSV format.
3. Data analysis: The bibliometric data analysis process was conducted using Vosviewer 1.6.15, Microsoft Excel, and the analytical tools provided by Scopus.
- 3) Data visualization: Data visualization was performed to provide a mapping of article networks based on the available literature. In this process, Vosviewer supported the visualization.
- 4) Analysis and Interpretation: In the final stage, interpretation was conducted based on the visualizations from Vosviewer, available bibliometric quantitative data, and extensive reading and examination of the articles

## Result and Discussion

By utilizing the 205 included research publications on PPP in waste management, this section presents a citation review based on the number of citations and the sources of journals, Co-Authorship analysis based on authors and countries, and Co-Occurrence analysis based on all keywords

### a) Citation Review

The citation review provides insights into the influence and impact of the research publications. It examines the number of citations received by each publication and identifies the journals that serve as the main sources of these citations. This analysis helps to determine the relevance and significance of the research within the academic community. The table below shows the highest number of citations in the top 5 articles. A high number of citations indirectly indicates the quality and relevance of an article. In the context of the included study, the article by Wilson et al. is the article with the highest number of citations.

**Table 3.** Top Five Total Citations

Authors	Title (Year)	Journal	Citations
Wilson, D.C., Velis, C., Cheeseman, C.	Role of informal sector recycling in waste management in developing countries (2006)	Habitat International, 30(4), pp. 797–808	581
Secondi, L. , Principato, L. , Laureti, T.	Household food waste behavior in EU-27 countries: A multilevel analysis (2015)	Food Policy, 56, pp. 25–40	294
Halloran, A. , Clement, J. , Kornum, N. , Bucatariu, C. , Magid, J.	Addressing food waste reduction in Denmark (2014)	Food Policy, 49(P1), pp. 294–301	225
Ahmed, S.A., Ali, M.	Partnerships for solid waste management in developing countries: Linking theories to realities (2004)	Habitat International, 28(3), pp. 467–479	194
Rathi, S	Alternative approaches for better municipal solid waste management in Mumbai, India (2006)	Waste Management, 26(10), pp. 1192–1200	166

Source: Scopus Database (2023)

**Table 4.** Top Five Total Citations

Source	Documents	Citations
Habitat International	9	1189
Waste Management	13	809
Resources, Conversation, and Recycling	8	392
Waste Management and Research	20	309
Journal of Cleaner Production	7	238

Source: Scopus Database (2023)

**b) Co-Authorship Analysis**

The Co-Authorship analysis consists of two aspects: the relationship between authors and the relationship between authors from different countries in the included articles. Firstly, Co-Authorship based on the relationship between authors provides an overview of the collaboration between authors. As shown in Figure 3, there are various nodes in the network representing the authors in the included articles, indicating whether the authors of those articles have collaborated in one or more publications. The network value reflecting the number of articles co-authored between authors is referred to as Total Link Strength (TLS), where a higher number of articles indicates stronger collaboration (Reyes-Gonzalez et al., 2016).

**Table 5. Top Ten Total Link Strength of Authors**

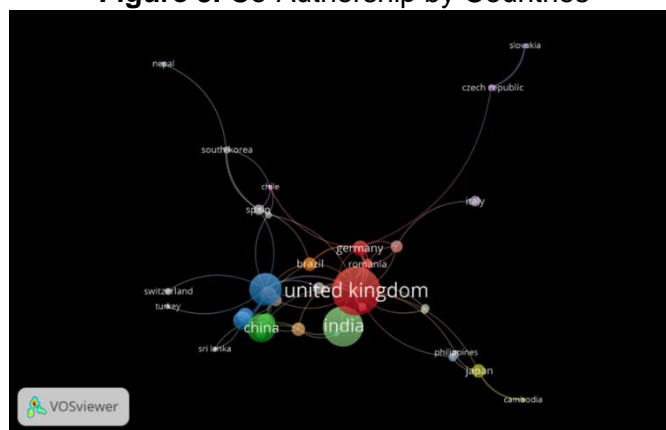
Author	Documents	Citations	TLS
Wilson D.C.	5	657	20
Lu W.	4	182	15
Briciu C.	2	16	14
Oelz B.	2	16	14
Soos R.	2	16	14
Whiteman A.D.	2	16	14
Laishram B.	7	29	12
Zhang X.	3	158	12
Baumgartner R.J	2	39	11
Hermann R.	2	39	11

Source: Author's compilation using Vosviewer 1.6.15

A total of 205 included studies were written by a total of 614 authors. In processing the data using Vosviewer, the Co-Authorship analysis applies a minimum criterion of two articles. The results show that 44 authors meet the threshold. The author with the highest TLS value is Wilson. d.c (657 citations, TLS 20). On the other hand, Laishram is the author with the most articles, with a total of 7 articles.

On the other hand, in terms of the relationship between the countries of the authors, all included articles are from 64 countries. The Co-Authorship criterion for countries is set at a value of 2, resulting in 43 countries meeting the threshold. The United Kingdom is the country with the highest TLS value and the highest number of documents (1410 total citations, 27 TLS).

**Figure 3. Co-Authorship by Countries**



Source: Author's compilation using Vosviewer 1.6.15 (2023).

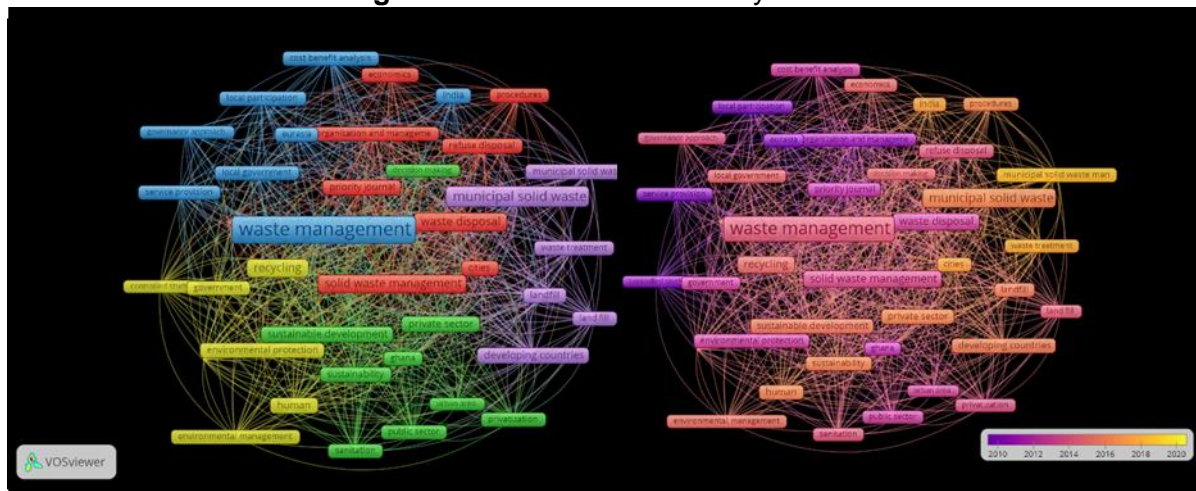


Based on the visualization in Figure 3, it is found that authors from the United Kingdom are connected with various other countries. These connections range from developed countries such as the USA, Germany, and the Netherlands, to developing countries such as Ghana, India, and Indonesia. This analysis suggests that authors from the United Kingdom have established collaborations and partnerships with researchers from diverse geographical backgrounds. Such collaborations can contribute to knowledge exchange, sharing of expertise, and fostering global perspectives in the field of study. It also indicates the potential for cross-country research collaborations and the importance of international cooperation in addressing waste management challenges.

**c) Co-Occurrence Analysis**

The Co-Occurrence analysis is conducted to understand the relationships among terms or keywords that appear in the articles. This analysis can generate a conceptual model of the research area based on the most significant keywords that emerge. According to the Vosviewer results, a total of 2041 keywords were identified. However, only 52 keywords met the criteria of 10 occurrences. Furthermore, only 38 items were included in the final analysis due to the presence of duplicate keywords. Therefore, only the keywords with the highest occurrences were retained, while the remaining duplicate keywords were excluded.

**Figure 4. Co-Occurrence of Keywords Network**



Cluster (Left), Pub. Year (Right)

Source: Author's compilation using Vosviewer 1.6.15 (2023).

The analysis using Vosviewer resulted in five clusters, as shown in Figure 4 (left) above. In the figure, the occurrence of keywords is represented by the size of the labels. The larger the label, the higher the occurrence of that keyword. This can indicate the intensity of discussion among researchers on that particular topic. For details of each cluster, please refer to Table 4 below.

**Table 6.** Cluster of Keywords

Cluster	Keyword	Qty.
1 (Red)	Cities, Economics, Organization and Management, Procedures, Refuse Disposal, Solid Waste, Solid Waste Management, Stakeholder, Waste Disposal	9
2 (Green)	Decision Making, Ghana, Private Sector, Privatization, Public Sector, Risk Assessment, Sanitation, Sustainability, Sustainable Development	10
3 (Blue)	Cost-Benefit Analysis, Eurasia, Governance Approach, India, Local Government, Local Participation, Service Provision, Waste Management	8
4 (Yellow)	Controlled Study, Environmental Management, Environmental Protection, Government, Human, Recycling	6
5 (Purple)	Developing Countries, Landfills, Municipal Solid Waste, Municipal Solid Waste Management, Waste Treatment	5

Source: Author's compilation using Vosviewer 1.6.15 (2023).

The first cluster is colored red. The keyword "Solid Waste Management" has the highest occurrence with a count of 49. Solid waste management is indeed a significant concern as solid waste constitutes the largest portion among other types of waste (Bhuiyan, 2010). Solid waste can include items such as plastics, electronics, and textiles. Poor solid waste management can have severe consequences for public health. Urban areas are the primary sources of solid waste due to high population concentrations (Chang et al., 2003). However, urban solid waste management is a complex issue. Solid waste production is not only generated by households but also by the industrial sector, as densely populated urban areas are often economic hubs. According to Meng (2021), there are five key aspects to consider in urban solid waste management: efforts to reduce industrial waste along the industrial chain, collaborative handling of classified municipal solid waste (MSW), efficient utilization of agricultural waste for various purposes, control of hazardous waste flow security, and optimization of market mechanisms. The PPP scheme in this cluster aims to engage industrial stakeholders in urban solid waste management.

The second cluster, colored green, is dominated by the keyword "Sustainable Development" with 33 occurrences. Many countries have adopted the SDGs 2030, which aimed at achieving a balanced state of development between the three dimensions: economic, social, and environmental. Consequently, sustainability aspects have become increasingly important in public infrastructure. Many PPP infrastructure projects are adopting the concept of sustainability as their project goal (Tian et al., 2023). On the other hand, the keyword "risk assessment" with 15 occurrences is also a vital topic in the decision-making process for both governments and the private sector. Many partnership projects meet failure, particularly due to the lack of financial capital. Dolla (2021) argues that to address financial implications, both direct and indirect political risks need to be carefully considered. For the public sector, a public body needs to conduct a careful social impact assessment before adopting a PPP model. Concession agreements should also include appropriate contractual provisions to compensate concessionaires and lenders with predetermined returns. For the private sector, specific risks in the form of contract breaches are a major concern for investors in public utility projects in developing countries.

The third cluster is dominated by articles located in India (19 occurrences). Based on Chatuverdi's research (2015) in Delhi, it is shown that the local government did not involve relevant stakeholders in the debate on PPP in waste management. This has resulted in the

formation of competitive alliances and taking advantage of the failures or weaknesses of opposing alliances. Furthermore, Assiamah's study (2017) recommends that in improving the performance of PPP in waste management, adequate decentralization is needed so that the local government has the authority to form partnerships based on their specific needs. In many developing countries, centralized PPP contracts are commonly found, which makes it difficult for local governments at the community level to facilitate effective waste management. Therefore, a decentralization process is required that involves local government institutions and actors, with contract agreements directly supervised by local governments instead of central governments (Faedlulloh, 2019). This decentralization process allows for adjustments to different local conditions. Furthermore, community participation will enhance "community ownership" and support for PPP programs in waste management. On the other hand, waste management projects and technologies within PPP should be based on cost-benefit analysis using credible data, ensuring the long-term sustainability of PPP projects.

The yellow cluster is dominated by the keyword "recycling" with 44 occurrences. Recycling waste can be done in various ways (see Table 1). The role of the private sector in this activity is to provide recycling facilities, as the limitations of technology and resources of the government cannot be ignored. The involvement of the private sector is not limited to large-scale projects such as infrastructure development but also allows for the participation of Small and Medium Enterprises (SMEs). Research conducted by Hughes (2018) provides an overview of how SMEs can play a role in waste recycling activities in Minnesota. Several small and medium-sized local businesses in Twin Cities Minnesota have chosen to operate in an open system and provide organic material recycling services. These small businesses have built their business models based on increasing consumer demand and government incentives. Similar views are also presented by Howard (2022).

The last cluster is the purple cluster. "Municipal Solid Waste" or MSW is the keyword with the highest intensity among all the included literature. In PPPs related to MSW, the government must play an active role as a regulator in setting environmental objectives, while the private sector provides financial resources, technical capabilities, and entrepreneurship to deliver public services (Arbulú et al., 2016). Many privatization cases aim to develop self-sustaining financial schemes without government support. In the MSW management system, this means that waste generators should pay user fees to service providers that cover costs; however, due to the nature of this service as a public good with significant investment, governments often provide payments to the private sector (Shekdar, 2009).

## Conclusion and Recommendation

This study aims to provide a comprehensive mapping of PPP literature in the field of waste management using bibliometric analysis. The analysis is conducted to evaluate citations, co-authorship, and co-occurrence of journals, articles, and authors from various countries contributing to this research field. The VOSviewer software and Scopus database are used to perform the analysis. The results of the analysis show that the journal "Habitat International" is the source of articles with the highest number of citations, totaling 1189 citations. Meanwhile, based on the Co-Authorship analysis, Wilson et al. (e.g. Wilson et al., 2006) are the most collaborative authors and have the most cited articles among all the included studies. Furthermore, the United Kingdom is the country of origin for most authors, with the highest TLS value. This indicates that PPP studies in waste management are centered there.

Furthermore, Co-occurrence analysis is conducted to map the articles into clusters based on keyword associations. This analysis resulted in five clusters, each with its dominant

topics. The first cluster is dominated by the topic of "Solid Waste Management," the second cluster by "Sustainable Development" and "Risk Assessment," the third cluster by articles with locations in India, the fourth cluster by the topic of "Recycling," and the fifth cluster by the topic of "Municipal Solid Waste."

Ultimately, the partnership between the government and the private sector in waste management can help address the limitations faced by the government and improve the overall quality and efficiency of public services. By harnessing the strengths of both sectors, it becomes possible to achieve better waste management outcomes and contribute to the sustainable development of communities.

The potential for effective partnership in waste management is greater when there is mutual interdependence between the parties involved. As highlighted by Smith (1985), governance relationships are established when organizations, including the government, become mutually dependent on each other. To manage this interdependence, strategies need to be developed that focus on resource interests, specifically the presence of waste management infrastructure that can be collectively managed through consensus among the involved parties. Therefore, it can be argued that the political dynamics between organizations play a crucial role in creating synergy between the government and the private sector.

At the level of partnership systems, the local government needs to have full involvement in the stages of waste selection, local transportation, and transportation to landfill sites. The government's role at higher hierarchical levels (e.g., province and central government) can provide support for waste management processes. However, it is important to emphasize decentralized waste management. On the other hand, the private sector can play a role in waste processing by utilizing technologies as agreed upon in the partnership agreement. If this is not feasible, privatization of waste management through independent Small and Medium Enterprises (SMEs) can become a new source of assistance for the government.

In addition, collaborative institutions need to be established collectively, such as Public Service Agencies, Technical Implementation Units, or other labeled entities that represent the political transactions and interests of the government. The role of these collaborative institutions is to coordinate and manage waste management activities along the waste management chain, including containment, collection, transportation, and processing.

## References

- Arbulú, I., Lozano, J., & Rey-Maqueira, J. (2016). The challenges of municipal solid waste management systems provided by public-private partnerships in mature tourist destinations: The case of Mallorca. *Waste Management*, 51(2016), 252–258. <https://doi.org/10.1016/j.wasman.2016.03.007>
- Bel, G., & Costas, A. (2006). Do Public Sector Reforms Get Rusty? Local Privatization in Spain. *The Journal of Policy Reform*, 9(1), 1–24. <https://doi.org/10.1080/13841280500513084>
- Bhuiyan, S. H. (2010). A crisis in governance: Urban solid waste management in Bangladesh. *Habitat International*, 34(1), 125–133. <https://doi.org/10.1016/j.habitatint.2009.08.002>
- Chang, M., Memon, M. A., & Imura, H. (2003). International Experience of Public-Private Partnerships for Urban Environmental Infrastructure, and its Application to China. *International Review for Environmental Strategies*, 4(2), 223–248.

- Chaturvedi, A., Arora, R., & Saluja, M. S. (2015). Private Sector and Waste Management in Delhi: A Political Economy Perspective. *IDS Bulletin*, 46(3), 7–16. <https://doi.org/10.1111/1759-5436.12140>
- Chen, Y. T., & Chen, C. C. (2012). The privatization effect of MSW incineration services by using data envelopment analysis. *Waste Management*, 32(3), 595–602. <https://doi.org/10.1016/j.wasman.2011.11.007>
- Cooke, A., Smith, D., & Booth, A. (2012). Beyond PICO: The SPIDER tool for qualitative evidence synthesis. *Qualitative Health Research*, 22(10), 1435–1443. <https://doi.org/10.1177/1049732312452938>
- Dewanti, M., Purnomo, E. P., & Salsabila, L. (2020). Analisa efektifitas bank sampah sebagai alternatif pengelolaan sampah dalam mencapai smart city di kabupaten kulon progo. *Publisia: Jurnal Ilmu Administrasi Publik*, 5(1). <https://doi.org/10.26905/pjiap.v5i1.3828>
- Dolla, T., & Laishram, B. (2021). Effect of energy from waste technologies on the risk profile of public-private partnership waste treatment projects of India. In *Journal of Cleaner Production* (Vol. 284). Elsevier Ltd. <https://doi.org/10.1016/j.jclepro.2020.124726>
- Ekere, W., Mugisha, J., & Drake, L. (2009). Factors influencing waste separation and utilization among households in the Lake Victoria crescent, Uganda. *Waste Management*, 29(12), 3047–3051. <https://doi.org/10.1016/j.wasman.2009.08.001>
- Faedlulloh, D. (2019). Program unggulan kampung iklim (proklam) berbasis pemberdayaan masyarakat. *Publisia: Jurnal Ilmu Administrasi Publik*, 4(1), 28-44. <https://doi.org/10.26905/pjiap.v4i1.2364>
- Giusti, L. (2009). A review of waste management practices and their impact on human health. *Waste Management*, 29(8), 2227–2239. <https://doi.org/10.1016/j.wasman.2009.03.028>
- Grimsey, D., & Lewis, M. K. (2004). Public-private partnerships: The worldwide revolution in infrastructure provision and project finance. *Public Private Partnerships: The Worldwide Revolution in Infrastructure Provision and Project Finance*, 1–268. <https://doi.org/10.4337/9781845423438>
- Howard, M., Yan, X., Mustafee, N., Charnley, F., Böhm, S., & Pascucci, S. (2022). Going beyond waste reduction: Exploring tools and methods for circular economy adoption in small-medium enterprises. *Resources, Conservation and Recycling*, 182(July), 106345. <https://doi.org/10.1016/j.resconrec.2022.106345>
- Hughes, S., & Peterson, J. (2018). Transforming municipal services to transform cities: Understanding the role and influence of the private sector. *Sustainability (Switzerland)*, 10(1). <https://doi.org/10.3390/su10010108>
- Kelleher, B. P., Leahy, J. J., Henihan, A. M., O'Dwyer, T. F., Sutton, D., & Leahy, M. J. (2002). Advances in poultry litter disposal technology - A review. *Bioresource Technology*, 83(1), 27–36. [https://doi.org/10.1016/S0960-8524\(01\)00133-X](https://doi.org/10.1016/S0960-8524(01)00133-X)
- Ma, J., & Hipel, K. W. (2016). Exploring social dimensions of municipal solid waste management around the globe – A systematic literature review. *Waste Management*, 56, 3–12. <https://doi.org/10.1016/j.wasman.2016.06.041>

- Meng, M., Wen, Z., Luo, W., & Wang, S. (2021). Approaches and policies to promote zero-waste city construction: China's practices and lessons. *Sustainability (Switzerland)*, 13(24), 1–22. <https://doi.org/10.3390/su132413537>
- Mulasari, S. A., Husodo, A. H., & Muhadjir, N. (2014). Kebijakan Pemerintah dalam Pengelolaan Sampah Domestik. *Kesmas: National Public Health Journal*, 8(8), 404. <https://doi.org/10.21109/kesmas.v8i8.412>
- OECD. (2022). *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options*. OECD. <https://doi.org/10.1787/de747aef-en>
- Ohlsson, H. (2003). Ownership and production costs: Choosing between public production and contracting out in the case of Swedish refuse collection. *Fiscal Studies*, 24(4), 451–476. <https://doi.org/10.1111/j.1475-5890.2003.tb00091.x>
- Osborne, D., & Gaebler, T. (1992). *Reinventing Government: How the Entrepreneurial Spirit Is Transforming the Public Sector, from Schoolhouse to the Pentagon*. (7th ed.). Addison-Wesley Publishing.
- Ralph, A., & Arora, A. (2022). A bibliometric study of reference literature on youth unemployment. *Journal of Enterprising Communities*. <https://doi.org/10.1108/JEC-04-2022-0062>
- Reyes-Gonzalez, L., Gonzalez-Brambila, C. N., & Veloso, F. (2016). Using co-authorship and citation analysis to identify research groups: a new way to assess performance. *Scientometrics*, 108(3), 1171–1191. <https://doi.org/10.1007/s11192-016-2029-8>
- Scharff, C., & Vogel, G. (1994). A Comparison of Collection Systems in European Cities. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 12(5), 387–404. <https://doi.org/10.1177/0734242X9401200503>
- Scheinberg, A., Spies, S., Simpson, M. H., & Mol, A. P. J. (2011). Assessing urban recycling in low- and middle-income countries: Building on modernized mixtures. *Habitat International*, 35(2), 188–198. <https://doi.org/10.1016/j.habitatint.2010.08.004>
- Shekdar, A. V. (2009). Sustainable solid waste management: An integrated approach for Asian countries. *Waste Management*, 29(4), 1438–1448. <https://doi.org/10.1016/j.wasman.2008.08.025>
- Sholahuddin, A., & Sadhana, K. (2022). The Implementation of Policies in the Management of Private Company based on the Regional Regulation of The Province of East Kalimantan, of Indonesia. *International Journal of Research in Social Science and Humanities (IJRSS)*, 3(9), 28-37. <https://doi.org/10.47505/IJRSS.2022.V3.9.4>
- Song, J., Song, D., Zhang, X., & Sun, Y. (2013). Risk identification for PPP waste-to-energy incineration projects in China. *Energy Policy*, 61, 953–962. <https://doi.org/10.1016/j.enpol.2013.06.041>
- Thanuskodi, S. (2010). *Journal of Social Sciences: A Bibliometric Study*. *Journal of Social Sciences*, 24(2), 77–80. <https://doi.org/10.1080/09718923.2010.11892847>

- Tian, B., Wang, Z., Li, C., & Fu, J. (2023). Can relational governance improve sustainability in public-private partnership infrastructure projects? An empirical study based on structural equation modeling. *Engineering, Construction and Architectural Management*, 30(1), 19–40. <https://doi.org/10.1108/ECAM-04-2021-0333>
- United Nations Environmental Programme. (2023). Turning off the Tap: How the World can end plastic pollution and create a circular economy. In United Nations Environment Programme.
- Wilson, D. C., Velis, C., & Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, 30(4), 797–808. <https://doi.org/10.1016/j.habitatint.2005.09.005>
- Xu, Y., Chan, A. P. C., Xia, B., Qian, Q. K., Liu, Y., & Peng, Y. (2015). Critical risk factors affecting the implementation of PPP waste-to-energy projects in China. *Applied Energy*, 158, 403–411. <https://doi.org/10.1016/j.apenergy.2015.08.043>
- Yeboah-Assiamah, E., Asamoah, K., & Kyeremeh, T. A. (2017). Decades of public-private partnership in solid waste management. *Management of Environmental Quality: An International Journal*, 28(1), 78–93. <https://doi.org/10.1108/MEQ-05-2015-0098>
- Zhuang, Y., Wu, S. W., Wang, Y. L., Wu, W. X., & Chen, Y. X. (2008). Source separation of household waste: A case study in China. *Waste Management*, 28(10), 2022–2030. <https://doi.org/10.1016/j.wasman.2007.08.012>
- Zupic, I., & Čater, T. (2015). Bibliometric Methods in Management and Organization. *Organizational Research Methods*, 18(3), 429–472. <https://doi.org/10.1177/1094428114562629>