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Article

Exploring and assessing landfill viability and sustainability dynamics in the Cape Coast Metropolis

Emmanuel Aidoo[1,2], C. D. Nandakumar[1,*], Gabriel Mwinkume[1,2], A. Bernick Raj[1]

[1] Department of Mathematics & Actuarial Science, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai 600048, India
[2] Department of Mathematics and Statistics, Cape Coast Technical University, Cape Coast P.O. Box DL 50, Ghana
*** Corresponding author:** C. D. Nandakumar, prof.cdnandakumaro@gmail.com

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Abstract: This study investigates the viability and sustainability of proposed landfill sites based on the uncapacitated facility location problem framework utilising the SmartPLS4 Structural Equation Modelling. Investigating the Cape Coast Metropolis, a stratified sampling method selected 400 samples out of which 320 valid respondents were used as the basis for the analysis. Through statistical analysis, significant correlations were identified among community acceptance, environmental impact, facility accessibility, site sustainability, and operational efficiency. However, no significant correlation was found between economic viability and site sustainability. Furthermore, the proposed indirect mediation pathway from operational efficiency to site sustainability via facility accessibility was also statistically insignificant. Employing the use of SmartPLS4 approach in studying the application of uncapacitated facility location problem framework, deepens the understanding of landfill viability and sustainability dynamics. This research contributes to the environmental sciences and sustainability by providing insights into landfill management strategies and emphasising the importance of community engagement and environmental performance in achieving sustainable outcomes. Future research could refine the model by including additional variables like technological advancements and regulatory frameworks, conducting longitudinal studies to track landfill dynamics over time, and undertaking comparative studies across different geographical regions. This could provide insights into management approaches' applicability. Interdisciplinary collaborations are recommended to address the multifaceted challenges of landfill sustainability.

Keywords: sustainability dynamics; landfill viability; uncapacitated facility location problem

1. Introduction

Landfills play a vital role in global waste disposal (Cao et al., 2019), prompting a transition to sustainable waste management (Sultana et al., 2023) methods amidst growing environmental apprehensions (Wanwari et al., 2018). It is imperative to identify appropriate landfill sites to ensure their long-term viability (Wunder, 2019), as they serve as pivotal centres for waste handling, resource reuse, and safeguarding the environment (Bueno et al., 2021; Mebunii, 2022; Pawandiwa, 2013). Incorporating modern practices like resource recovery and landfill gas capture promotes a circular economy and enhances sustainability (Hettiaratchi et al., 2021). Landfills must also ensure proper waste management to prevent environmental contamination (Laner et al., 2012). Mathematical models like the Uncapacitated Facility Location Problem (UFLP) (Baş and Yildizdan, 2024) aid in optimal landfill site selection (Ghosh, 2003), forming the underlying theory for this study. Critical factors influencing landfill success include location suitability, operational efficiency, economic viability, environmental impact, future sustainability, and community acceptance (Nanda and Berruti, 2021). Economic viability encompasses initial investment costs, operating expenses, and revenue from recyclables (Matthew, 2011), while environmental concerns like air and water pollution are significant (Hussain et al., 2024). Future sustainability, measured by factors such as remaining capacity and post-closure plans, is crucial (Townsend et al., 2015). Community acceptance, measured by public engagement and opposition levels, is essential for landfill success (ELARD, 2004; Hussain et al., 2024; Townsend et al., 2015). Robust software aids in landfill sustainable analysis (Sivakumar Babu et al., 2017). Future research should focus on environmental concerns for a sustainable society (Shui et al., 2023). This study evaluates the long-term sustainability of selected landfill sites in the Cape Coast Metropolis, exploring their capacity to meet waste disposal needs (Laner et al., 2012). It examines the mediating effects of facility accessibility and environmental impacts on the relationship between operational efficiency, economic viability, community acceptance, and landfill sustainability.

In this study, the UFLP model was employed as a mathematical technique (Ghosh, 2003; Glover et al., 2018; Sonuç, 2021) to predict the effects of these variables on the selection of optimal landfill sites (Zhang et al., 2023) to minimise fixed setup and variable operating expenses (Verter, 2011). Besides, using the SmartPLS4 model dwelling on the UFLP model to examine landfill site sustainability opens a new paradigm in the scholarly literature to predict landfill site sustainability.

This area of study of landfill site sustainable (Hettiaratchi et al., 2021) facility location still needs to be explored, necessitating a comprehensive approach and a well-structured problem framework. However, the variables employed in this study still necessitate further research. Based on six key constructs, we predicted the long-term sustainability and viability (Salnikova, 2023) of the selected landfill sites using the study's variables. Each construct is meticulously measured using specific indicators, providing a comprehensive analysis. The study further explores the mediating effects of landfill site facility accessibility and environmental impacts (Donevska et al., 2021) on the relationship between operational efficiency, economic viability, community acceptance (ELARD, 2004; Townsend et al., 2015), and landfill site sustainability. Dwelling on the understanding of the UFLP model, the SmartPLS4 model was used to predict the relationship among the variables; community acceptance, environmental impact, facility accessibility, site sustainability, and operational efficiency about landfill site sustainability to minimise fixed setup and variable operating expenses (ELARD, 2004; Townsend et al., 2015). In doing this, the study presents a novel approach to predicting landfill site sustainability using the SmartPLS4 model based on the understanding of UFLP. It contributes to the scholarly literature, providing a more robust and comprehensive approach to assessing landfill sustainability. Also, the study significantly contributes to environmental management (Agamuthu and Fauziah, 2011) and sustainability, offering a solid framework for landfill sustainability analysis and facilitating the adoption of sustainable waste management practices. It underscores the potential of using advanced analytical tools like SmartPLS4 to enhance our understanding and management of landfill sustainability (Kuhlman and Farrington, 2010).

The research conducted by Devaki and Shanmugapriya (2023) demonstrated that both legislation and top management significantly influence sustainable waste management in the construction and demolition sector. These findings provide essential insights for policymakers and stakeholders in waste management. The methodology used in the study is not specified in this context. However, by integrating UFLP and SmartPLS4 models in this study, the study introduces a pioneering methodology for predicting landfill site sustainability, offering valuable insights for policymakers and waste management professionals. This comprehensive approach contributes to the advancement of environmental management practices and emphasises the importance of holistic strategies and community engagement in achieving sustainable landfill outcomes. The study's innovative methodology and findings can significantly impacts academic research and provide practical implications for landfill sites' management.

2. Theoretical development

The Uncapacitated Facility Location Problem (UFLP) model is a classic optimisation problem in the areas of operations research and logistics (Armas et al., 2017). The UFLP model entails a preselected group of potential facility locations for building and a defined set of demand points in need of service (Aboolian et al., 2021) with the aim of determining which facilities to open and distribute demand points to these facilities. According to Ghosh (2003), the uncapacitated facility location issue entails choosing appropriate locations from a list of options to fulfil customer needs while minimising expenses. According to a study by Zhang et al. (2023), UFLP serves as a valuable tool for enhancing waste management systems. It achieves this by seamlessly integrating landfill sustainability and viability (Shakoor and Ahmed, 2023) considerations. By strategically locating facilities (such as recycling centres, waste treatment plants, or collection points), the UFLP contributes to more efficient waste handling, reduced environmental impact, and overall system optimisation (Earth5R's Blog, 2023). Similarly, Kik et al. (2022) indicated that UFLP enables planners to make well-informed decisions regarding facility locations, minimising costs, transportation distances, and environmental impact while optimising service coverage. Integrating UFLP into landfill siting and management practices can lead to positive outcomes in waste management systems (Donevska et al., 2021; Kundariya et al., 2021). (Maheshwari and Deswal, 2017) assert that UFLP enhances sustainability by enabling planners to strategically choose landfill sites based on environmental, economic, and social criteria. This approach minimises long-term environmental harm, while also promoting recycling initiatives (Saha, 2023).

It also improves viability by aiding decision-makers in identifying financially viable landfill locations (Sharer, 2023), optimising resource utilisation, and minimising environmental impacts. Properly located landfills minimise infrastructure costs and human resources for operations.

The study conducted by Pratiwi et al. (2019) focuses on addressing the Uncapacitated Facility Location Problem through the utilisation of the Cuckoo Search Algorithm. UFLP involves efficiently managing fixed setup and serving costs across multiple locations and facilities to meet customer demands without limitations on facility capacity. The Cuckoo Search Algorithm replicates the nesting behaviour of cuckoo species, drawing inspiration from their parasitic behaviour. The computational analysis showed that by increasing the number of nests and iterations, the total costs were minimised, and the value of pa, the probability of a cuckoo abandoning its nest and searching for a new one, was reduced, resulting in improved UFLP solutions. A paper by Baş and Yildizdan (2022) introduces the binary version of the arithmetic optimisation algorithm. The authors also propose a novel approach for generating candidate solutions using the XOR logic gate. Both approaches were evaluated for their effectiveness in tackling UFLPs and were compared to other binary heuristic methods. A thorough analysis was conducted on various candidate generation scenarios, suggesting that the binary version of the arithmetic optimisation algorithm could be a viable alternative.

2.1. Operations research and optimisation theory

The ucapacitated facility location problem is a concept in operations research that focuses on locating facilities to minimising costs while meeting demand (Mahdian et al., 2002). In landfill site selection, stakeholders can adapt UFLP to find sites strategically, relative to waste generation points to reduce transportation costs (Ahire et al., 2022; Janga and Reddy, 2024). Environmental science and Geographic Information Systems can be used to evaluate the suitability of candidate sites (Matthew, 2011) based on ecological, hydrological, and geological criteria. The UFLP can be integrated with sustainability assessment frameworks (Yousefi et al., 2018) to evaluate the long-term viability of landfill sites, considering economic, social, and environmental dimensions (Donevska et al., 2021). Risk management techniques and uncertainty analysis are also used to account for uncertainties and risks related to future waste generation rates, regulatory changes, and environmental impacts (Hussain et al., 2024). Community engagement and stakeholder analysis are essential for conducting sustainability and viability assessments. By integrating these theoretical perspectives, UFLP can be a powerful tool for predicting landfill sites and assessing their viability and sustainability (Donevska et al., 2021).

2.2. Landfill sites sustainability

Landfill sites play a vital role in waste management systems globally, ensuring current needs are met without jeopardising the needs of future generations (Lin et al., 2022). Modern landfills are designed to prioritise environmental protection by minimising harmful gases like methane and carbon dioxide and encouraging the reuse of resources while reducing waste. For sustainable landfilling (Brown et al., 1987; Townsend et al., 2015), it is crucial to implement integrated approaches like utilising landfill gas, incorporating renewable energy sources, treatment of waste and materials recovery, life-cycle management, site waste management plans, and ensuring regulatory compliance. To achieve sustainability in a cost-effective manner, several key factors have been meticulously considered. The seminal work by Chauhan and Singh (2016) underscores the significance of integrating these methodologies to address the intricate challenges associated with sustainable healthcare waste management, identified through a comprehensive analysis of existing research and on-site investigations.

2.3. Landfill Site acceptability

Community acceptability (Khan et al., 2018) involves alignment with community values, needs, and preferences regarding an action, project, or facility. United States Environmental Protection Agency (USEPA, 1993), discusses facility acceptability as the process of assessing the suitability of a landfill site for waste disposal. It involves evaluating factors such as land use, ecological impact (Desta et al., 2023), groundwater protection, leachate management, air quality, public acceptance (Cook, 2014), technical factors like stability, leachate collection, groundwater control, transportation, and regulatory compliance. The site must also comply with safety standards and guidelines (Paredes, 2023). The results of the siting process are often presented in an acceptability matrix, aiding local officials in selecting the best site for the proposed landfill and waste management centre (Donevska et al., 2021). According to Donevska et al. (2021), the evaluations of the landfill siting criteria indicate that the most frequent main criterion is environmental, followed by economic and social criteria, while the most preferred sub-criteria is distance to the surface waters.

2.4. Landfill operational efficiency

Facility management operational efficiency involves assessing the relationship between an organisation's output and input, aiming to maximise return on investment. It consists of minimising inputs and streamlining processes to deliver services and products cost-effectively (McDonald, 2022). Best practices include streamlining processes and monitoring performance. Prioritising operational efficiency leads to desirable profit margins, investor satisfaction, and high-quality products (McDonald, 2022). Efficient operations are essential for effective business management, as numerous organisations face challenges in boosting profits because of resource wastage. By incorporating operational efficiency best practices, businesses can transform their operations by striking the right balance between revenue and resources, ultimately increasing their return on investment.

2.5. Environmental impact

Assessment of environmental impact (Hussain et al., 2024) involves a crucial process that evaluates the environmental consequences of proposed projects, policies, or facilities. It helps identify potential environmental impacts (Ozbay et al., 2021), make informed decisions, and suggest mitigation measures. It influences landfill site sustainability (Sauve and Van Acker, 2020) by guiding site selection, design, operation, leachate management, air quality, biodiversity, health impacts, and climate change. Environmental impact assessment (Vasarhelyi, 2021) promotes sustainable landfill practices and contributes to overall environmental well-being (Townsend et al., 2015).

2.6. Economic viability

Economic viability, essential for investments, must justify costs throughout the facility's lifecycle, impacting profitability and public programme viability (McDonald, 2022). Talib et al. (2022) scrutinise data collection instruments for sustainable facilities management in Malaysian 5-star hotels using Partial Least Squares-

Structural Equation Modelling. Waste management's link to infrastructure development (Jayasinghe et al., 2023) is explored, highlighting community-led efforts with calls for increased government support (Phonchi-Tshekiso et al., 2020). Experts stress prioritising integrated solid waste management (Fadugba et al., 2022; Kumari and Sharma, 2018; Zurbrügg et al., 2012), considering various sustainability factors beyond technical aspects (Al-Khateeb et al., 2017). Zurbrügg et al. (2012) present a tailored assessment approach encompassing social mobilisation, stakeholder involvement, and legal structures.

This method enables policymakers, waste management entities, and researchers to make well-informed decisions (UNECE, 2018) based on the findings. Thorough evaluation and statistical examination assist in comprehending the sustainability of landfills and directing subsequent research endeavours (Chen et al., 2023; Thomas, 2023). The framework supports long-term waste disposal needs, minimises environmental impact, and ensures community acceptance (Vincevica-Gaile et al., 2023).

3. Hypotheses development and conceptual development

Researchers formulate and test hypotheses based on evidence, reasoning, and the context. They also build and organise a theoretical framework or model based on a literature review, key concepts, variables, and their interrelationships. Both processes are essential for conducting rigorous and coherent research (Creswell and Creswell, 2018; Kumar and Antonenko, 2014; Sekaran and Bougie, 2016).

3.1. Community acceptance of a landfill site and environmental impact

The acceptance of landfills and their environmental impact is a complex issue. Landfills, a standard waste disposal method, can cause groundwater contamination, air pollution, and landfill gas production, contributing to climate change (Abiriga et al., 2021; Vasarhelyi, 2021). Such impacts can affect the health and well-being of communities near landfills. Effective management of landfills can increase community acceptance (Ozbay et al., 2021), while opposition can lead to calls for better waste management practices (Vaverková, 2019). The hypothesis suggests that reducing landfill environmental impact can increase community acceptance, emphasises the importance of sustainable waste management for environmental protection and social acceptance. On this basis, it was hypothesised that:

H1: Community acceptance of landfill sites is influenced by the environmental impact of the landfill.

3.2. Community acceptance, and landfill site sustainability

Public support is pivotal for achieving sustainability goals (Vu et al., 2022), providing the framework for this study. Initiatives targeting sustainable resource utilisation necessitate changes in practices and behaviour, relying on consent and cooperation across various levels, from individuals to multinational entities (Bicket and Vanner, 2016). Public acceptability holds significance for several reasons. It can enhance participation and compliance, thus reducing enforcement costs and improving overall effectiveness and efficiency (Bicket and Vanner, 2016). A landfill site that garners greater acceptability can prompt community members to safeguard the landfill resources, thereby enhancing its sustainability and longevity (Bicket and Vanner, 2016). This study's premise is rooted in the understanding that community acceptance (Jugah et al., 2022) significantly influences the success and longevity of projects, particularly in environmental and waste management contexts (Achillas et al., 2013; Bicket and Vanner, 2016). Community acceptance is multifaceted, encompassing awareness, attitudes, and perceptions toward a project (Achillas et al., 2013). When a community embraces a project, it promotes a sense of ownership and responsibility, leading to behaviours that support the project's sustainability (Kinyata and Abiodun, 2020). Site sustainability pertains to a site's ability to maintain its functions and services over time (Gallopín, 2003), considering environmental, economic, and social dimensions (Morelli et al., 2018). In landfill site management, site sustainability involves efficient facility operation, environmental impact mitigation, and contributions to the local economy (Morelli et al., 2018). Consequently, examining the proposed relationship between community acceptance and site sustainability empirically can assess community acceptance levels and perceived site sustainability. In light of this, the hypothesis is posited that:

H2: Community acceptance of landfill sites influences its sustainability.

3.3. Environmental impact and site sustainability

The hypothesis "Environmental impact directly influences site sustainability" suggests a link between environmental impact and site sustainability (Nallapaneni et al., 2023; Vu et al., 2022). To develop this hypothesis effectively, precise definitions, context, and a testable relationship are crucial (Mair and Smith, 2021). Environmental impact (Khamis et al., 2024) encompasses pollution, resource depletion, and habitat destruction, while site sustainability entails ecological balance, social equity, and economic viability (Brown et al., 1987). The hypothesis suggests that as environmental impact rises, so site sustainability declines (Mair and Smith, 2021). Quantitative measures of environmental impacts (Basiago, 1998; Vaverková, 2019) can be collected from construction projects, and regression modelling can assess the relationship (Basiago, 1998; Núñez et al., 2011). This approach enables researchers to investigate the relationship effectively, contributing to environmental management and sustainable development (Bartelmus, 2013; Tuckett, 1994; Worku, 2017). Thus, it is hypothesised that:

H3: Environmental impact directly influences site sustainability.

3.4. Economic viability and environmental impact

The economic viability of a landfill is closely linked to its environmental impact (Khamis et al., 2024). The cost-effectiveness of its operation, including construction, maintenance, post-closure care, and potential revenue generation through recycling materials or energy production, are key factors. However, environmental impacts like air and water pollution, greenhouse gas emissions, and land degradation can have significant costs (Kumar et al., 2022). The hypothesis suggests that landfills managed effectively for minimising environmental impact are more economically viable (Allen, 2023), highlighting the importance of sustainable waste management practices for environmental protection (Usoh, 2024) and economic efficiency. Further research is needed to test this hypothesis and explore the complex relationship between economic viability and environmental impact in landfill management. On this premise, we hypothesised that:

H4: Economic viability has direct influence on environmental impact.

3.5. Economic viability and facility accessibility

Economic viability is a critical consideration for facilities managers, since financial planning ensures facilities yield positive returns on investment (Jones et al., 2008). The hypothesis statement, "Economic viability directly impacts facility accessibility," suggests a direct relationship between the economic viability of a facility and its accessibility (Moharekpour et al., 2024). This relationship can be explored through various dimensions of economic viability (Morelli et al., 2018), such as operational costs, maintenance costs, and revenue generation, and their effects on the accessibility of a facility (Okitasari et al., 2022; Stessens et al., 2017). For instance, high operational costs could limit the accessibility of a facility (PPPLRC, 2022; Stessens et al., 2017) by necessitating higher user fees or limiting the hours of operation (Smith, 2020). Maintenance costs could influence facility accessibility (Bhakuni and Das, 2023) by affecting the quality and safety of the facility, which in turn could impact user access. Qualitative methods, such as interviews and case studies, could provide insights into the mechanisms through which economic viability influences facility accessibility (Bhakuni and Das, 2023; Stessens et al., 2017). In conclusion, the hypothesis statement suggests a complex and multifaceted relationship between economic viability and facility accessibility (Stessens et al., 2017). Considering this premise, the hypothesis is formulated as follows:

H5: Economic viability of a landfill site influences its accessibility.

3.6. Economic viability and landfill site sustainability

Economic viability entails covering costs and generating returns while ensuring reliable landfill services (Vivien, 2023), whereas site sustainability involves minimising negative impacts and maximising resource recovery over time (Mor and Ravindra, 2023). Both concepts are interconnected (Desta et al., 2023; Osazee, 2021; Sivakumar Babu et al., 2017). Landfills are vital for waste disposal (Nanda and Berruti, 2021) but pose environmental and social challenges (Vasarhelyi, 2021). Economic viability relies on revenue from waste disposal fees, recycling, and energy generation, while sustainability encompasses environmental compliance and social acceptance. Sustainable practices yield economic benefits like revenue from recycling and offsetting operational costs (Allen, 2023; Qureshi, 2023). Conversely, unsustainable operations lead to increased costs and reputational damage. However, establishing a causal relationship depends on research specifics, available data, and context. Further research is needed to establish a causal relationship, and on this basis, we hypothesised that:

H6: Economic viability influences landfill site sustainability.

3.7. Facility accessibility and site sustainability

The hypothesis speculates a causal link between facility accessibility and site sustainability, emphasises the importance of access to waste disposal facilities in maintaining landfill sites' long-term viability (Bhakuni and Das, 2023). Defined as the ease of access and utilisation of waste facilities by stakeholders, facility accessibility plays a crucial role (Bhakuni and Das, 2023; Xiao and Wang, 2022). Site Sustainability encompasses environmental, social, and economic viability while ensuring ecosystem and community health (Cappuyns, 2016). Thus, facility accessibility can directly and indirectly affect landfill sustainability (Maleki and Zain, 2011). The proposed relationship suggests that higher facility accessibility leads to increased sustainability (Cervero, 2005). To test this, quantitative measures of accessibility (e.g., distance, availability, affordability) and sustainability (Bhakuni and Das, 2023) (e.g., environmental impact, social acceptability) can be collected and analysed using statistical methods like correlation or regression (Núñez et al., 2011). By investigating this relationship, researchers can provide valuable insights into landfill and waste management (Parvin et al., 2021). Upon this premise, it is hypothesised that:

H7: Facility accessibility directly influences site sustainability.

3.8. Operational efficiency and facility accessibility

Operational efficiency and facility accessibility are paramount in landfill management. Operational efficiency, defined as delivering superior services with minimal resources (Jeong and Phillips, 2001), involves optimising waste disposal processes, resource utilisation, and waste reduction. Facility accessibility (Bhakuni and Das, 2023) refers to the ease of accessing public amenities. Research indicates its impact on housing prices and public health (Liu et al., 2022). Improved operational efficiency may mitigate landfill impacts, enhancing community acceptance and accessibility (Sharma, 2023), although outcomes may vary based on local conditions and management practices. Therefore, prioritising operational efficiency and enhancing facility accessibility can foster more sustainable waste management practices. Upon this premise, it is hypothesised that:

H8: Operational Efficiency directly influences facility accessibility.

3.9. Operational efficiency and site sustainability

The hypothesis statement "operational efficiency directly influences site sustainability" suggests a direct relationship between the operational efficiency of waste management facilities, such as landfills, and the sustainability of these sites (Pagell and Gobeli, 2009). To develop this hypothesis effectively, it is essential to clarify the key terms, provide context, and propose a testable relationship. Operational efficiency is the ratio of output to input in a production system (C. Y. Lee and Johnson, 2014). In the context of landfill and waste management, it could refer to the effectiveness of waste disposal processes, the utilisation of resources, and the reduction of waste (Morris and Barlaz, 2011). Site sustainability, however, denotes the ability of a landfill site to maintain environmental, social, and economic viability over time, without compromising the health and safety of the surrounding ecosystem and community (Seo et al., 2023). Operational efficiency in waste management practices can influence the environmental impacts and costs of waste disposal (Gupta, 1995). For instance, efficient waste management practices can reduce the amount of waste that ends up in landfills, thereby reducing the environmental impact (Gupta, 1995). Based on the literature and the context, the following hypothesis can be formulated: Higher levels of operational efficiency in waste management lead to increased site sustainability (Seadon, 2010). This hypothesis suggests a positive relationship, proposing that as operational efficiency in waste management improves, the sustainability of landfill sites also improves (Das et al., 2019). In conclusion, by formulating a clear hypothesis based on the key terms, context, and literature, researchers can effectively investigate the relationship between operational efficiency and site sustainability, contributing valuable insights to the field of landfill and waste management. On this premise, it is hypothesised that:

H9: Operational efficiency directly influences site sustainability.

3.10. Community acceptance environmental impact, and landfill site sustainability

The environmental impact (Choo et al., 2024) of a landfill site, including air, water, and soil pollution, is a crucial aspect of waste management (Abubakar et al., 2022; Siddiqua et al., 2022; Vasarhelyi, 2021). It can be influenced by factors like methane emissions, leachate production, and improper waste management. Community acceptance is influenced by the perceived environmental impact of the landfill site, which can lead to protests and legal challenges (Otterbring and Folwarczny, 2024; Zhang et al., 2021). Landfill site sustainability is the ability of the site to minimise environmental impact, comply with regulations, and be socially acceptable (Osazee, 2021). The environmental impact can mediate the relationship between community acceptance and sustainability (Cope et al., 2022; Schmitz et al., 2019). High environmental impact may lead to low community acceptance and struggle to achieve sustainability, while low impact may lead to high acceptance and sustainability (Okitasari et al., 2022; Steyer, 2021; Toniolo et al., 2023; Zheng et al., 2021). A possible hypothesis is that efforts to reduce environmental impact can increase community acceptance and improve the site's sustainability (Guillette, 2016). However, this hypothesis depends on the specific research question, available data, and the context of the study. Further research is needed to establish a causal relationship. On this premise, we hypothesised that:

H10: Environmental impact mediates community acceptance and landfill site sustainability.

3.11. Economic viability, facility accessibility and landfill site sustainability

Landfill facility accessibility (Stessens et al., 2017), economic viability, and sustainability are crucial aspects of waste management. Accessibility refers to the ease of transporting waste to the landfill site, while economic viability involves the ability of the site to generate revenue and support its long-term operation. Accessibility, a key factor influencing landfill performance (Mahmood et al., 2024), refers to the ease of reaching the facility and the quality of transport infrastructure (Okitasari et al., 2022). Sustainability involves operating the landfill in a manner that minimises environmental impact, complies with regulations, and is socially acceptable. The accessibility of a landfill facility can mediate the relationship between economic viability and sustainability.

A possible hypothesis is that improving landfill facility accessibility, such as improving transportation links or extending operating hours, could lead to increased economic viability and improved sustainability (Stessens et al., 2017). On this note, it is hypothesised that:

H11: Facility accessibility mediates economic viability and landfill site sustainability.

3.12. Economic viability, environmental impact and site sustainability

Landfills' environmental impact is closely linked to their economic viability and site sustainability. Strict environmental regulations dictate waste management, leachate control, and methane emissions, which can lead to site sustainability. Site selection is also influenced by environmental factors, requiring locations away from sensitive ecosystems and residential areas. Waste diversion and recycling efforts reduce waste volume, but this reduces revenue from tipping fees. Advances in waste-to-energy technologies and alternative waste treatment methods offer environmentally friendly alternatives to landfills. Externalities like odour, traffic congestion, and visual blight also impact landfills' economic viability. Balancing environmental considerations with economic factors is crucial for the long-term success and sustainability of landfill projects. On this note, it is hypothesised that:

H12: Environmental impact mediates economic viability and landfill site sustainability.

3.13. Operational efficiency, facility accessibility and site sustainability

Facility accessibility significantly influences the operational efficiency and site sustainability of landfills in several ways. Firstly, easy accessibility facilitates the transportation of waste materials to the landfill site, reducing transportation costs and improving operational efficiency, thus ensuring timely waste disposal and smooth operations. Secondly, accessibility impacts the overall logistics of waste management within the landfill site. Well-designed access roads and layout allow for efficient movement of vehicles, machinery, and personnel within the facility, optimizing workflow and reducing operational bottlenecks. This enhancement in productivity and operational efficiency ultimately contributes to the economic viability of the landfill. Regarding site sustainability, facility accessibility can impact environmental considerations such as air and noise pollution. Furthermore, accessibility influences the social aspect of landfill operations by affecting community relations and public perception, contributing to the long-term sustainability of the site by reducing the likelihood of opposition or regulatory challenges. In summary, facility accessibility is integral to the operational efficiency and site sustainability of landfills. By facilitating waste transportation, optimizing logistics, enabling emergency response capabilities, and minimizing environmental and social impacts, accessible landfill facilities can enhance overall performance and contribute to the successful and sustainable management of waste. On this basis, it is hypothesised that:

H13: Facility accessibility mediates operational efficiency and landfill site sustainability.

3.14. Conceptual framework

The conceptual framework for exploring the viability and sustainability of landfill sites proposed and identified using the Uncapacitated Facility Location Problem (UFLP) model involves several interconnected components (Armas et al., 2017). Firstly, it encompasses constructs including site suitability, operational efficiency, economic viability, environmental impact, facility accessibility, and community acceptance, among others, all of which are deemed to collectively contribute to landfill site viability and sustainability (Ali and Ahmad, 2020). These constructs are operationalised (Bhattacherjee, 2023) as latent variables within the framework, with site suitability reflecting factors such as geographical location, operational efficiency encompassing waste management processes and resource utilisation, environmental impact addressing emissions reduction and ecosystem preservation, facility accessibility focusing on transportation logistics and infrastructure, and stakeholder engagement and social equity.

In the context of waste management and landfill siting, addressing sustainability and viability challenges, emphasis the need for environmentally sound and economically feasible solutions (Higham, 2014). This allows for decision makers to adopt systematic methods to evaluate siting strategies, ensuring environmentally sound, socially acceptable, and economically feasible solutions. This approach includes utilising optimisation criteria such as waste generation rates, transportation costs, and environmental impact to determine optimal landfill site locations. Additionally, the framework explores the interrelationships among the factors and considers moderating factors such as technological advancements, regulatory frameworks, and community engagement strategies as precursors of the relationship predicted (Votruba et al., 2018). This comprehensive framework facilitates systematic analysis of the complex interactions and trade-offs involved in landfill site selection and management, informing decision-making processes for promoting more sustainable waste management practices (Pereira et al., 2024).

In a recent study for example, Hamad et al. (2022) investigated the complex relationships between sustainable waste management practices, domestic tourism activities, and their collective impact on environmental pollution. Using structural equation modelling and SmartPLS software, the study provided valuable insights into the relationships among these factors, highlighting the need for effective waste management strategies to mitigate environmental pollution induced by domestic tourism. However, this current research delves into a related but distinct area of inquiry: the viability and sustainability of proposed landfill sites. While the previous study focused on the broader implications of waste management and tourism activities on environmental pollution, this study specifically examines the dynamics of landfill management and its environmental, economic, and social implications. This study bridges the knowledge gap regarding how sustainable waste management practices can influence landfill sites' viability and long-term sustainability. Specifically, the study explores the use SmartPLS4, to examine how factors such as community acceptance, environmental impact, and operational efficiency influence the overall effectiveness of landfill management strategies. Additionally, it assesses the role of sustainability in mitigating environmental pollution associated with landfill operations, drawing parallels with the broader context outlined in the previous study. The network of relationship is exhibited in **Figure 1** and explains the paths of the phenomena of relationship examined.

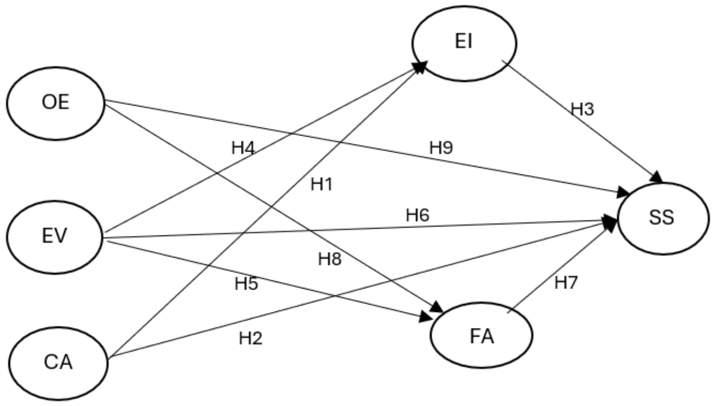

Figure 1. Conceptual model.

(Source: The authors' own creation, 2024).
Note: EV = Economic Viability, CA = Community Acceptance, OE = Operational Viability, EI = Environmental Impact, FA = Facility Accessibility, and SS = Site Sustainability. The deep arrows indicate direct relationships.

4. Materials and methods

This study explores the viability and sustainability of landfill drawing its understanding from UFLP models and using SmartPLS4.0 SEM path modelling. SmartPLS is suitable for this study due to its capability to handle reflective and formative constructs (Sarstedt et al., 2021). It is also adept at managing complex data with multiple relationships, including mediation and moderation such as this study (Hair et al., 2017; Nitzl, 2016). A total of 400 samples were collected, out of which 320 valid responses were used. The researchers utilised a standardised questionnaire to collect these responses, with the assistance of teaching assistants from the Mathematics and Statistics Departments at Cape Coast Technical University.

4.1. Sampling technique

The population of this study constitutes of all residents of Cape Coast Metropolis who are potential users of landfill sites. Cape Coast Metropolis covers an approximate area of 122 square kilometers with a housing population of 189,925 according to Cape Coast Metropolitan Assembly (n.d.). These population were all considered to be potential users of landfill sites. Therefore, to construct a robust sample, the researchers employed the stratified sampling method (Stellingwerf and Lwin, 1985). This method divided the population into two distinct strata (Cohen, 1992): Cape Coast North and Cape Coast South. The researchers selected 200 respondents within each stratum using a simple random sampling technique. Given the population size of 189,925 (Abdul-

Barik, 2012; Krejcie and Morgan, 1970), criterion was used as the basis of the sample selection. A population 189,295 correspond with 400 sample size as chosen for this study. This sample size was deemed adequate for the exploratory study as explained by Hair et al. (2017). However, as mentioned earlier, a valid response rate of 320 was validly used for this study. This application provides reliable statistical analysis of intricate relationships among several variables within a model. Notably, it estimates path coefficients and effect sizes by Hair et al. (2017). The use of SmartPLS4 programme is now a widespread tool in analysing multivariate data across diverse domains, including environmental sciences. It examines intricate interactions between latent variables, both independent and dependent. These latent variables are measured using sets of observable variables, effectively allowing the calculation of equations where all variables are directly observed (Sarstedt et al., 2020).

In this study therefore, the methodology adopted allowed for the examination of the usage and perspective landfill sites sustainability among residents of Cape Coast Metropolis. The objective of this approach was to analyse potential differences in landfill usage across various geographical regions within the metropolis. Two hundred (200) respondents were selected from each stratum using a simple random sampling technique, resulting in 400 participants with a 320 response rate. The chosen sample size for this study was considered appropriate given its exploratory nature, as detailed by Hair et al. (2017). Despite diligent efforts to achieve a sample size of 400, a response rate of 320 respondents was attained. Although this response rate may impact the generalizability of the findings, it was deemed sufficient for conducting statistical analysis of the relationships between variables within the model. This analysis facilitated a deeper understanding of landfill viability and sustainability by calculating path coefficients and determining their potential significance (Hair et al., 2017).

4.2. Data analysis and measurement scale

The study analyses the variability and sustainability of a facility located (a dumpsite or a landfill site) using constructs such as facility accessibility, operational efficiency, economic viability, environmental impact, site sustainability, and community acceptance. The study's independent variables consist of operational efficiency, economic viability and community acceptance while mediating variables are comprising facility accessibility and environmental impact all of them predicting landfill site sustainability, the dependent variable.

These variables were the focal points of the investigation. The questionnaires were mainly quantitative using 5-point Likert scale with categories (1—Strongly Agree, 2—Agree, 3—Not Sure, 4—Disagree and 5—Strongly Disagree) (Bhandari and Nikolopoulou, 2020).

Cleaning the initial data processing is always recommended to improve convergent validity of the indicator items (Ramayah, Francis, et al., 2017; Sarstedt et al., 2021). During the factor analysis, items falling below the minimum threshold were systematically eliminated, as proposed by Ramayah, Francis, et al. (2017); Sarstedt et al. (2021). According to Hair et al. (2017), a value of 0.70 is usually considered an adequate threshold for exploratory studies. Additionally, values higher than 0.90 indicate that all construct elements are highly correlated (Hair et al., 2017). The average variance extracted (AVE) should also fall above 0.50 to meet the convergent validity threshold (Cheung et al., 2023). Similarly, the composite reliability, and Cronbach alpha need to be greater than 0.70, with a better corresponding AVE (Cheung et al., 2023).

In this study, some of the indicator loadings were below the recommended threshold of 0.70 (Hair et al., 2017), and were deemed that convergent validity condition have not been met hence they were cleaned accordingly. However, those indicator loadings that were within the threshold were maintained and deemed that convergent validity condition have been met. **Figure 2** and **Table 1**, illustrate the measurement model showing the results of factor loadings, AVE, path coefficient with six latent variables and their corresponding indicators.

Table 1 summarises the results of construct validity and reliability including outer loadings, composite *R*, and the average value extract (AVE) for the latent variables in the measurement model

Table 1. The results of construct validity and reliability.

Latent Variables	Indicators	Outer loadings	Composite *R*	AVE
Community acceptability (CA)	CA1	0.770	0.853	0.591
	CA2	0.767		
	CA3	0.749		
	CA4	0.789		
Environmental impact (EI)	EI1	0.797	0.872	0.629
	EI4	0.790		
	EI5	0.778		
	EI6	0.807		
Economic viability (EV)	EV3	0.774	0.835	0.629
	EV4	0.825		
	EV5	0.778		
Facility accessibility (FA)	FA1	0.885	0.869	0.692
	FA3	0.903		
	FA4	0.690		
Operational efficiency (OE)	OE1	0.769		
	OE2	0.777	0.866	0.619
	OE4	0.800		
	OE5	0.799		
Site sustainability (SS)	SS1	0.975	0.978	0.938
	SS3	0.958		
	SS4	0.972		

Source: Authors creation on measurement model (Hair et al., 2009).
Note(s): EV = Economic Viability, CA = Community Acceptance, OE = Operational Viability, EI = Environmental Impact, FA = Facility Accessibility, and SS = Site Sustainability.

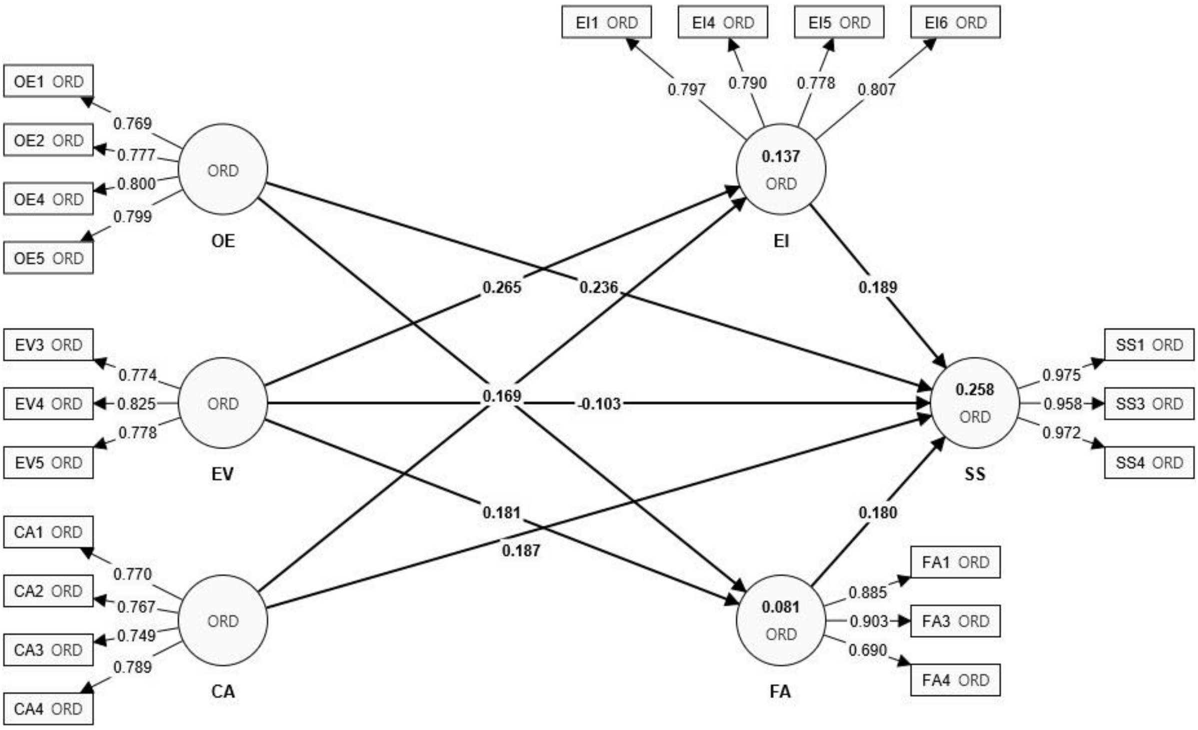

Figure 2. Measurement model results, final algorithm.

Source: The authors' own creation.

Note: EV = Economic Viability, CA = Community Acceptance, OE = Operational Viability, EI = Environmental Impact, FA = Facility Accessibility, and SS = Site Sustainability. The deep arrows indicate direct relationships.

4.3. Assessment of measurement model

The measurement model analysis evaluates the reflective model's internal consistency, indicator reliability, convergent validity, and discriminant validity (Ramayah, Cheah, et al., 2017). We use composite reliability to assess internal consistency. Furthermore, we evaluate the loading of indicators to establish their reliability. Calculating the average variance extracted (AVE) is essential for determining convergent validity. When assessing discriminant validity, we utilise the Fornell-Larcker test, cross-loading, and the Heterotrait-Monotrait ratio (HTMT) of correlations (Hair Jr. et al., 2017). The criteria for the measurement model involve item loadings above 0.7 (Hair Jr. et al., 2017; Ramayah, Cheah, et al., 2017), a composite reliability value of at least 0.7, and an AVE of at least 0.5 (Hair et al., 2009; Hair Jr. et al., 2017).

Nevertheless, loadings above 0.6 are considered acceptable (Hair Jr. et al., 2017), thus the loading 0.690 was considered to have met the required threshold. Convergent validity confirms that an item accurately reflects a latent variable, while AVE measures the extent of estimation errors (Hair et al., 2009; Hair Jr. et al., 2017; Henseler et al., 2015; Siang, 2014). The results from **Table 2** provide insights into construct validity and reliability across various latent variables, indicators, outer loadings, composite reliability, and average variance extracted. Indicators CA2 and CA4 of the construct community acceptance show high outer loadings of 0.984, indicating strong correlations with the latent variable (J. F. Hair et al., 2021). Indicators EI4 and EI5 of the construct environmental impact exhibit robust outer loadings of 0.976 and 0.972 respectively, indicating solid associations with the latent variable. The indicators EV3, EV4, and EV5 of the construct economic viability exhibit outer loadings ranging from 0.766 to 0.830, signifying moderate to strong correlations with the latent variable (J. F. Hair et al., 2021). Indicators FA1 and FA3 of the construct facility accessibility demonstrate high outer loadings of 0.909 and 0.926, respectively, indicating solid correlations with the latent variable. The provided composite reliability and AVE values indicate good construct validity and reliability. Indicators OE1 and OE6 of the construct operational efficiency exhibit robust outer loadings of 0.907 and 0.941, respectively, indicating solid associations with the latent variable, indicating good construct validity and reliability (J. F. Hair et al., 2021). Indicators SS2 and SS4 of the construct site sustainability show moderate outer loadings of 0.815 and 0.713, respectively, indicating correlations with the latent variable. composite reliability and AVE values are provided, with SS4 displaying relatively lower values, suggesting potential issues with construct validity (J. F. Hair et al., 2021).

Firstly, regarding community acceptability, all indicators (CA1, CA2, CA3, CA4) demonstrate strong representation of the latent variable, as indicated by high outer loadings ranging from 0.749 to 0.789. However, while the composite reliability exceeds the recommended threshold at 0.853, the average variance extracted (AVE) falls below the desired level at 0.591, suggesting that the indicators collectively may not explain a sufficient amount of variance in community acceptability, potentially indicating the presence of unmeasured factors (J. F. Hair et al., 2021). Conversely, environmental impact exhibits strong representation, with all indicators (EI1, EI4, EI5, EI6) displaying high outer loadings ranging from 0.778 to 0.807, accompanied by a composite reliability of 0.872 and an AVE of 0.629, indicating good internal consistency reliability and sufficient explanation of variance. Regarding economic viability, the indicators (EV3, EV4, EV5) also demonstrate strong representation, with high outer loadings ranging from 0.774 to 0.825, along with satisfactory composite reliability (0.835) and AVE (0.629), indicating robust internal consistency reliability and adequate explanation of variance. Facility accessibility showcases strong representation through its indicators (FA1, FA3, FA4), displaying high outer loadings ranging from 0.690 to 0.903, supported by a composite reliability of 0.869 and an AVE of 0.692, suggesting good internal consistency reliability and sufficient explanation of variance. Operational efficiency exhibits strong representation, with all indicators (OE1, OE2, OE4, OE5) showing high outer loadings ranging from 0.769 to 0.800, alongside a composite reliability of 0.866 and an AVE of 0.619, indicating robust internal consistency reliability and adequate explanation of variance (J. F. Hair et al., 2021). Lastly, site sustainability displays exceptionally strong representation, as evidenced by extremely high outer loadings for all indicators (SS1, SS3, SS4) ranging from 0.958 to 0.975. Similarly, the composite reliability of 0.978 far exceeds the recommended threshold, and the AVE of 0.938 is well above the desired level, indicating excellent internal consistency reliability and substantial explanation of variance. Overall, the SmartPLS analysis underscores the reliability and validity of the model, with most latent variables exhibiting strong representation by their indicators. However, attention may be needed to enhance the AVE of community acceptability and further explore potential unmeasured factors influencing this latent variable (J. F. Hair et al., 2021).

4.4. Enhancing discriminant validity assessment in the study

In our research, we conducted a thorough analysis of factor loadings, composite reliability, and average variance extracted to evaluate the validity of our study constructs. Specifically, we focused on discriminant validity (Rönkkö and Cho, 2022), which ensures that distinct constructs are indeed different from one another. Initially, the Fornell-Larcker criterion was applied to gain a comprehensive understanding of the validity measurement. However, it's worth noting that some scholars, including (Henseler et al., 2015), have raised concerns about its robustness. Despite these criticisms, we included the Fornell-Larcker criterion to provide a broader context for our validity assessment within the field. Recognising limitations in the Fornell-Larcker approach (Henseler et al., 2015), we also employed the Heterotrait-Monotrait Ratio (HTMT) method. Two tables (referred to as **Tables 2** and **3**) present the results of our discriminant validity analysis. The bolded values along the diagonal in these tables indicate that the discriminant validity criterion is met (Rönkkö and Cho, 2022; Voorhees et al., 2016). In summary, our findings demonstrate that the distinct and well-defined relationships between our study constructs support the validity of our research. These validity assessments enhance the robustness of our research and contribute to a deeper understanding of the underlying associations.

Table 2. Fornell-Larcker criterion.

Construct	CA	EI	EV	FA	OE	SS
CA	**0.769**					
EI	0.269	**0.793**				
EV	0.280	0.320	**0.793**			
FA	0.290	0.341	0.236	**0.832**		
OE	0.341	0.283	0.324	0.227	**0.786**	
SS	0.342	0.334	0.128	0.328	0.361	**0.968**

Source: Authors creation on measurement model (Hair et al., 2009).
Note(s): EV = Economic Viability, CA = Community Acceptance, OE = Operational Viability, EI = Environmental Impact, FA = Facility Accessibility, and SS = Site Sustainability.

Table 3. Heterotrait-Monotrait ratio (HTMT)—Matrix.

Constructs	CA	EI	EV	FA	OE	SS
CA						
EI	0.340					
EV	0.375	0.420				
FA	0.371	0.420	0.296			
OE	0.434	0.354	0.429	0.273		
SS	0.396	0.377	0.150	0.370	0.410	

Source: Authors creation on measurement model (Hair et al., 2009).
Note(s): EV = Economic Viability, CA = Community Acceptance, OE = Operational Viability, EI = Environmental Impact, FA = Facility Accessibility, and SS = Site Sustainability.

Table 4 presents the results of hypotheses testing, including the paths, original sample values, *t*-statistics, *p*-values, and decisions for each hypothesis. The table indicates whether each hypothesis was accepted or rejected based on the significance level. Additionally, mediation effects are examined, showing specific indirect paths between variables.

Table 4. The result of hypotheses testing.

Hypothesis	Path	Original sample (*O*)	*T* statistics (|*O*/STDEV|)	*P* values	Decision
H1	CA → EI	0.195	3.315	0.001	Accepted
H2	CA → SS	0.187	3.183	0.001	Accepted
H3	EI → SS	0.189	3.137	0.002	Accepted
H4	EV → EI	0.265	4.640	0.000	Accepted
H5	EV → FA	0.181	2.749	0.006	Accepted
H6	EV → SS	−0.103	1.855	0.064	Rejected
H7	FA → SS	0.180	2.859	0.004	Accepted
H8	OE → FA	0.169	2.593	0.010	Accepted
H9	OE → SS	0.236	3.476	0.001	Accepted
Mediation (Specific indirect)					
H10	CA → EI → SS	0.037	2.017	0.044	Accepted
H11	EV → FA → SS	0.033	2.092	0.036	Accepted
H12	EV → EI → SS	0.050	2.807	0.005	Accepted
H13	OE → FA → SS	0.030	1.627	0.104	Rejected

Source: Authors creation on measurement model (Hair et al., 2009).
Note(s): EV = Economic Viability, CA = Community Acceptance, OE = Operational Viability, EI = Environmental Impact, FA = Facility Accessibility, and SS = Site Sustainability. The arrows indicate direct relationships.

The table displays the results of hypothesis testing on the relationships between different factors that impact site sustainability. An analysis was conducted on the interconnections between community acceptance, environmental impact, economic viability, facility acceptance, operational viability, and site sustainability. The analysis uncovers noteworthy direct connections between community acceptance and both environmental impact (p = 0.001) and site sustainability (p = 0.001), indicating that community acceptance has an impact on environmental impact and overall site sustainability. In addition, there is a significant relationship between environmental impact and site sustainability (p = 0.002), suggesting that improved environmental impact results in enhanced site sustainability. The impact of economic viability on environmental outcomes and the acceptance of facilities is significant, as indicated by the statistical significance of environmental impact (p = 0.000) and facility accessibility (p = 0.006). Nevertheless, the correlation between economic viability and site sustainability is not statistically significant (p = 0.064), indicating that site sustainability may not be directly influenced by economic viability alone. In addition, facility acceptance has a substantial impact on site sustainability (p = 0.004), highlighting its importance in the overall sustainability of the site. The significance of operational viability is evident in its effect on facility accessibility (p = 0.010) and site sustainability (p = 0.001), highlighting its crucial role in determining the acceptance of facilities and overall site sustainability. Further examination of mediation effects reveals the presence of indirect relationships between variables. The indirect paths from community acceptance to site sustainability via environmental impact ($p = 0.044$), economic viability to site sustainability via facility accessibility ($p = 0.036$), and economic viability to site sustainability via environmental impact ($p = 0.005$) are statistically significant, highlighting the need to consider various factors in promoting sustainability. Nevertheless, limited significance of the mediation hypothesis operational efficiency to site sustainability via facility accessibility ($p = 0.104$) implies that the indirect path from operational viability to site sustainability through facility accessibility may hold little influence in this context. These findings offer valuable insights for stakeholders engaged in sustainability initiatives, highlighting the importance of addressing community acceptance, economic viability, and operational viability to improve site sustainability.

Table 5. The table presents path coefficients and associated confidence intervals for various direct.

Paths	Original sample (*O*)	Sample mean (*M*)	2.5%	97.5%
CA → EI	0.195	0.201	0.084	0.315
CA → SS	0.224	0.224	0.103	0.342
EI → SS	0.189	0.187	0.064	0.301
EV → EI	0.265	0.268	0.151	0.376
EV → FA	0.181	0.182	0.052	0.306
EV → SS	−0.021	−0.018	−0.122	0.086
FA → SS	0.180	0.182	0.059	0.303
OE → FA	0.169	0.177	0.048	0.302
OE → SS	0.266	0.269	0.140	0.394
Mediators				
CA → EI → SS	0.037	0.038	0.009	0.080
EV → FA → SS	0.033	0.032	0.006	0.067
EV → EI → SS	0.050	0.049	0.017	0.088
OE → FA → SS	0.030	0.033	0.004	0.077

Source: Authors Creation on Measurement Model (Hair et al., 2009).
Note(s): EV = Economic Viability, CA = Community Acceptance, OE = Operational Viability, EI = Environmental Impact, FA = Facility Accessibility, and SS = Site Sustainability. The arrows indicate direct relationships.

Table 5 presents path coefficients and associated confidence intervals for various direct and mediated pathways within a structural equation model. In examining the results: The table offers a thorough understanding of the direct and indirect connections between essential factors that impact site sustainability—analysing the direct connections between community acceptance, environmental impact, economic viability, facility accessibility, operational efficiency and site sustainability, while also considering mediation pathways. It is worth mentioning that community acceptance has a significant impact on both environmental impact and site sustainability, with path coefficients of 0.195 and 0.224, respectively. In the same vein, the effects on the environmental impact and the accessibility of the facility are greatly influenced by economic viability highlighting its significant role in shaping sustainability outcomes.

Nevertheless, the correlation between economic viability and site sustainability lacks statistical significance, indicating the necessity for additional investigation.

Operational efficiency, plays a crucial role in driving facility accessibility and site sustainability, highlighting its significance in bolstering sustainability initiatives. Mediation analysis uncovers complex pathways, illustrating the indirect effects of community acceptance and economic viability on site sustainability through environmental impact. The findings highlight the intricate factors that influence sustainability outcomes and offer valuable insights for stakeholders seeking to promote sustainability initiatives. Further research could investigate additional variables or contextual factors to enhance our understanding of sustainability dynamics in the studied context.

5. Results/discussion

The analysis uncovers a strong link between community acceptance and environmental impact. The *p*-value of 0.001 signifies the statistical significance of this connection, highlighting the influential role of community attitudes on environmental outcomes (David, 2023; Vetters, 2023). The acceptance of Hypothesis H1 indicates that communities that are more accepting of landfill sites also tend to be more tolerant of their environmental effects. This finding is consistent with previous research that emphasises the significant impact of community attitudes on environmental outcomes (Wunder, 2019). It underscores the importance of actively involving the community to achieve sustainable waste management practices (Ozbay et al., 2021; Vaverková, 2019). Extensive research consistently shows the significant influence of community acceptance on waste management practices and environmental policies (Zhang et al., 2021). Thus, the strong connection between community acceptance and environmental impact highlights the need to focus on strategies involving communities in tackling the adverse environmental effects of landfill sites (Vukovic, 2024).

The analysis reveals a significant direct correlation between community acceptance and site sustainability, supported by a *p*-value of 0.001, indicating a substantial impact of community attitudes on overall site sustainability (Kalra, 2020). The acceptance of Hypothesis H2 strengthens this finding, highlighting a robust connection between community acceptance and the enduring viability of landfill sites (Zhang et al., 2021). This finding is consistent with prior research emphasising the crucial role of community support in fostering sustainable waste management practices (Mair and Smith, 2021). Community engagement plays an important role in enhancing the sustainability of waste management initiatives by raising public awareness, fostering acceptance, and promoting cooperation (David, 2023b). Thus, the significant association between community acceptance and site sustainability underscores the importance of collaborative efforts with local communities to achieve sustainable waste management objectives.

The analysis uncovers a robust link between environmental impact and site sustainability, supported by a significant *p*-value of 0.002, underscoring the importance of reducing environmental harm to bolster site sustainability (Beth Howell, 2024). Hypothesis H3 supports this correlation, suggesting that taking measures to reduce ecological impacts can improve the overall sustainability of landfill sites. This discovery echoes earlier research emphasizing the critical importance of mitigating environmental harm and embracing sustainable waste management practices (Nallapaneni et al., 2023; Vu et al., 2022). Research highlights the importance of effectively managing and mitigating ecological impacts to ensure the sustainability of landfill sites and the surrounding ecosystems (Mair and Smith, 2021). The strong link between environmental impact and site sustainability highlights the importance of environmental conservation initiatives led by professionals to maintain the efficiency of waste management practices (Sirisha, 2023).

The analysis highlights the strong influence of economic viability on environmental outcomes, as evidenced by a p-value of 0.000, underscoring the need to consider economic factors when making waste management decisions in addition to environmental considerations (Allen, 2023). The connection between economic viability and environmental impact is confirmed by Hypothesis H4, as demonstrated by Khamis et al. (2024). This discovery resonates with earlier research highlighting the intricate interplay between economic factors and ecological outcomes in managing landfill sites, as discussed by Kumar et al. (2022). Financial factors are crucial in determining waste management practices and policies, frequently impacting decision-making processes (Usoh, 2024). Hence, the robust correlation between economic viability and environmental impact underscores the critical need for implementing sustainable waste management strategies that skillfully reconcile economic interests with environmental sustainability (Cohen, 2020).

The analysis highlights the importance of economic viability in determining the accessibility of waste management facilities (Cohen, 2020), as evidenced by a statistically significant p-value of 0.006. Hypothesis H5 supports the correlation, indicating that economic factors significantly influence public perceptions and accessibility of waste management infrastructure (Staley, 2023). This finding reinforces earlier research emphasising the substantial influence of economic factors on public perceptions of waste management facilities (Yasmeen et al., 2023). Financial stability is a crucial factor when assessing the approval of a facility. Facilities that demonstrate economic viability are seen as reliable and trustworthy (Begum and Ehsan, 2020). Thus, the connection between financial sustainability and ease of access to facilities underscores the significance of considering economic factors to improve public acceptance of waste management facilities.

The analysis suggests no statistically significant correlation between economic viability and site sustainability. The p-value of 0.064 indicates that economic viability alone may not directly influence site sustainability. As a result, Hypothesis H6 is rejected, suggesting no significant correlation between economic viability and site sustainability. While economic factors play a crucial role in shaping waste management strategies, it is essential to recognise that economic viability alone may not guarantee the suitability of a landfill site (Begum and Ehsan, 2020; Emilio and Escamilla-García, 2024). This finding challenges the findings of previous research studies that have highlighted the economic advantages of sustainable practices, such as generating revenue from recycling and reducing operational costs (Afroze, 2023; Martinez Sanchez et al., 2021). The surprising outcome emphasises the intricate nature of the various factors that impact the long-term viability of a site. It also emphasises the importance of conducting additional research to understand better the connection between economic feasibility and sustainable waste management practices (Allen, 2023; Mor and Ravindra, 2023; Qureshi, 2023).

The analysis emphasises the significant impact of facility accessibility on on-site sustainability, as supported by a *p*-value of 0.004, which underscores its importance in the overall sustainability of the site, highlighting the critical role of facility accessibility in determining suitable landfill locations (Ali and Ahmad, 2020b; Donevska et al., 2021; Kharat et al., 2016). Hypothesis H7 suggests that public perceptions and attitudes towards facility accessibility and site sustainability can influence the long-term sustainability of waste facilities (Yu et al., 2019). This finding is consistent with the existing literature highlighting the significance of public acceptance in promoting sustainable waste management practices (Enserink and Koppenjan, 2007). Establishments that inspire trust and approval from the community are more likely to attract support and cooperation, leading to better outcomes in terms of sustainability (McNeish et al., 2022). Thus, the strong link between facility accessibility and site sustainability highlights the value of fostering positive connections between waste management facilities and the communities they serve.

The importance of operational efficiency is evident in its effect on site sustainability (Muscad, 2023), with a *p*-value of 0.001, highlighting its critical role in determining overall site sustainability. Hypothesis H9 proposes a connection between operational efficiency and site sustainability, suggesting that landfill sites that are well-managed and operated efficiently have a higher likelihood of being sustainable in the long term (Ololade and Orimoloye, 2022). This finding is supported by previous research that has consistently shown a link between operational efficiency and the overall sustainability of waste management practices (Nicolli, 2019). Studies conducted by Gupta (1995) and Pagell and Gobeli (2009) have provided evidence for this connection. Efficient operational management is crucial for achieving better waste management results, improving environmental performance, and ensuring community satisfaction, all of which are essential for the long-term sustainability of the site, as emphasised by Seadon (2010). Hence, the evident link between operational efficiency and site sustainability underscores the significance of prioritising operational excellence to establish sustainable waste management practices.

The importance of community engagement in environmental management practices is underscored by the *p*-value of 0.044, which indicates the indirect connection between community acceptance and site sustainability through environmental impact. This finding aligns with prior research that emphasises the substantial impact of community attitudes on ecological outcomes in waste management activities (Wijntjes, 2023). Studies conducted by Otterbring and Folwarczny (2024) and others have provided evidence to support this. Communities prioritising environmental responsibility adopt sustainable practices (Natalie Ricklefs, 2022), leading to reduced environmental impacts and improved sustainability, as evidenced by research conducted by Cope et al. (2022) and Schmitz et al. (2019). Therefore, the connection between community acceptance and site sustainability highlights the importance of involving the community in promoting environmentally friendly waste management practices.

The significance of economic viability, site sustainability, and facility accessibility is underscored by the statistically significant *p*-value of 0.036, emphasising the interdependence of these factors in waste management practices. This finding is consistent with prior research that highlights the substantial influence of economic factors on public opinions and attitudes towards waste management facilities, as shown by Mahmood et al. (2024). Economically viable facilities are often considered more efficient and effective, increasing public acceptance and support and ensuring their long-term sustainability, as highlighted in studies conducted by Stessens et al. (2017). Therefore, the connection between economic viability and site sustainability, specifically regarding facility accessibility, highlights the importance of integrating economic factors to enhance the long-term sustainability of waste management practices.

The significance of the economic viability of site sustainability and environmental impact is highlighted by the statistically significant *p*-value of 0.005, highlighting the intricate relationship between financial factors, environmental outcomes, and the overall sustainability of waste management practices. The acceptance of this hypothesis underscores the link between economic viability and site sustainability, underscoring the significance of financial factors in shaping environmental outcomes (Lanfredi et al., 2023). This finding is consistent with prior research that emphasises the complex connection between economic viability, environmental impact, and sustainability, as demonstrated by Siddiqui (2020). Research conducted by Khamis et al. (2024) has demonstrated that economically viable practices or technologies can positively impact environmental performance and site sustainability in the long term. Therefore, the connection between economic viability and site sustainability, influenced by environmental impact, emphasises the importance of including economic factors in environmental decision-making to promote sustainable waste management practices.

The mediation hypothesis of operational efficiency to site sustainability via facility accessibility, with a *p*-value of 0.104, indicates that the indirect path from operational viability to site sustainability through facility accessibility may have minimal impact. The rejection of Hypothesis H13 indicates that there might be additional factors that exert a more significant influence on facility accessibility and site sustainability in waste management practices. There appears to be no notable connection between the practicality of operations and the site's long-term sustainability, specifically in terms of how easily the facility can be accessed (J. Lee et al., 2023). This unexpected finding contradicts previous research that suggested a connection between facility accessibility and landfill sustainability (Maleki and Zain, 2011), ensuring the performance and reliability of the facility is crucial for maintaining operational viability (Domenek et al., 2022). Therefore, the absence of a strong connection between operational efficiency and site sustainability through facility accessibility emphasises the need for further investigation into the factors that impact facility acceptance and site sustainability in waste management practices.

6. Conclusions and implications

The results yield invaluable insights into the intricate interplay of various factors that influence site sustainability and provide significant implications for stakeholders involved in sustainability initiatives. Hypothesis H1 suggests that the level of community acceptance has a significant influence on both the environmental impact and site sustainability. The significance level is set at 0.05. The results indicate that community acceptance has a significant impact on environmental impact ($p = 0.001$) and site sustainability ($p = 0.001$), exceeding the acceptable threshold. The importance of community involvement and support in driving environmental initiatives and fostering overall site sustainability cannot be overstated. Stakeholders must focus on implementing strategies that effectively engage and gain support from local communities to improve sustainability outcomes. Hypothesis H3 posits a positive association between environmental impact and site sustainability, with a significance level set at 0.05. The analysis uncovers a noteworthy correlation between environmental impact and site sustainability ($p = 0.002$), meeting the acceptable threshold. Enhancing environmental performance is crucial for achieving long-term sustainability goals, ensuring site sustainability, and emphasising the significance of adopting sustainable environmental practices. Hypotheses H4 and H5 suggest that economic viability has a significant impact on both environmental impact and facility accessibility, with a significance level of 0.05. The results demonstrate the substantial effects of economic viability on environmental impact ($p = 0.000$) and facility accessibility ($p = 0.006$), which meet the acceptable thresholds. However, the correlation between economic viability and site sustainability ($p = 0.064$) is not statistically significant, suggesting that economic viability alone might not directly impact the overall sustainability of the site. This emphasises the necessity of a holistic approach that encompasses economic, environmental, and social facets of sustainability. Hypotheses H8 and H9 investigated the impact of operational efficiency on facility accessibility and site sustainability, with a significance threshold of 0.05. The analysis uncovers noteworthy impacts of operational efficiency on both facility accessibility ($p = 0.010$) and site sustainability ($p = 0.001$), surpassing the acceptable thresholds.

The significance of efficient operations in promoting facility accessibility and overall site sustainability cannot be overstated. Stakeholders must prioritise improving operational efficiency and effectiveness. The existence of notable indirect connections between variables, demonstrated by mediation hypotheses (H10–H13), highlights the intricate nature of factors that impact sustainability outcomes. While some indirect paths show statistical significance, others do not meet the acceptable thresholds, indicating different levels of influence in promoting site sustainability. It is essential for stakeholders to thoroughly evaluate these indirect relationships and their implications when developing sustainability interventions and strategies.

6.1. Practical implications of the study

The study provides a detailed analysis of the sustainability and viability of landfills using SmartPLS. The findings can guide policymakers, waste management professionals, and stakeholders in developing more effective strategies for landfill management, such as optimising locations, enhancing waste diversion and recycling efforts, and implementing innovative technologies. The study also emphasises the importance of incorporating sustainability considerations into landfill planning and operations, such as investing in renewable energy generation, implementing best practices for waste handling and disposal, and engaging with local communities. This study offers valuable insights into the future of landfills and provides practical guidance to improving their sustainability.

6.2. Theoretical implications

The study has important theoretical implications. This research utilises SmartPLS, a cutting-edge method in waste management, to enhance our understanding of the methodology and stimulate discussions on its potential in intricate systems such as landfill viability and sustainability. The study highlights the importance of incorporating sustainability into landfill management practices. It aims to contribute to ongoing discussions on sustainable development and influence decision-making in waste management. It provides valuable insights into the dynamics of landfills, sparking theoretical discussions on complex systems theory in effectively managing these dynamic systems. The study also combines advanced statistical techniques with technological innovation, emphasising the potential of technology in improving landfill viability and sustainability.

6.3. Economic implications

The study "Unveiling the Future of Landfills" offers valuable insights into the viability and sustainability of landfills. It analyses operational costs and revenue streams, offering cost-effective strategies through SmartPLS analysis. The focus on sustainability can lead to long-term savings by reducing waste disposal expenses and addressing environmental issues. The findings could encourage investment in technological innovation to enhance landfill efficiency, minimise environmental impact, and optimise resource recovery, driving economic growth and job creation.

6.4. Social implications

The study emphasises the importance of efficient landfill management practices for environmental justice and pollution reduction. It underscores the need for community involvement in decision-making processes and the potential benefits of sustainable practices. The survey promotes community engagement and empowerment in waste management decisions, enhancing their well-being and contributing to collaborative efforts. The study also serves as an educational resource, raising awareness about landfill operations' environmental and social impacts.

6.5. Future directions of siting landfills

The study suggests future directions for siting landfills, emphasising strategic locations, sustainability, and economic feasibility. It suggests using SmartPLS techniques to aid decision-making, involving stakeholders through public consultations and workshops, and incorporating sustainable practices. The study also highlights the importance of proximity to recycling facilities and renewable energy resources. It also suggests exploring habitat restoration and conservation opportunities. Future landfill siting should prioritise adaptability and resilience, considering climate-related risks. Advanced technologies like landfill gas capture systems and remote sensing monitoring can enhance site operations and reduce environmental impacts.

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References

Abdul-Barik, A. (2012). Location of Semi-Obnoxious Facility and the Transportation of Solid Waste in the Northern Region of Ghana. Case Study: Zoomlion Ghana Limited. Available online: https://ir.knust.edu.gh/server/api/core/bitstreams/a2c211ce-b977-4cb3-a3cc-aa543fb45f8b/content (accessed on 8 March 2020).

Abiriga, D., Jenkins, A., Vestgarden, L. S., et al. (2021). A nature-based solution to a landfill-leachate contamination of a confined aquifer. Scientific Reports, 11(1), 1–12. https://doi.org/10.1038/s41598-021-94041-7

Aboolian, R., Berman, O., & Krass, D. (2021). Optimizing facility location and design. European Journal of Operational Research, 289(1), 31–43. https://doi.org/10.1016/j.ejor.2020.06.044

Abu Talib, A. A., Muhamad Ariff, N. R., Hasim, M. S., et al. (2022). Sustainable Facilities Management (SFM) initiatives in Malaysia hotel industry: reliability and validity analysis using Smart-PLS. IOP Conference Series: Earth and Environmental Science, 1067(1), 012079. https://doi.org/10.1088/1755-1315/1067/1/012079

Abubakar, I. R., Maniruzzaman, K. M., Dano, U. L., et al. (2022). Environmental Sustainability Impacts of Solid Waste Management Practices in the Global South. International Journal of Environmental Research and Public Health, 19(19), 12717. https://doi.org/10.3390/ijerph191912717

Achillas, C., Moussiopoulos, N., Karagiannidis, A., et al. (2013). The use of multi-criteria decision analysis to tackle waste management problems: a literature review. Waste Management & Research: The Journal for a Sustainable Circular Economy, 31(2), 115–129. https://doi.org/10.1177/0734242x12470203

Afroze, A. (2023). The economics of recycling: Balancing environmental benefits and costs. Journal of Environmental Waste Management and Recycling, 6(5), 165. https://doi.org/10.35841/aaewmr-6.5.165

Agamuthu, P., & Fauziah, S. H. (2011). Challenges and issues in moving towards sustainable landfilling in a transitory country - Malaysia. Waste Management and Research, 29(1), 13–19. https://doi.org/10.1177/0734242X10383080

Ahire, V., Behera, D. K., Saxena, M. R., et al. (2022). Potential landfill site suitability study for environmental sustainability using GIS-based multi-criteria techniques for Nashik and environs. Environmental Earth Sciences, 81(6). https://doi.org/10.1007/s12665-022-10295-y

Ali, S. A., & Ahmad, A. (2020). Suitability analysis for municipal landfill site selection using fuzzy analytic hierarchy process and geospatial technique. Environmental Earth Sciences, 79(10). https://doi.org/10.1007/s12665-020-08970-z

Al-Khateeb, A. J., Al-Sari, M. I., Al-Khatib, I. A., et al. (2017). Factors affecting the sustainability of solid waste management system—the case of Palestine. Environmental Monitoring and Assessment, 189(2). https://doi.org/10.1007/s10661-017-5810-0

Allen, C. (2023). The Economic and Environmental Benefits of Efficient Waste Management. Advances in Recycling & Waste Management. 8, 297. https://doi.org/10.37421/2475-7675.2023.8.297

Bartelmus, P. (2013). The future we want: Green growth or sustainable development? Environmental Development, 7(1), 165–170. https://doi.org/10.1016/j.envdev.2013.04.001

Baş, E., & Yildizdan, G. (2022). A New Binary Arithmetic Optimization Algorithm for Uncapacitated Facility Location Problem. https://doi.org/10.21203/rs.3.rs-2088938/v1

Baş, E., & Yildizdan, G. (2023). A new binary arithmetic optimization algorithm for uncapacitated facility location problem. Neural Computing and Applications, 36(8), 4151–4177. https://doi.org/10.1007/s00521-023-09261-x

Basiago, A. D. (1998). Economic, social, and environmental sustainability in development theory and urban planning practice. Environmentalist, 19(2), 145–161. https://doi.org/10.1023/A:1006697118620

Baskar, C., Ramakrishna, S., Baskar, S., et al. (2022). Handbook of Solid Waste Management. Springer Singapore. https://doi.org/10.1007/978-981-16-4230-2

Begum, R. A., & Ehsan, S. (2020). Economics of Waste Minimization, Recycling, and Disposal. Environmental Science. https://doi.org/10.1093/acrefore/9780199389414.013.424

Beth Howell. (2024). Environmental Sustainability: The importance, Issues and Benefits. Available online: https://blog.cleanhub.com/importance-issues-and-benefits-of-environmental-sustainability#:~:text=Improved human health, a major threat to life (accessed on 1 March 2024).

Bhakuni, P., & Das, A. (2023). An Innovative Algorithm-Driven Optimization Framework for Landfill Mining: Aiming Sustainable Profitability Expeditiously. IEEE Access, 11, 122792–122820. https://doi.org/10.1109/access.2023.3329583

Bhandari, P., & Nikolopoulou, K. (2020). What Is a Likert Scale? Available online: https://www.scribbr.com/methodology/likert-scale/ (accessed on 1 March 2024).

Bhattacherjee, A. (2023). 6.2: Operationalization. Available online: https://socialsci.libretexts.org/Bookshelves/Social_Work_and_Human_Services/Social_Science_Research_-_Principles_Methods_and_Practices_(Bhattacherjee)/06%3A_Measurement_of_Constructs/6.02%3A_Operationalization (accessed on 5 April 2021).

Bicket, M., & Vanner, R. (2016). Designing Policy Mixes for Resource Efficiency: The Role of Public Acceptability. Sustainability, 8(4), 366. https://doi.org/10.3390/su8040366

Brown, B. J., Hanson, M. E., Liverman, D. M., et al. (1987). Global sustainability: Toward definition. Environmental Management, 11(6), 713–719. https://doi.org/10.1007/bf01867238

Bueno, F. B., Günther, W. M. R., Philippi, A., et al. (2021). Site-specific framework of sustainable practices for a Brazilian contaminated site case study. Science of The Total Environment, 801, 149581. https://doi.org/10.1016/j.scitotenv.2021.149581

Cao, X., Lu, S., Stevens, W. R., et al. (2019). Fast indirect measurement of PCDD/F TEQ emission from municipal solid waste incineration: a review. Waste Disposal & Sustainable Energy, 1(1), 39–51. https://doi.org/10.1007/s42768-019-00003-1

Cape Coast Metropolitan Assembly. (n.d.). (index.php). Available online: https://ccma.gov.gh/aboutccma (accessed on 14 February 2024).

Cappuyns, V. (2016). Inclusion of social indicators in decision support tools for the selection of sustainable site remediation options. Journal of Environmental Management, 184, 45–56. https://doi.org/10.1016/j.jenvman.2016.07.035

Cervero, R. (2005). Accessible Cities and Regions: A Framework for Sustainable Transport and Urbanism in the 21st Century. UC Berkeley: Center for Future Urban Transport: A Volvo Center of Excellence. Available online: https://escholarship.org/uc/item/27g2q0cx (accessed on 1 March 2024).

Charity, P. C. (2013). Municipal solid waste disposal site selection. University of the Free State.

Chauhan, A., & Singh, A. (2016). A hybrid multi-criteria decision making method approach for selecting a sustainable location of healthcare waste disposal facility. Journal of Cleaner Production, 139, 1001–1010. https://doi.org/10.1016/j.jclepro.2016.08.098

Chen, W., Gu, J., Zeng, S., et al. (2023). Solid Waste Landfill Site Assessment Framework Based on Single-Valued Neutrosophic Hybrid Aggregation and Multi-Criteria Analysis. Sustainability, 15(7), 6021. https://doi.org/10.3390/su15076021

Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., et al. (2023). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. Asia Pacific Journal of Management. https://doi.org/10.1007/s10490-023-09871-y

Choo, C. Y., Abdul-Rahman, S., Yaakob, A. M., et al. (2023). Sustainable food waste management using modified fuzzy improved analytic hierarchy process: a study of Malaysia. Waste Disposal & Sustainable Energy, 6(1), 63–84. https://doi.org/10.1007/s42768-023-00176-w

Cohen, R. D. (1992). How the size of a random sample affects how accurately it represents a population. Journal of Chemical

Education, 69(3), 200. https://doi.org/10.1021/ed069p200
Cohen, S. (2020). Economic Growth and Environmental Sustainability. Sustainability. https://doi.org/10.4324/9780203011751
Cook, P. (2014). A systems view of community engagement: Exploration for simple rules of interaction to explain community resistance in Landfill Siting situations. In: Proceedings of the 58th Annual Meeting of the ISSS-2014 United States.
Cope, M. R., Kernan, A. R., Sanders, S. R., et al. (2022). Social Sustainability?: Exploring the Relationship between Community Experience and Perceptions of the Environment. Sustainability, 14(3), 1935. https://doi.org/10.3390/su14031935
Das, S., Lee, S. H., Kumar, P., et al. (2019). Solid waste management: Scope and the challenge of sustainability. Journal of Cleaner Production, 228, 658–678. https://doi.org/10.1016/j.jclepro.2019.04.323
David, B. (2023). Community engagement in the waste management and recycling: Best practices and success stories. Environmental Waste Management Recycling, 6(4), 158. https://doi.org/10.35841/aaewmr-6.4.158
de Armas, J., Juan, A. A., Marquès, J. M., et al. (2017). Solving the deterministic and stochastic uncapacitated facility location problem: from a heuristic to a simheuristic. Journal of the Operational Research Society, 68(10), 1161–1176. https://doi.org/10.1057/s41274-016-0155-6
Desta, M. D., Tesseme, T., Yigezu, T. T., et al. (2023). Assessment of landfill site suitability using GIS, remote sensing, and the multi-criteria decision-making (AHP) approach, Ethiopia. Geology, Ecology, and Landscapes, 1–14. https://doi.org/10.1080/24749508.2023.2256549
Devaki, H., & Shanmugapriya, S. (2023). Investigating barriers to sustainable management of construction and demolition waste: the case of India. Journal of Material Cycles and Waste Management, 25(3), 1594–1607. https://doi.org/10.1007/s10163-023-01631-w
Domenek, A. C., Moori, R. G., & Vitorino Filho, V. A. (2022). The mediating effect of operational capabilities on operational performance. Revista de Gestão, 29(4), 350–366. https://doi.org/10.1108/rege-01-2021-0016
Donevska, K., Jovanovski, J., & Gligorova, L. (2021). Comprehensive Review of the Landfill Site Selection Methodologies and Criteria. Journal of the Indian Institute of Science, 101(4), 509–521. https://doi.org/10.1007/s41745-021-00228-2
Earth5R's Blog. (2023). Sustainable Waste Management in Indore: A Case Study. Available online: https://earth5r.org/sustainable-waste-management-in-indore-a-case-study/ (accessed on 1 March 2024).
Emilio, P., & Escamilla-García. (2024). Landfills in Developing Economies: Drivers, Challenges, and Sustainable Solutions BT—Technical Landfills and Waste Management: Volume 1: Landfill Impacts, Characterization and Valorisation. In: Technical Landfills and Waste Management. Springer Nature Switzerland. pp. 157–170. https://doi.org/10.1007/978-3-031-52633-6_6
Ekins, P. (2002). Economic Growth and Environmental Sustainability. Routledge. https://doi.org/10.4324/9780203011751
ELARD. (2004). Solid waste treatment center "Jbeil-Hbaline" union of municipalities of Jbeil caza of Jbeil. Available online: https://pdf.usaid.gov/pdf_docs/Pnadg551.pdf (accessed on 29 July 2019).
Enserink, B., & Koppenjan, J. (2007). Public participation in China: sustainable urbanization and governance. Management of Environmental Quality: An International Journal, 18(4), 459–474. https://doi.org/10.1108/14777830710753848
European Commission. Joint Research Centre. (2021). Review of economic and socio-economic studies on recycling topics. Publications Office. https://doi.org/10.2760/041884
Fadugba, G. O., Yusoff, M. S., Arogundade, S., et al. (2022). Sustainable solid waste management. In: Dynamics and Interrelations Between Nature, Science, and Society. Springer, Cham. https://doi.org/10.1007/978-3-030-89336-1_1
Ghosh, D. (2003). Neighborhood search heuristics for the uncapacitated facility location problem. European Journal of Operational Research, 150(1), 150–162. https://doi.org/10.1016/S0377-2217(02)00504-0
Ghosh, S. K. (2020). Sustainable Waste Management: Policies and Case Studies. Springer Singapore. https://doi.org/10.1007/978-981-13-7071-7
Glover, F., Hanafi, S., Guemri, O., et al. (2018). A simple multi-wave algorithm for the uncapacitated facility location problem. Frontiers of Engineering Management, 5(4), 451. https://doi.org/10.15302/j-fem-2018038
Guillette A. (2016). Achieving Sustainable Site Design through Low Impact Development Practices. Available online: https://wbdg.org/resources/achieving-sustainable-site-design-through-low-impact-development-practices (accessed on 12 March 2024).
Gupta, M. C. (1995). Environmental management and its impact on the operations function. International Journal of Operations & Production Management, 15(8), 34–51. https://doi.org/10.1108/01443579510094071
Gallopín, G. (2003). A systems approach to sustainability and sustainable development. In: Buletinul Institutului de Studii si Proiectari Energetice English. Walter de Gruyter GmbH, Berlin/Munich/Boston. https://doi.org/10.1515/9783110608212-

011
Hair Jr, J. F., Matthews, L., Matthews, R., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: updated guidelines on which method to use. International Journal of Multivariate Data Analysis, 1, 107. https://doi.org/10.1504/IJMDA.2017.087624
Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2009). Multivariate data analysis, Seventh Edition. Pearson.
Hamad, K. O., Sulaiman, S. Z., Sürücü, A., et al. (2022). The Impact of Sustainable Waste Management and Domestic Tourism on Environmental Pollution in Erbil Governorate. International Journal of Environmental Pollution and Environmental Modelling, 5(2), 82–92.
Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8
Hettiaratchi, J. P. A., Jayasinghe, P. A., Yarandy, T. A., et al. (2021). Innovative Practices to Maximize Resource Recovery and Minimize Greenhouse Gas Emissions from Landfill Waste Cells: Historical and Recent Developments. Journal of the Indian Institute of Science, 101(4), 537–556. https://doi.org/10.1007/s41745-021-00230-8
Higham, A. P. (2014). Conceptual Framework for the Sustainable Benefit Evaluation of UK Social Housing Projects [PhD thesis]. Sheffield Hallam University.
Homburg, C., Klarmann, M., & Vomberg, A. (2020). Handbook of Market Research. Springer International Publishing. https://doi.org/10.1007/978-3-319-05542-8
Homburg, C., Klarmann, M., & Vomberg, A. (2022). Handbook of Market Research. Springer Cham. https://doi.org/10.1007/978-3-319-57413-4
Hussain, A., Deshwal, A., Priyadarshi, M., et al. (2024). Landfill leachate analysis from selected landfill sites and its impact on groundwater quality, New Delhi, India. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-023-04403-6
Hussain, C. M. (2018). Handbook of Environmental Materials Management. Springer International Publishing. https://doi.org/10.1007/978-3-319-58538-3
Jones, C., Leishman, C., MacDonald, C., et al. (2008). Economic Viability. Springer, Dordrecht. pp. 145–162. https://doi.org/10.1007/978-1-4020-8647-2_7
Janga, J. K., & Reddy, K. R. (2024). Integrated Resiliency and Sustainability Assessment of Bioreactor Landfills. Indian Geotechnical Journal. https://doi.org/10.1007/s40098-023-00838-w
Jayasinghe, P. A., Derrible, S., & Kattan, L. (2023). Interdependencies between Urban Transport, Water, and Solid Waste Infrastructure Systems. Infrastructures, 8(4), 76.
Jeong, K., & Phillips, D. T. (2001). Operational efficiency and effectiveness measurement. International Journal of Operations & Production Management, 21(11), 1404–1416. https://doi.org/10.1108/eum0000000006223
Jugah, I., Shin Yi, C., Afisha Yusuf, N., et al. (2022). Public Readiness and Acceptance Towards Implementation of Sarawak Digital Economy: A Case Study in Kuching, Sarawak. Journal of Administrative Science, 19(2), 109–118.
Khamis, S. S., Purwanto, H., Salleh, H. M., et al. (2023). Novel energy recovery from an integrated municipal solid waste and leachate treatment system. Waste Disposal & Sustainable Energy, 6(1), 53–61. https://doi.org/10.1007/s42768-023-00177-9
Khan, D., Kumar, A., & Samadder, S. R. (2018). Public Acceptance Study of Environmentally Suitable Landfill Sites. Current Science, 115(11), 2122. https://doi.org/10.18520/cs/v115/i11/2122-2129
Kharat, M. G., Kamble, S. J., Raut, R. D., et al. (2016). Identification and evaluation of landfill site selection criteria using a hybrid Fuzzy Delphi, Fuzzy AHP and DEMATEL based approach. Modeling Earth Systems and Environment, 2(2). https://doi.org/10.1007/s40808-016-0171-1
Kik, D., Wichmann, M. G., & Spengler, T. S. (2021). Decision support framework for the regional facility location and development planning problem. Journal of Business Economics, 92(1), 115–157. https://doi.org/10.1007/s11573-021-01050-z
Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement, 30(3), 607–610. https://doi.org/10.1177/001316447003000308
Kuhlman, T., & Farrington, J. (2010). What is Sustainability? Sustainability, 2(11), 3436–3448. https://doi.org/10.3390/su2113436
Kumar, A., Sharma, A., & Rawal, N. (2022). An approach for selection of solid waste treatment and disposal methods based on fuzzy analytical hierarchy process. Waste Disposal & Sustainable Energy, 4(4), 311–322. https://doi.org/10.1007/s42768-

022-00117-z
Kumar, S., & Antonenko, P. (2014). Connecting practice, theory and method: Supporting professional doctoral students in developing conceptual frameworks. TechTrends, 58(4), 54–61. https://doi.org/10.1007/s11528-014-0769-y
Kumari, S., & Sharma, S. (2018). ENVISION-International Journal of Commerce and Management Integrated Solid Waste Management: A System Approach. International Journal of Commerce and Management, 12(2018), 2456–4575.
Kundariya, N., Mohanty, S. S., Varjani, S., et al. (2021). A review on integrated approaches for municipal solid waste for environmental and economical relevance: Monitoring tools, technologies, and strategic innovations. Bioresource Technology, 342: 125982. https://doi.org/10.1016/j.biortech.2021.125982
Kinyata, G. S., & Abiodun, N. L. (2020). The Impact of Community Participation on Projects Success in Africa: A Bottom Up Approach. International Journal of Research in Sociology and Anthropology, 6(3), 1–8. https://doi.org/10.20431/2454-8677.0603001
Laner, D., Crest, M., Scharff, H., et al. (2012). A review of approaches for the long-term management of municipal solid waste landfills. Waste Management, 32(3), 498–512. https://doi.org/10.1016/j.wasman.2011.11.010
Lanfredi, M., Coluzzi, R., Imbrenda, V., et al. (2023). In-between Environmental Sustainability and Economic Viability: An Analysis of the State, Regulations, and Future of Italian Forestry Sector. Land, 12(5), 1001. https://doi.org/10.3390/land12051001
Lee, C. Y., & Johnson, A. L. (2013). Operational efficiency. Industrial Innovation, 17–44. https://doi.org/10.1201/b15964-5
Lee, J., Chung, H., & Cho, N. E. (2023). The Effects of Operational Efficiency and Environmental Risk on the Adoption of Environmental Management Practices. Sustainability, 15(22), 15869. https://doi.org/10.3390/su152215869
Lin, X., Ma, Y., Chen, T., et al. (2022). PCDD/Fs and heavy metals in the vicinity of landfill used for MSWI fly ash disposal: Pollutant distribution and environmental impact assessment. Environmental Pollution, 312, 120083. https://doi.org/10.1016/j.envpol.2022.120083
Liu, L., Yu, H., Zhao, J., et al. (2022). Multiscale Effects of Multimodal Public Facilities Accessibility on Housing Prices Based on MGWR: A Case Study of Wuhan, China. ISPRS International Journal of Geo-Information, 11(1), 57. https://doi.org/10.3390/ijgi11010057
Matthew, J. (2011). Economic and Operational Feasibility Analysis of Solid Waste Minimization Projects. In: Integrated Waste Management. IntechOpen. https://doi.org/10.5772/16420
Mahdian, M., Ye, Y., & Zhang, J. (2002). On Approximating Facility Location and Related Problems. Available online: https://web.stanford.edu/~yyye/aflp.pdf (accessed on 1 March 2024).
Maheshwari, S., & Deswal, S. (2017). Role of Waste Management at Landfills in Sustainable Waste Management. International Journal on Emerging Technologies, 8(1), 324–328.
Mahmood, S., Misra, P., Sun, H., et al. (2024). Sustainable infrastructure, energy projects, and economic growth: mediating role of sustainable supply chain management. Annals of Operations Research. https://doi.org/10.1007/s10479-023-05777-6
Mair, J., & Smith, A. (2021). Events and sustainability: why making events more sustainable is not enough. Journal of Sustainable Tourism, 29(11–12), 1739–1755. https://doi.org/10.1080/09669582.2021.1942480
Maleki, M. Z., & Zain, M. F. M. (2011). Factors that influence distance to facilities in a sustainable efficient residential site design. Sustainable Cities and Society, 1(4), 236–243. https://doi.org/10.1016/j.scs.2011.07.008
McDonald, J. (2022). Operational Efficiency: The Holy Grail of Facility Management. Available online: https://www.iofficecorp.com/blog/operational-efficiency-in-facility-management (accessed on 1 March 2024).
McNeish, R., Albizu-Jacob, A., & Memmoli, C. (2021). Engaging the Community to Effectively Plan and Implement Community-Based Mental Health Programs. The Journal of Behavioral Health Services & Research, 49(2), 149–161. https://doi.org/10.1007/s11414-021-09767-z
Mebunii, C. E. (2022). Landfill Meaning, Purpose and Alternatives Explained Landfill Meaning. Available online: https://www.felsics.com/landfill-meaning-purpose-and-alternatives-explained/ (accessed on 1 March 2024).
Moharekpour, M., Shokri, M., Wellerdick, E., et al. (2024). An Evaluation of the Economic Viability and Accessibility of CRCP and JPCP: A Comparative Analysis. Sustainability, 16(3), 1108. https://doi.org/10.3390/su16031108
Mor, S., & Ravindra, K. (2023). Municipal solid waste landfills in lower- and middle-income countries: Environmental impacts, challenges and sustainable management practices. Process Safety and Environmental Protection, 174, 510–530. https://doi.org/10.1016/j.psep.2023.04.014
Morelli, B., Cashman, S., Ma, X., et al. (2018). Effect of Nutrient Removal and Resource Recovery on Life Cycle Cost and

Environmental Impacts of a Small Scale Water Resource Recovery Facility. Sustainability, 10(10), 3546. https://doi.org/10.3390/su10103546

Morris, J. W. F., & Barlaz, M. A. (2011). A performance-based system for the long-term management of municipal waste landfills. Waste Management, 31(4), 649–662. https://doi.org/10.1016/j.wasman.2010.11.018

Muscad, O. (2023). The Role of Operational Efficiency in Business Success: What is Operational Efficiency? Why is Operational Efficiency Important? Promoting Sustainability Efficiency Vs. Productivity: What's the Difference? Expects in the Connected Factory. Available online: https://datamyte.com/blog/operational-efficiency/ (accessed on 1 March 2024).

Nallapaneni, M. K., Hait, S., Priya, A., et al. (2023). From Trash to Treasure: Unlocking the Power of Resource Conservation, Recycling, and Waste Management Practices. Sustainability, 15(18), 13863. https://doi.org/10.3390/su151813863

Nanda, S., & Berruti, F. (2020). Municipal solid waste management and landfilling technologies: a review. Environmental Chemistry Letters, 19(2), 1433–1456. https://doi.org/10.1007/s10311-020-01100-y

Natalie Ricklefs. (2022). Community engagement for environmental justice and sustainability. CitizenLab, May. Available online: https://www.citizenlab.co/blog/environment-sustainability/community-engagement-for-environmental-justice-and-sustainability/ (accessed on 1 March 2024).

Nitzl, C. (2016). The use of partial least squares structural equation modelling (PLS-SEM) in management accounting research: Directions for future theory development. Journal of Accounting Literature, 37(1), 19–35. https://doi.org/10.1016/j.acclit.2016.09.003

Núñez, E., Steyerberg, E. W., & Núñez, J. (2011). Regression Modeling Strategies. Revista Española de Cardiología (English Edition), 64(6), 501–507. https://doi.org/10.1016/j.rec.2011.01.017

Nicolli, F. (2019). Waste Management Evaluations and Sustainability. In: Encyclopedia of Sustainability in Higher Education. Springer International Publishing. https://doi.org/10.1007/978-3-030-11352-0_457

Okitasari, M., Mishra, R., & Suzuki, M. (2022). Socio-Economic Drivers of Community Acceptance of Sustainable Social Housing: Evidence from Mumbai. Sustainability, 14(15), 9321. https://doi.org/10.3390/su14159321

Osazee, I. T. (2021). Landfill in a Sustainable Waste Disposal. European Journal of Environment and Earth Sciences, 2(4), 67–74. https://doi.org/10.24018/ejgeo.2021.2.4.165

Otterbring, T., & Folwarczny, M. (2024). Social validation, reciprocation, and sustainable orientation: Cultivating "clean" codes of conduct through social influence. Journal of Retailing and Consumer Services, 76, 103612. https://doi.org/10.1016/j.jretconser.2023.103612

Ozbay, G., Jones, M., Gadde, M., et al. (2021). Design and Operation of Effective Landfills with Minimal Effects on the Environment and Human Health. Journal of Environmental and Public Health, 2021, 1–13. https://doi.org/10.1155/2021/6921607

Pagell, M., & Gobeli, D. (2009). How Plant Managers' Experiences and Attitudes Toward Sustainability Relate to Operational Performance. Production and Operations Management, 18(3), 278–299. https://doi.org/10.1111/j.1937-5956.2009.01050.x

Paredes, R. (2023). Site Inspection: Keep Your Site Safe and Compliant What is a Site Inspection? Available online: https://safetyculture.com/topics/site-inspection/ (accessed on 1 March 2024).

Parvin, F., Ali, S. A., Hashmi, S. N. I., et al. (2020). Accessibility and site suitability for healthcare services using GIS-based hybrid decision-making approach: a study in Murshidabad, India. Spatial Information Research, 29(1), 1–18. https://doi.org/10.1007/s41324-020-00330-0

Pereira, L. M., Sanchez Rodrigues, V., & Freires, F. G. M. (2024). Use of Partial Least Squares Structural Equation Modeling (PLS-SEM) to Improve Plastic Waste Management. Applied Sciences, 14(2), 628. https://doi.org/10.3390/app14020628

Phonchi-Tshekiso, N. D., Mogomotsi, P. K., Mogomotsi, G. E. J., et al. (2020). A qualitative assessment of solid waste management in Peleng township in Lobatse, Botswana considering spatial aspects. Waste Disposal & Sustainable Energy, 2(3), 219–230. https://doi.org/10.1007/s42768-020-00042-z

PPPLRC. (2022). Assessing project feasibility and economic viability. Private Partnership Legal Resource Center, De 1998. Available online: https://ppp.worldbank.org/public-private-partnership/assessing-project-feasibility-and-economic-viability (accessed on 1 March 2024).

Pratiwi, A. B., Faiza, N., & Edi Winarko, E. (2019). Penerapan Cuckoo Search Algorithm (CSA) untuk Menyelesaikan Uncapacitated Facility Location Problem (UFLP). Contemporary Mathematics and Applications (ConMathA), 1(1), 34. https://doi.org/10.20473/conmatha.v1i1.14773

Qureshi, A. (2023). The Economics of Sustainability Why Sustainable Practices Make Business Sense. Available online:

https://blueandgreentomorrow.com/features/economics-of-sustainability-why-sustainable-practices-make-business-sense/ (accessed on 12 March 2024).

Ramayah, T., Cheah, J., Chuah, F., et al. (2017b). Partial Least Squares Structural Equation Modeling. In: Handbook of Market Research. Springer, Cham. pp. 587–632. https://doi.org/10.1007/978-3-319-57413-4_15

Ramayah, T., Cheah, J. H., Chuah, F., et al. (2017). PLS-SEM using SmartPLS 3.0: Chapter 13: Assessment of Moderation Analysis. In: Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.0 An Updated and Practical Guide to Statistical Analysis. Pearson.

Rönkkö, M., & Cho, E. (2020). An Updated Guideline for Assessing Discriminant Validity. Organizational Research Methods, 25(1), 6–14. https://doi.org/10.1177/1094428120968614

Saha, A. (2023). Circular Economy Strategies for Sustainable Waste Management in the Food Industry. Journal of Recycling Economy and Sustainability Policy, 2(2), 1–16.

Salnikova, K. (2023). Method for determining the optimal location of public catering facilities. The Eurasian Scientific Journal, 15(3). https://doi.org/10.15862/71ecvn323

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial Least Squares Structural Equation Modeling. In: Handbook of Market Research. Springer; pp. 587–632. https://doi.org/10.1007/978-3-319-57413-4_15

Sauve, G., & Van Acker, K. (2020). The environmental impacts of municipal solid waste landfills in Europe: A life cycle assessment of proper reference cases to support decision making. Journal of Environmental Management, 261, 110216. https://doi.org/10.1016/j.jenvman.2020.110216

Schmitz, C. L., Stinson, C. H., & James, C. D. (2019). Community and Environmental Sustainability. Critical Social Work, 11(3). https://doi.org/10.22329/csw.v11i3.5834

Seadon, J. K. (2010). Sustainable waste management systems. Journal of Cleaner Production, 18(16–17), 1639–1651. https://doi.org/10.1016/j.jclepro.2010.07.009

Sekaran, U., & Bougie, R. (2016). Research Methods for Business: A Skill Building Approach, Seventh Edition. John Wiley & Sons.

Seo, J., Lee, J., Jung, S., et al. (2023). The Role of Creating Shared Value and Entrepreneurial Orientation in Generating Social and Economic Benefits: Evidence from Korean SMEs. Sustainability, 15(7), 6168. https://doi.org/10.3390/su15076168

Shakoor, A., & Ahmed, R. (2023). The environmental sustainable development goals and economic growth: an empirical investigation of selected SAARC countries. Environmental Science and Pollution Research, 30(54), 116018–116038. https://doi.org/10.1007/s11356-023-30483-y

Sharer, H. (2023). What is Financial Viability? Understanding the Basics and Impact on Businesses. Available online: https://www.tffn.net/what-is-financial-viability/ (accessed on 14 March 2024).

Shui, W., Feng, X., & Yue, F. (2023). Our Future Earth and Sustainable Ecological Environment and Society. Environmental Sustainability and Applications, 7, 1–19.

Siang, T. C. (2014). A Moral Extension of the Theory of Planned Behavior to Predict Consumers' Purchase Intention for Energy-Efficient Household Appliances [Master's thesis]. Universiti Sains Malaysia.

Siddiqua, A., Hahladakis, J. N., & Al-Attiya, W. A. K. A. (2022). An overview of the environmental pollution and health effects associated with waste landfilling and open dumping. Environmental Science and Pollution Research, 29(39), 58514–58536. https://doi.org/10.1007/s11356-022-21578-z

Siddiqui, D. A. (2020). Conceptual Framework of Sustainable Economic Growth: A Theoretical Review. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3641573

Sirisha. (2023). Global Waste Solutions: Environmental Significance of Sustainable Waste Management. Available online: https://scaleclimateaction.org/environment/global-waste-solutions-environmental-significance-of-sustainable-waste-management/ (accessed on 1 March 2024).

Sloane-Seale, A. (2009). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Canadian Journal of University Continuing Education, 35(2). https://doi.org/10.21225/d54s3d

Sonuç, E. (2021). Binary crow search algorithm for the uncapacitated facility location problem. Neural Computing and Applications, 33(21), 14669–14685. https://doi.org/10.1007/s00521-021-06107-2

Staley, B. (2023). Reimagining Waste: How Management Practices Shape Economic Circularity. Available online: https://www.waste360.com/sustainability/reimagining-waste-how-management-practices-shape-economic-circularity (accessed on 1 March 2024).

Stellingwerf, D. A., & Lwin, S. (1985). Stratified sampling compared with two-phase stratified cluster sampling for timber volume estimation. Netherlands Journal of Agricultural Science, 33(2), 151–160. https://doi.org/10.18174/njas.v33i2.16861

Stessens, P., Khan, A. Z., Huysmans, M., et al. (2017). Analysing urban green space accessibility and quality: A GIS-based model as spatial decision support for urban ecosystem services in Brussels. Ecosystem Services, 28, 328–340. https://doi.org/10.1016/j.ecoser.2017.10.016

Steyer, S. (2021). Introduction. In: Grid-Based Object Tracking. VDI Verlag. pp. 1–12. https://doi.org/10.51202/9783186272089-1

Sultana, M., Jahiruddin, M., Kibria, M. G., et al. (2023). Applying organic amendment enriches nutrient status of municipal solid waste compost and its application enhances tuber yield and nutrient concentrations of potato. Waste Disposal & Sustainable Energy, 5(4), 439–450. https://doi.org/10.1007/s42768-023-00142-6

Sivakumar Babu, G. L., Lakshmikanthan, P., & Santhosh, L. G. (2017). Assessment of Landfill Sustainability. Springer, Singapore. pp. 257–269. https://doi.org/10.1007/978-981-10-1930-2_15

Sharma, R. (2023). Leveraging AI and IoT for Sustainable Waste Management BT—Sustainable Development through Machine Learning, AI and IoT. Springer Nature Switzerland. pp. 136–150.

Thomas, L. (2023). Stratified Sampling | Definition, Guide & Examples. Available online: https://www.scribbr.com/methodology/stratified-sampling/ (accessed on 1 March 2024).

Toniolo, S., Pieretto, C., & Camana, D. (2023). Improving sustainability in communities: Linking the local scale to the concept of sustainable development. Environmental Impact Assessment Review, 101, 107126. https://doi.org/10.1016/j.eiar.2023.107126

Townsend, T. G., Powell, J., Jain, P., et al. (2015). Sustainable Practices for Landfill Design and Operation. Springer New York. https://doi.org/10.1007/978-1-4939-2662-6

Tuckett, D. (1994). Developing a grounded hypothesis to understand a clinical process: the role of conceptualisation in validation. The International Journal of Psychoanalysis, 75(5-6), 1159–1180.

UNECE. (2018). Waste Management Indicators and Policies | UNECE. Available online: https://unece.org/environment-policy/environmental-monitoring-and-assessment/waste-management-indicators-and-policies (accessed on 1 March 2024).

USEPA. (1993). Criteria for Solid Waste Disposal Facilities: A Guide for Owners/Operators. Available online: https://www.epa.gov/landfills/criteria-solid-waste-disposal-facilities-guide-ownersoperators (accessed on 1 March 2024).

Usoh, A. (2024). The Vital Role of Waste Management Practices in Sustaining a Clean Environment. Available online: https://medium.com/@fascinakon/the-vital-role-of-waste-management-practices-in-sustaining-a-clean-environment-6cd27208e754 (accessed on 1 March 2024).

Vasarhelyi, K. (2021). The Hidden Damage of Landfills. Environmental Center, University of Colorado. Available online: https://www.colorado.edu/ecenter/2021/04/15/hidden-damage-landfills (accessed on 1 March 2024).

Vaverková. (2019). Landfill Impacts on the Environment—Review. Geosciences, 9(10), 431. https://doi.org/10.3390/geosciences9100431

Vetters, N. (2023). Community engagement in waste management: Empowering local solutions. Journal of Environmental Waste Management and Recycling, 6(6), 172. https://doi.org/10.35841/aaewmr-6.6.172

Verter, V. (2011). Uncapacitated and capacitated facility location problems. In: International Series in Operations Research and Management Science. Springer, New York, NY. pp. 25–37. https://doi.org/10.1007/978-1-4419-7572-0_2

Vincevica-Gaile, Z., Burlakovs, J., Fonteina-Kazeka, M., et al. (2023). Case Study-Based Integrated Assessment of Former Waste Disposal Sites Transformed to Green Space in Terms of Ecosystem Services and Land Assets Recovery. Sustainability, 15(4), 3256. https://doi.org/10.3390/su15043256

Vivien, S. (2023). Sustainable Development: Balancing Economic Prosperity and Environmental Concerns. Journal of Economics and Economic Education Research, 24(4), 1–3.

Voorhees, C. M., Brady, M. K., Calantone, R., et al. (2015). Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies. Journal of the Academy of Marketing Science, 44(1), 119–134. https://doi.org/10.1007/s11747-015-0455-4

Votruba, N., Ziemann, A., Grant, J., et al. (2018). A systematic review of frameworks for the interrelationships of mental health evidence and policy in low- and middle-income countries. Health Research Policy and Systems, 16(1). https://doi.org/10.1186/s12961-018-0357-2

Vu, T. H., Nguyen, H. V. H., Phạm, T. C. A., et al. (2022). Towards sustainability in waste management: a systematic literature

review. Journal of International Economics and Management, 22(1). https://doi.org/10.38203/jiem.022.1.0044
Vukovic, N., & Makogon, E. (2024). Waste-to-Energy Generation: Complex World Project Analysis. Sustainability, 16(9), 3531. https://doi.org/10.3390/su16093531
Wunder, T. (2019). Rethinking Strategic Management: Sustainable Strategizing for Positive Impact—Google Books. Springer Cham. https://doi.org/10.1007/978-3-030-06014-5
Wijntjes, L. (2023). How Sustainable Construction and Community Engagement Go Hand in Hand. Available online: https://www.sitepodium.com/blog/sustainable-construction-community-engagement/ (accessed on 5 March 2023).
Worku, H. (2017). Mainstreaming environmental impact assessment as a tool for environmental management in Ethiopia: Current challenges and directions for future improvements. Environmental Quality Management, 26(4), 75–95. https://doi.org/10.1002/tqem.21506
Xiao, W., & Wang, W. (2022). Study on the Accessibility of Community Sports Facilities in Fuzhou, China. Sustainability, 14(21), 14331. https://doi.org/10.3390/su142114331
Yasmeen, R., Sarfraz, M., Shah, W. U. H., et al. (2023). The impact of public awareness, infrastructure, and technological development with economic growth on solid waste management of European countries: does governance quality matters. Environmental Science and Pollution Research, 30(53), 113442–113456. https://doi.org/10.1007/s11356-023-30356-4
Yousefi, H., Javadzadeh, Z., Noorollahi, Y., et al. (2018). Landfill Site Selection Using a Multi-Criteria Decision-Making Method: A Case Study of the Salafcheghan Special Economic Zone, Iran. Sustainability, 10(4), 1107. https://doi.org/10.3390/su10041107
Yu, Y., Xu, H., Wang, X., et al. (2019). Residents' Willingness to Participate in Green Infrastructure: Spatial Differences and Influence Factors in Shanghai, China. Sustainability, 11(19), 5396. https://doi.org/10.3390/su11195396
Zhang, F., He, Y., Ouyang, H., et al. (2023). A fast and efficient discrete evolutionary algorithm for the uncapacitated facility location problem. Expert Systems with Applications, 213, 118978. https://doi.org/10.1016/j.eswa.2022.118978
Zhang, Y., Liu, Y., & Zhai, K. (2021). Identifying the Predictors of Community Acceptance of Waste Incineration Plants in Urban China: A Qualitative Analysis from a Public Perspective. International Journal of Environmental Research and Public Health, 18(19), 10189. https://doi.org/10.3390/ijerph181910189
Zheng, X., Wang, R., Hoekstra, A. Y., et al. (2021). Consideration of culture is vital if we are to achieve the Sustainable Development Goals. One Earth, 4(2), 307–319. https://doi.org/10.1016/j.oneear.2021.01.012
Zurbrügg, C., Gfrerer, M., Ashadi, H., et al. (2012). Determinants of sustainability in solid waste management—The Gianyar Waste Recovery Project in Indonesia. Waste Management, 32(11), 2126–2133. https://doi.org/10.1016/j.wasman.2012.01.011