



Circular Economy Based City Park Management Model in Surabaya Indonesia

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ABSTRACT

Maintaining a green, clean, beautiful, and lush city park through the year requires sustainable management, which includes maintenance like watering, pruning, trimming, and rejuvenation, as well as the creation of new parks. This study aims to identify the factors that influence the successful management of city parks in Surabaya and to understand the organic material cycle involved in managing these parks. This study used qualitative descriptive method. Data were collected through interviews with park management personnel, documentation from various city government policies, and field observations related to park management activities. Data were analysed using triangulation methods. Trees and city parks need regular care, such as pruning and trimming, to provide optimal benefits. Pruning waste, along with other organic waste, is composted at composting facilities or recycling centers widely available in Surabaya. The cyclical management of organic waste from city parks impacts the growth and development of Surabaya's parks while simultaneously solve the problem of organic waste produced by city communities. Although many studies discuss urban green space and waste management in Surabaya, specific research mapping the biomass cycle and circular economy framework in city park management is still limited. Therefore, this study aims to fill that research gap by exploring how circular economy principles are implemented in the Surabaya city park management system.

Keywords: Circular economy, management, city park, Biomassa

1. INTRODUCTION

Surabaya successfully got the eighth Adipura Kencana award in the Metropolitan City category from the Ministry of Environment and Forestry of the Republic of Indonesia. The Adipura Kencana is the highest accolade given to cities and regencies in Indonesia that demonstrate excellence in environmental management, particularly in waste management, cleanliness, and the innovative and sustainable use of green spaces and also "ASEAN Environmentally Sustainable City (ESC)" award in the Clean Air category, highlighting the city's effectiveness in managing emissions and air pollution. The Surabaya city government is strongly committed to reclaiming land that has been used for other purposes, transforming it back into city parks in line with spatial planning for green open spaces (Hasyimi and Suroso, 2017). Community involvement in the



"Surabaya Green and Clean (SGC)" program includes the formation of environmental cadres, environmental education awareness, waste recycling, the management of waste banks, and ecotourism initiatives (Prasetyo et al., 2019). Surabaya has successfully managed city waste and integrated it with the management of city parks and city forests as green open spaces.

Green open spaces can be used to improve quality of life, shape community identity, preserve environmental quality, increase the economic value of buildings or residences, and create beauty and comfort in terms of greenery and nature conservation (Suryaningsih et al., 2019; Wiranata et al., 2020). City parks serve as green infrastructure, giving social and ecological benefits while reducing carbon emissions. These environmentally friendly public areas help to mitigate and adapt to climate change (Cappucci et al., 2022; Ekawati et al., 2024). While city parks absorb carbon through vegetation growth, they simultaneously emit carbon from material manufacturing, transportation, construction, maintenance, destruction, and disposal, resulting in an overall cycle (Park and Jo, 2021). Green open spaces include land areas, city forests, plants along road medians, and parks at road intersections (Pattanakiat et al., 2024). The preservation and development of city parks are essential for building livable city areas (Darettamarlan et al., 2020).

A circular economy is an economic concept that tries to transform trash into value-added goods in order to improve environmental quality, public health, and community economic benefits (Kristianto et al., 2023). garbage management should follow a linear model that includes collection, transportation, and disposal of particular forms of garbage with economic value, while indirectly implementing circular economy concepts (Rahmi, 2024). Circular economy-based organic waste management gives economic, social, and environmental benefits (Ddiba et al., 2022). The circular economy concepts can be applied to solve the problems in managing the city solid waste (Mandpe et al., 2022). There is potential to transform organic waste and residues into valuable products, as part of efforts to develop circular bio-economy strategies (Lizundia et al., 2022). A circular economy ensures sustainable city development by explicitly incorporating ecological objectives into city governance strategies (Kebrowski et al., 2020).

The government is responsible for managing organic waste from city parks and city woods (Eades et al., 2020). In residential areas, inhabitants compost tree trimming trash and utilize it to grow fruits, vegetables, and ornamental plants (Haryanta et al., 2022). Compost can be used in city agriculture, contributing to a sustainable cycle (Brown and Beecher, 2019; Tendero and Phung, 2019). Composting city organic waste at the source can be less expensive than composting at landfill sites (Castellani et al., 2023). Governments, businesses, and communities collaborate to

develop a closed-loop system that reduces waste and optimizes the use of natural resources, supporting sustainable city environments (Franco, 2023). Anaerobic decomposition, densification and drying to produce solid fuels, composting, treatment with black soldier flies (BSF), and processing for eco-enzyme production are the five key technologies with the potential to convert city organic waste into valuable resources (Gunamantha et al., 2023). The trash management in Surabaya incorporates partnership with private enterprises as well as active community participation in waste management in local neighborhoods (Al Amin et al., 2023).

Plants in city parks and trees require healthy soil to thrive. As these plants grow and acquire dense foliage, constant trimming is required to maintain the parks' visual harmony and attractiveness while also ensuring the safety of visitors and commuters. To avoid becoming an environmental burden, pruning waste should be composted. This compost can subsequently be used as organic fertilizer, promoting plant growth during normal maintenance and park renewal. By combining plant care and composting, organic waste is converted into a valuable resource, resulting in a sustainable cycle of organic material in park management. This study aims to identify the factors that contribute to the successful management of city parks in Surabaya and to explore the cycle of organic material involved in these practices. Although many studies discuss urban green space and waste management in Surabaya, specific research mapping the biomass cycle and circular economy framework in city park management is still limited. Therefore, this study aims to fill that research gap by exploring how circular economy principles are implemented in the Surabaya city park management system.

2. RESEARCH METHODS

The study was conducted at two locations: the park along Ahmad Yani Street to Darmo Street and the surrounding parks, and the park along Dr. Ir. Sukarno Street (MER Street), from the UPN "Veteran" East Java campus to Kenjeran Street. The locations of the study are shown in Figure 1. According to the Köppen climate classification, Surabaya is categorized as tropical wet and dry climate (Aw), experiencing two seasons each year: a rainy season and a dry season. There are six wet months (December to May) and six dry months (June to November). Geographically, Surabaya is located between 7°9'-7°21' South Latitude and 112°36'-112°54' East Longitude.

This study used a descriptive qualitative method to collect and analyze data through observed behaviors, spoken words, and written descriptions to gain a deep and detailed

understanding of the phenomenon, allowing the researcher to experience, understand, and comprehend the research object. This study was case study designed to explore specific issue within defined boundaries through in-depth data collection and cross-verification of various information sources. The goal was to achieve a comprehensive and detailed understanding of the phenomenon. To strengthen methodological rigor, this study also included semi-quantitative indicators, such as the estimated volume of pruning waste composted (m^3 per month), the percentage of compost reused in park maintenance, and the frequency of pruning and watering per week. These indicators provide measurable support for qualitative findings.



Figure 1. Locations of the research sites: Dr. Ir. Sukarno Street and Ahmad Yani Street-Darmo Street, Surabaya.

The data consisted of three types: (1) qualitative data from interviews with research participants, (2) documentation data, which included observations of park and city forest management activities, composting techniques, and the movement of organic material between parks and compost facilities, captured through photos, logbooks, and reports, and (3) secondary data related to the management of parks, city forests, and the composting of pruning waste in Surabaya. Data collection methods included interviews, documentation, and observation.

Interviews

The study used in-depth interviews to gather information relevant to the research objectives. This included dialogue between the researcher and informed individuals to verify the collected data by consulting those knowledgeable about the issue or phenomenon.



Documentation

Documentation was used to gather data from various sources such as letters, diaries, reports, artifacts, and photos. These documents, not restricted by time or space, help researchers understand past events and gave valuable supplementary information through written records, images, and other materials with valuable insights during the research process.

Observation

Observation is a data collection method where the researcher directly examines and records behaviors related to a specific phenomenon to describe these behaviors and understand particular events. Through observation, researchers aimed to provide an accurate depiction of behaviors or events, answer research questions, gain insights into human behavior, and evaluate aspects as feedback for existing information.

Data Analysis Techniques

Analysis consisted of structuring and reorganising interview, observation and other data so that it was interpretable and reportable. The method used was triangulation, where data from the same source was cross-checked using different techniques. For example, interview data were compared with observations or documentation. After cross-checking, the data were described and sorted into categories based on similarities or differences, drawing the conclusions.

3. RESULTS AND DISCUSSION

In this study, interviews were conducted with key informants, including the Head of the Park Management Office, Pruning Field Coordinators, Maintenance Coordinators, Watering Coordinators, and the Compost House Supervisor in South and East areas of Surabaya. The questions focused on the scope of their activities and how these activities contribute to optimizing city parks in Surabaya.

Documentation involved reviewing regulatory documents governing the management of city parks in Surabaya, including work guidelines and schedules at various levels of park management organizations and published research on park management in Surabaya. The policy issued by Surabaya city government on managing green open spaces is outlined in Regional Regulation No. 7 of 2002, concerning the management of green open spaces. According to Reviandani et al. (2020), the strategies implemented by the Surabaya City Environmental Agency for city park management include:



- a) Revitalizing and restoring the function of government's land for green open spaces (GOS), including both active and passive parks.
- b) Developing new GOS and organizing new GOS areas, including the rejuvenation of outdated parks.
- c) Maintaining and providing park infrastructure.

Observations were carried out across all locations, including city parks along Ahmad Yani Street to Darmo Street in South Surabaya and along Dr. Ir. Sukarno Street in East Surabaya. the plants grew well, even in the dry season without rain, because they were watered every day, as shown in Figure 2.



(a)



(b)

Figure 2. View of the park and the watering process in the South Surabaya area: (a) Trees and shrubs that need pruning; (b) Watering activities.

Trees with dense canopies or those that may risk the power lines or obstruct road users were pruned. Pruning waste is immediately cleaned up and transported to Jambangan recycling center for South Surabaya, Wonorejo recycling center for East Surabaya, or the nearest compost facility that still has capacity. An illustration of tree pruning activities is shown in Figure 3.



(a)



(b)

Figure 3. Tree Pruning Activities in the Road Median: (a) Pruning waste were transported to the recycling center, (b) Piles of pruning waste at recycling center.

Pruning waste is composted with leaves and small branches, while large branches are separated. At Jambangan, it's mixed with kitchen waste; at Wonorejo, with market waste. The finished compost is available for residents or park managers for use in maintenance. Composting activities at Wonorejo are shown in Figure 3(b) and Figure 4(a).



(a)



(b)

Figure 4. (a) Finished compost pile at the Wonorejo compost house, (b) Park maintenance with compost fertilizer.

Composting was applied for park maintenance and mixed with soil for renovation or new fully matured parks indicated by a temperature equal to the surrounding environment. Figure 4(b) shows its application in park maintenance.

Data Analysis

The analysis technique used is triangulation analysis, which involves cross-checking or synchronizing data obtained through different methods or different data collection techniques. In this study, the data obtained from interviews with informants will be synchronized with data from document analysis and field observations. Conclusions are drawn for each item based on support from all data sources. The results of the triangulation analysis of park management data in Surabaya, gathered from interviews, documentation, and observations, are presented in Table 1.

Table 1. Triangulation Analysis Based on Data Collection Methods for Park Management in Surabaya

No.	Type of Activity	Data Collection Technique			conclusion
		Informant	Documentation	observation	
1.	City Park Management Activities	Information from the Head of South Surabaya Region: park management includes public street lighting (PJU), landscaping, and decoration. The park activities include watering, maintenance, pruning, and handling citizen complaints.	According to Reviandani et al. (2020), city park management strategies include: • maintenance and provision of infrastructure, • revitalization of green open spaces, and • construction of city parks.	Activities include maintenance, watering (Figure 2), pruning, and transporting waste to the compost house (Figure 3). Composting is done at the compost house (Figure 4), and maintenance and rejuvenation use compost (Figure 5).	Park management includes: maintenance, watering, pruning, trimming, and rejuvenation.
2	City Park Watering Activities	Information from the Field Coordinator: watering is done daily, prioritizing plants that are prone to drought. On average, plants are watered twice a day. If it rains, the watering volume is reduced, and	The regional office has a daily watering schedule, including the names of staff, shifts (morning, afternoon, evening), vehicle license plates, and target areas.	Field activities include watering (Figure 2).	The scope of watering activities includes drawing water from nearby ponds, rivers, or drains and distributing it with tanker trucks twice a day. During the



		workers are reassigned to other tasks.			rainy season, the watering volume is reduced.
3	Tree Pruning Activities	Information from the Field Coordinator: pruning is done routinely in city parks or residential areas (upon residents' requests), focusing on trees prone to falling or those disrupting residents' activities. Pruning waste is taken to the compost house or disposed of at the final disposal site (TPA).	Monthly pruning schedules are available at each regional office for both trees and park plants in road or public areas, as well as residential areas upon residents' requests. During the research, the schedule available was for January-February 2024.	Field activities include tree pruning, with waste transported to the compost house (Figure 3).	Pruning activities involve trimming trees and shrubs to optimize the function of city parks.
4	Composting Tree Pruning Waste from City Parks	Information from the compost house supervisor: composting starts with leaf stripping from pruning waste, followed by shredding with a machine, then piling and watering daily. Every 7 days, the pile is turned over. Composting takes one month, involving three turns. Pruning waste is mixed with kitchen or market waste.	Data on daily incoming pruning waste or trash (m ³) and available ready-to-use compost is available at the Wonorejo, Bratang, and Jambangan recycling centers. Small compost houses do not have data records. Generally, only large-scale compost pickups (using vehicles) are recorded at each compost house.	Field activities include composting pruning waste at the compost house (Figure 4).	The scope of composting activities at compost houses includes leaf stripping, shredding with machines (some compost houses do not do this), mixing with market or kitchen waste (for certain compost houses), piling, watering, and turning three times over one





		Ready compost is taken by residents in need or by city park and green lane rejuvenation staff in Surabaya.			month until compost is ready.
5.	City Park Maintenance Activities	Information from the managers of Bungkul Park and Pelangi Park in South Surabaya: City park maintenance work includes sweeping fallen leaves, watering, grass cleaning, hoeing, replanting, composting, and rejuvenation. Composting and rejuvenation are done regularly. Seedlings for replanting come from young plants in city parks, while park renewal requires compost from the compost house.	The Regional Office holds data on the distribution of city parks that need monitoring and services: city parks along the edges and medians of main roads, specific city park areas, and parks within residential areas.	Field activities include park maintenance, hoeing, weeding, and rejuvenation using compost (Figure 5).	The scope of City park maintenance includes sweeping, watering, grass cleaning, hoeing, replanting, composting, and rejuvenation. Park rejuvenation requires compost from the compost house.

Triangulation Data Analysis Results

The results of the triangulation data analysis suggest that the management of city parks in Surabaya is carried out regularly, including tree pruning, composting of pruning waste, and renewal of shrubs. Watering is done using water drawn from nearby rivers or ditches, or by installing pump wells at the park location. Watering is performed daily, and in critical situations, it may be done twice a day. According to Reviandani et al. (2020), green open space management programs include the arrangement of green open spaces, maintenance, and provision of park and green lane facilities. Supporting factors for city park management include community organizations, green open space management programs, human resources, community participation, and collaboration with private parties. Cappucci et al. (2022) stated that city park management strategies are influenced by the primary functions of city parks, their location within



city areas, government-established standard park management procedures, and plant waste management techniques.

Tree pruning is performed to shape the plant canopy to look attractive, reduce branches to prevent falling in the event of rain or wind, and cut down dead or hazardous trees. Pruning waste is transported to the nearest compost house that is not full to be processed into compost. According to Viretto et al. (2021), tree pruning activities in city parks generate waste that can be utilized as a lignocellulosic-rich resource, processed into compost, and used as lignocellulosic filler through dry fractionation. Haryanta et al. (2024) mention that composting green leaf waste from city parks is a crucial step in organic waste management, reducing the burden on landfills. According to Praweswari (2018), dry leaves from city park waste can be used as mulch and compost for tree maintenance in city parks.

Park renewal is specifically done for shrubs and bushes. New park media or renewal uses soil from parks or dredged ditches mixed with compost. According to Saebo and Ferrini (2006), using compost from park waste for soil improvement and mulching can enhance plant management quality in city park areas. Oktavia et al. (2023) states that city parks and forests are needed by the community as recreational spaces, and to optimize recreational carrying capacity, it is necessary to improve ecological management through the enrichment and renewal of old plants.

A detailed study of city park management in Surabaya discovered a biomass cycle that begins with tree trimming and shrub waste being processed into compost, which is subsequently used as fertilizer for park renewal or the building of new parks, as seen in Figure 6. The biomass cycle can reduce city trash while increasing environmental, economic, and social value. According to Lan et al. (2022), using city tree waste to make compost and biochar reduces the risk of global warming and promotes the establishment of a circular bioeconomy in city areas. Viva et al. (2020) contend that city waste management is a complicated system that necessitates a comprehensive approach. It is critical to shift waste management processes from linear and fragmented to integrated and circular techniques.



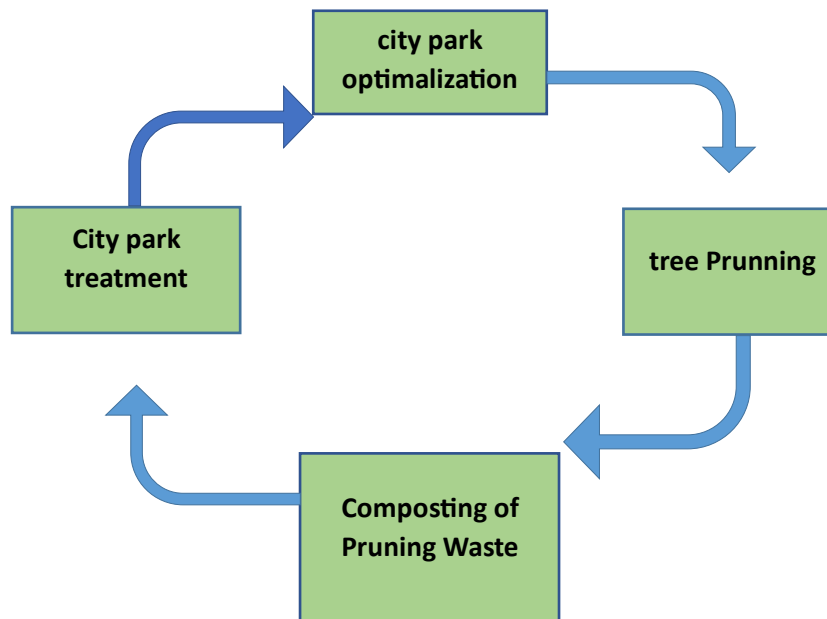


Figure 6. Biomass cycle chart in city park management in Surabaya

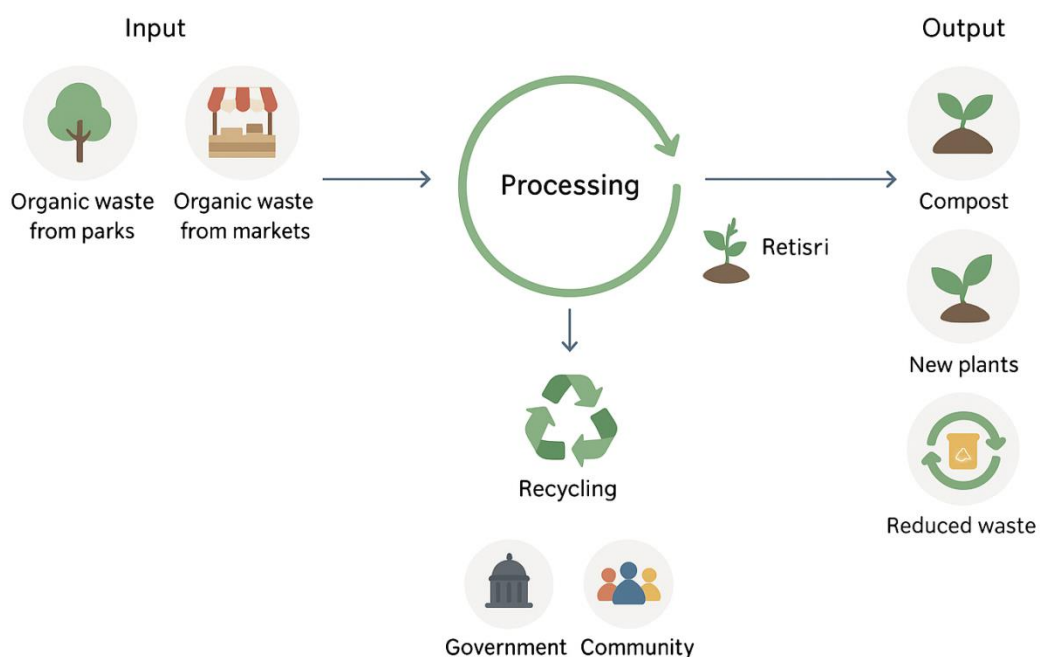


Figure 7. Conceptual Model of Circular Economy-Based City Park Management — illustrates the integration between input sources (organic waste from parks, markets, and households), processing



stages (composting, recycling, redistribution), output (compost, new plants, reduced waste), and stakeholders (government, community, and private sector).

4. CONCLUSION

Surabaya's city parks must be kept green, clean, beautiful, and lush all year, which necessitates long-term management that includes both maintenance activities (such as watering, pruning, trimming, and rejuvenation) and the creation of new parks. This is strongly related to waste management approaches, specifically the processing of organic waste into compost for city agriculture and park maintenance. Surabaya's city park management involves a biomass flow in which tree pruning and park trimming waste, as well as kitchen and market garbage, are turned into compost. This compost is then utilized to nourish existing parks or to develop new ones. To reap the full benefits, trees and city parks must be pruned and trimmed. Pruning and trimming waste, as well as other organic waste, is composted in Surabaya's composting facilities or Recycling Centers. The cyclical management of organic waste from city parks benefits the growth and development of Surabaya's parks while also addressing the organic waste challenges raised by city residents. A circular economy-based city park management concept will help to promote sustainable city management.

Policy and Urban Planning Implications: The findings provide practical insights for city planning, including: (1) integrating circular economy programs into urban green space policies; (2) promoting public-private partnerships for organic waste management; and (3) developing monitoring indicators for circular economy performance in city parks.

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