

Design Analysis of Trash Bin with Pull-Push System for Environmental life services Workers (Case Study: Street Sweeper)

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Abstract: Design is a planning process in creating objects or systems, including trash cans that function as temporary waste containers. With technological developments, innovation in design has become very important to increase efficiency and user comfort, especially for Environmental life services workers such as street sweepers. Push-pull trash cans have helped mobility and waste management, but still have weaknesses related to time and energy efficiency, such as impractical lid mechanisms, and difficulties when loading waste with a dustpan. qualitative method in this study was used to analyze the Trash bin with push-pull system for Environmental life services Workers in order to obtain information regarding the advantages and disadvantages of its use by street workers. This condition adds to the burden on workers who are already facing health risks due to a lack of personal protective equipment. Therefore, in-depth analysis is needed to evaluate and design a more efficient and ergonomic push-pull bin design, to support the tasks of street sweepers and create a more productive and safe work environment.

Keywords: Environment; Trash Cart, Workers, Street sweeper

1. Introduction

Waste has become one of the environmental issues in the world today. Every year, millions of tons of waste are produced by human activities, and most of it is not managed properly (Ramadhan et al., 2020). Plastic waste, for example, often ends up in the sea, polluting marine ecosystems and threatening the lives of living creatures in them. In addition, piles of rubbish in landfills produce methane gas, which contributes to climate change. Therefore, sustainable waste management is a global challenge that requires cooperation from all parties, from individuals to governments and international organization (Kholidah et al., 2018).

Design is planning in creating an object, system, component and structure. In the past, the design process still used manual methods using various tools such as rulers, pencils, drawing pens, drawing paper, and the process of creating a design took a long time (Ashby & Johnson, 2013). The information development technology is rapid and has a big impact on the activities that support our daily work. A trash can is a container that is used to temporarily store various kinds of waste and is usually made of plastic or metal (Wargantiwar et al., 2023). Trash cans are usually placed indoors or outdoors and some trash cans have a cover on the top.

Meanwhile, there are 2 types of trash can lid models, namely those that still open the lid manually and those that use a pedal to make it easier to lift the trash can lid. The push-pull system is a system of movements carried out by the user to achieve a desire to open, push, close and pull an object (Healy et al., 2018). In general, this system is used in various ways, namely when opening and closing cupboards and doors, pushing and pulling strollers or other wheeled items.

The trash can design with a push-pull system is a design that is used to make it easier for users to move the trash can from one place to another, and in this transfer the user only needs to push or pull the trash can. Industrial Workers are the company's most important asset in carrying out its business processes (Toniolo-Barrios & Pitt, 2021).

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Workers in industrial companies has an important role in the sustainability of the company. This is because if workers cannot work well are disturbed, then the quality produced will decrease, so that the profit or profits obtained by the company will decrease (Beckman et al., 2023).

Environmental life services workers are working in the environmental sector, and the areas are usually areas close to where the workers live. Environmental life services workers include activities in supervising, controlling and controlling everything related to the environment (Guo et al., 2020). Environmental life services workers have the mandate to maintain the quality of the environment for the sake of life in the future (Amélia & Ana Gonçalves, 2021). Therefore, serious and consistent protection and management of the environment is needed by all parties. Street sweepers have a very important role in helping city development, including the beauty and cleanliness of the city. In their daily duties, all field work, including street sweepers, are required to use personal protective equipment.

However, most street sweepers often neglect the use of personal protective equipment when working for various reasons, which in the end causes street sweepers to experience health problems such as acute respiratory infections, skin irritation, and even being stabbed by sharp objects while working (Pritesh & Jasmin, 2023). Currently, push-pull trash cans generally have a handle for pulling and pushing, wheels for moving from one place to another, and a trash can with a lid that has a hinge that is integrated with the handle (Pimthong et al., 2024).

The existing push-pull trash cans have disadvantages in terms of time and energy efficiency, because when opening the lid of the trash can, the user has to open it until the lid is completely behind the trash can (Melo, 2019). And when putting in the rubbish, the user has to lift the dustpan quite high to put in the rubbish, and that will create a risk that the rubbish will fall back onto the road which will add more energy to repeating the same thing over and over again. And when moving from one place to another, the user has to carry a broom and dustpan and at the same time pull a trash can and that will add more energy because the user does it every day (Abbasi et al., 2025).

Waste is not only an environmental problem, but also plays a role in the economic sector, especially for street sweeping workers. From an economic perspective, waste creates employment opportunities for many people, including informal workers involved in waste management and cleaning (Ajayi et al., 2017). Street sweepers has an important role for keeping cities clean, although they often face less than optimal working conditions, such as low wages and health risks from exposure to hazardous waste (Beckman et al., 2023). The importance of this research is to understand the benefits of the push-pull system in trash bins used by street sweepers. This way, in addition to understanding its advantages and disadvantages, trash bin products can be developed based on the relevant factors.

By increasing awareness and supporting policies, waste can be used to create a positive economic impact while improving the welfare of street sweepers. This research was conducted to determine the application of the Pull-Push system to street sweeper trash bins. This is because, in its current implementation, these trash bins have a unique value for their users. Therefore, further design developments can be made to directly provide added value to users, namely street sweepers, and maximize results for both the environment and workers. (Kholidah et al., 2018). Based on the background explained. It is found that the formulation of the problem. How the push-pull system is applied to trash bins, How the Trash Bin with Pull-Push System for Environmental Life Services Street Sweeper Workers.

2. Materials and Methods

2.1 Theoretical Framework

The influence of the push-pull trash bin design is very important to increase the efficiency of street sweepers in carrying out all the activities they do. Therefore, design analysis of trash cans is one of the problems taken up in this research to improve the welfare of street sweeping workers in carrying out their duties (Helen et al., 2020). This study uses qualitative methods to understand the social phenomenon of trash bin use by street sweepers. (Dewantara, 2011). The qualitative research is a type of research whose findings are not obtained through statistical procedures, while qualitative research is research that emphasizes quality about the nature of a good/service. A cognitive ergonomics approach is applied to determine the interaction between trash bin users and the trash bins using the push-pull system. This allows for the understanding of the system's functional limitations on user performance

2.2 Method of Collecting Data

In industrial design, research is conducted, among other things, to identify and solve problems inherent in a product. This can indirectly provide innovative solutions, thereby minimizing product development failure (Morris, 2016). Its application requires data that can be used to generate baseline information that forms the basis of the design process.

Data collection conducted in this study was to obtain non-numerical data that could be used to obtain information related to the object in question and its supporting aspects (Mudjiyanto, 2018). Therefore, in this study, the data collection method used was interviews with users, namely street sweepers, to determine their usage values (Rukin, 2019).

Observations of the product and its use were conducted to identify factors that would influence the use of the push-pull system in the trash can (Fiantika et al., 2022). Documentation was conducted to provide a clear picture of the results of the observation and to use scientific library data that could support this research in terms of the data obtained regarding related social phenomena (Kusumastuti et al., 2025).

2.3 Analysis Method

The analytical method, as one of the stages in research, is used to uncover the meaning that underlies the research. The stages of data collection, data reduction, data presentation, and conclusions are carried out to obtain research results that can be reported as a research report (Salmon et al., 2022). The analytical method is also used to describe the results of the study regarding the application of a push-pull system to trash bins used by street sweepers. Therefore, the conclusions can be used in the process of developing a trash bin design that has innovative value and maximizes the work of its users.

3. Results

3.1 Street Sweepers as Environmental Workers

Street sweepers as environmental workers are individuals who maintain the cleanliness of public areas by sweeping and collecting rubbish on streets, sidewalks and other public areas (Brinkmann et al., 2001). Working as a street sweeper is a job that plays a crucial role in maintaining environmental conditions. In their work, street sweepers are required to deliver maximum results, particularly in terms of environmental cleanliness. (Amasuomo & Baird, 2016). With the equipment provided, and the constraints of the work environment, street sweepers are required to be able to produce a clean environment.(Jenal et al., 2022).



Figure 1. Street sweeper worker

As individuals responsible for maintaining clean and beautiful conditions, street sweepers play a crucial role in the environment. They are the front-line workers responsible for protecting the environment from pollution, particularly air pollution, odors, and visual pollution, particularly street cleanliness.(John et al., 2011). With the obligation to carry out his duties in the form of collecting rubbish on streets and public areas, In this way, their presence helps maintain urban ecosystems and supports environmental conservation efforts.

In their work, street sweepers can be seen as a symbol of commitment to keeping the city clean. They work in a variety of unpredictable weather conditions to ensure public services continue to operate. (Dahlia & Sunartio, 2019). In its efforts to contribute to public health by reducing the risk of disease transmission from waste, this work incorporates social and environmental solutions. Therefore, the role of street sweepers is not only focused on physical cleanliness but also has a broad impact on the community's quality of life.

3.2 Design of a Trash Can for Street Sweepers

A trash can used by street sweepers is a trash can designed to support their work. These trash cans are designed to be lightweight, portable, and weather-resistant, making them suitable for outdoor use. (Melo, 2019). This trash can is equipped with wheels and a handle for increased mobility and easier waste collection. The lid on the trash can prevents odors from the trash inside and maintains cleanliness. As intended, the trash can maintain environmental cleanliness. This ensures that collected waste does not spill out easily and emit unpleasant odors in the area it passes through. (Abbasi et al., 2025).



Figure 2. Street sweeper trash can

When implementing a trash can for street sweepers, it's important to consider their operational needs and comfort. The bin should be large enough to accommodate the daily waste collected, while still maintaining weight considerations to ensure ease of use for mobile users (Pecuch et al., 2020). Attention to the components involved is also essential, such as the durability of the material, ensuring it can withstand various weather conditions. Furthermore, stability during use is crucial to ensure the collected waste doesn't spill out. (Pritesh & Jasmin, 2023).

From a work perspective, the trash bin used should not cause injury or fatigue to street sweepers, thus achieving optimal results and indirectly increasing work

efficiency(Ramadhan, 2018). With a design that suits the job requirements, the trash bin not only functions as a place to store trash, but also as a work aid that increases the productivity and comfort of street sweepers (Das et al., 2002).

It is known that street sweeper trash bins are special containers designed to facilitate cleaning staff in collecting and transporting trash while cleaning streets. Therefore, these bins are lightweight for ease of transportation (Pimthong et al., 2024). These bins are designed to ensure worker comfort, adequate capacity, and resistance to weather and loads. These bins are often designed to enhance work efficiency. Their use helps maintain environmental cleanliness in a practical and orderly manner (Cart, 2025).



Figure 3. Outdoor trashcan

Trash bins for street sweepers must support the effectiveness of their cleaning work. With their ergonomic design and portability, these bins enable workers to better collect waste (Abbasi et al., 2025). They offer sufficient capacity to accommodate various types of waste, yet remain easy to operate. With optimal functionality, these bins are essential for maintaining city cleanliness (Ravish & Chaudhry, 2025).

Trash bins used by street sweepers should support occupational health and safety. This reduces the risk of injury from lifting heavy loads or repetitive movements. Furthermore, their use supports better waste management from the outset, ensuring optimal street sweeping performance.

3.3 Trash Cart System

The push-pull trash bin design is an innovation that utilizes a simple mechanism to move the trash bin by pulling or pushing. This system is designed to make it easier for users to move the trash bin from one place to another (Melo, 2019). Typically, these trash bins are equipped with handles, wheels, and lids to facilitate user activities. This design is often used in public places to facilitate transportation. This system provides users with ease of handling, especially when transporting items (Wargantiwar et al., 2023).



Figure 4. Various types of wheeled trash cans

The push-pull trash bin design is an innovation that utilizes a simple mechanism to facilitate moving the trash bin from one location to another. This mechanism typically consists of a handle and wheels, allowing for easier and more efficient movement (Wu, 2025). With its combination of functional components, this design provides a practical solution for everyday waste management (Melo, 2019).

The push-pull system for trash bins is often adapted to the needs of the user's environment. The trash bin design directly allows users to move the bin without having to lift it. For public areas, such as parks or public facilities, this design makes it easier for

cleaning staff to manage waste more quickly. With a design approach that prioritizes convenience and efficiency, this system is a choice that supports easy waste management.

3.4 Environmental life services Trash Bin

Trash bins, as an environmental service product, are facilities provided by local governments for environmental management. These bins typically facilitate the public's orderly disposal of waste and support sustainable waste management programs. Directly, these facilities aim to raise public awareness of proper waste management and contribute to environmental sustainability (Negri et al., 2021).



Figure 5. ELS trash can

Trash bins, as an environmental service, are a crucial element in local governments' efforts to manage waste in a structured manner (Ramadhan et al., 2020). These facilities support a more effective waste collection system by providing waste disposal points in strategic locations. With designs that generally separate waste categories such as organic, inorganic, and recyclable, these bins help encourage waste sorting habits in the community. The use of these bins also supports environmental programs, such as reducing waste sent to landfills and increasing recycling rates. Furthermore, their presence can enhance the aesthetics of the environment by minimizing indiscriminate waste disposal. (F. Wahyudi, 2020).

The implementation of these waste bins requires integrated management with waste collection and processing systems. Collected waste can be sorted by category to optimize waste management. These bins can also serve as an indirect educational tool, raising public awareness about waste management. They also demonstrate the government's commitment to maintaining environmental cleanliness and sustainability.

3.5 Trash Cans

Push-pull trash cans have various types to suit your needs and location of use. First, the pedal trash can use a footrest mechanism to open the lid, making it more hygienic and practical (Wargantiwar et al., 2023). Second, there are trash cans with wheels that make it easier to move, especially in large areas such as parks, offices or other public places. Third, the type of automatic trash can with a motion sensor that opens the lid automatically when it detects movement, providing more convenience (Abbasi et al., 2025). These three types are designed to support efficient waste management in various environments.

Table 1: Types of pull-push trash cans

Types	Excess	Lack
	It has a pedal that can be used as a step to open the lid of the trash can, so that the user's hands can always be hygienic.	Does not have a handle to move the trash can.

	Has a handle to make it easier to move the trash can.	The trash can cover must be opened manually which will cause the user to use up more energy.
	Has a sensor that is used to open the lid of the trash can so that users remain hygienic.	It doesn't have wheels to move the trash can.

From these three types, it can be concluded that the use of the current system can help users in using the trash can. Through the advantages and disadvantages above, it can be a consideration for researchers in analyzing appropriate and efficient systems for street sweepers to use in carrying out their duties as Environmental life services workers.

4. Discussion

4.1 Street Sweeper's Facilities

Street sweeping workers need adequate facilities to support their duties in maintaining a clean environment. Work tools such as brooms, dustpans and trash cans must be available and easy to use (Brinkmann et al., 2001). Apart from that, safety equipment such as reflective vests, masks, boots and gloves are a primary requirement. A clean and comfortable rest room is also needed so they can rest well. This facility ensures the smooth running of work while maintaining the health and safety of workers (Van Kampen et al., 2020).



Figure 6. Street sweeper facilities

Support in the form of providing adequate equipment to meet environmental hygiene standards is essential. This not only makes work easier but also fosters a sense of appreciation for workers' contributions. With adequate facilities, they can perform more optimally.

The push-pull trash can is designed for ease of use in a variety of situations. The push-pull mechanism allows users to easily move the trash can. Push-pull trash cans are portable, making them functional and suitable for public spaces. With its capacity, it can be adjusted to suit the needs of users in various locations. By considering the color and shape, it can be customized to complement the aesthetics of the surrounding environment. This opening system is designed for easy cleaning and maintenance by users, promoting hygiene and comfort.

4.2 Trash Can for The Environmental life services

Trash bins for the Environmental life services are designed to support efficient waste management in public spaces (Melo, 2019). These trash cans usually have a large capacity to accommodate large amounts of waste. The design is equipped with category divisions, such as organic, inorganic and B3, to support recycling programs. The material is chosen to be durable against extreme weather and intensive use (Wahyudi et al., 2018).



Figure 8. Trash media provided by ELS

Trash bins are designed in striking colors to be easily recognized by the public. They also serve to maintain environmental cleanliness. Easy access to trash bins also supports efforts to maintain environmental cleanliness sustainably. Trash bins now serve not only as disposal containers but also as attractions that enhance environmental beauty. Innovative designs with bright colors and unique shapes are often used to attract attention and encourage public awareness of cleanliness (Ravish & Chaudhry, 2025). Some trash bins serve as educational tools to raise environmental awareness. Furthermore, strategic placement, such as in parks or public spaces, makes trash bins part of the city's aesthetic. With a combination of function and design, trash bins can inspire clean living behaviors while beautifying the surrounding environment (Abbasi et al., 2025).

Trash bins can act as attractions that support environmental cleanliness and aesthetics. With creative designs, trash bins can attract people to dispose of waste properly. Placing trash bins in strategic locations, such as parks or tourist areas, also provides a visual touch that blends with the beauty of the surrounding environment

5. Conclusions

A push-pull trash bin design is essential to improve work efficiency and comfort for street sweepers working in these environments. The current waste transportation process often presents challenges, such as heavy loads and unfavorable working positions, which can lead to fatigue and work injuries. Implementing a push-pull trash bin design also has the potential to increase long-term work productivity. This system can reduce the time required to move trash, allowing workers to focus on cleaning larger areas. Furthermore, ergonomic design can improve worker well-being, thus supporting sustainable worker health.

Further analysis of the push-pull trash bin design is necessary to ensure that the resulting design meets the needs of street sweepers. The push-pull system aims to reduce the physical strain experienced by workers when moving the trash bin, therefore, ergonomics, materials, and work mechanisms need to be examined. Furthermore, this analysis also considers the efficiency of the work process, from waste collection to disposal, to optimize work time. The results of this in-depth analysis will provide a design solution that is not only functional but also safe and comfortable for long-term use. With the right approach, this design can become an innovation that improves the quality of work and the well-being of street sweepers.

With the development of better designs, street sweepers can perform their duties more easily and quickly, without compromising their health. Furthermore, the design can support the achievement of better city cleanliness standards and increase public satisfaction with cleaning services. Therefore, a thorough analysis is needed to ensure this design is truly functional, safe, and meets requirements. This is to support environmentally friendly initiatives by creating efficient or energy-saving solutions. Therefore, this design analysis is a strategic step towards realizing a humanistic design.

The trash bins used by street sweepers must consider environmental and sustainability factors in their design. A design that minimizes negative impacts on the environment is a crucial element. Furthermore, the implementation of this design needs to be tested to ensure its performance in the field meets expectations. This analysis also includes an evaluation of production and operational costs to ensure the design remains affordable and can be widely adopted. With this step, the push-pull trash bin design can become part of a more efficient and sustainable urban waste management system.

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