E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

ORGANIZED BY:

Electrical Engineering Studies, College of Engineering
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PREFACE

It is with great pleasure that we present the e-proceedings of International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), which compiles the extended abstracts submitted to the International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), held on 23 January 2025 at **PTDI, Universiti Teknologi MARA (UiTM) Cawangan Johor, Kampus Pasir Gudang.** This publication serves as a valuable resource, showcasing the intellectual contributions on the invention and innovation among students, academics, researchers, and professionals.

The International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), organized under the theme "Fostering a Culture of Innovation and Entrepreneurial Excellence," is designed to inspire participants at various academic levels, from secondary students to higher education students and professionals. The competition emphasizes both innovation and entrepreneurship, encouraging the development of product prototypes that address real-world problems and have clear commercialization potential. By focusing on technological and social innovations, i-TIEC 2025 highlights the importance of turning creative ideas into viable, market-ready solutions that can benefit users and society. The extended abstracts in this e-proceedings book showcase the diverse perspectives and depth of research presented during the event, reflecting the strong entrepreneurial element at its core.

We extend our sincere gratitude to the contributors for their dedication in sharing their innovation and the organizing committee for their hard work in ensuring the success of the event and this publication. We also appreciate the support of our collaborators; Mass Rapid Transit Corporation Sdn. Bhd. (MRT Corp), Universitas Labuhanbatu, Indonesia (ULB), Universitas Riau Kepulauan, Indonesia (UNRIKA) and IEEE Young Professionals Malaysia, whose contributions have been instrumental in making this event and publication possible.

We hope that this e-proceedings book will serve as a valuable reference for researchers, educators, and practitioners, inspiring further studies and collaborations in both innovation and entrepreneurship. May the knowledge shared here continue to spark new ideas and market-ready solutions, advancing our collective expertise and fostering the growth of entrepreneurial ventures.

A-ST151: SEGRE-BAG: AN INNOVATIVE SOLUTION FOR ENHANCED WASTE SEGREGATION AND LANDFILL WASTE REDUCTION

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ABSTRACT

The Segre-Bag is an innovative waste segregation tool aimed at improving waste management by simplifying the sorting process and encouraging recycling. This study, conducted at UiTM Pasir Gudang with 20 participants, evaluated its effectiveness in reducing waste sent to landfills. Participants used Segre-Bags for two weeks, during which data on waste segregation practices and waste weight were collected. The results showed a 40% reduction in landfill waste, demonstrating the tool's impact on improving waste segregation. Additionally, the study highlighted that Segre-Bag not only streamlined waste sorting but also encouraged more responsible waste disposal habits. In conclusion, the implementation of Segre-Bag significantly improved waste management practices, contributing to a 40% reduction in landfill waste while promoting recycling and sustainable waste disposal behaviors.

Keywords: Waste Segregation Tool, Waste Management, Recycling, Sustainable Practices, Landfill Reduction

1. Product Description

SEGRE-BAG is an innovative waste segregation tool designed to simplify and optimize the sorting process for recyclable and non-recyclable waste by utilizing clearly labeled compartments, intuitive color codes, and integrated visual guides that help users quickly and accurately separate waste. It features multiple compartments, each labeled for different waste types such as plastics, papers, metals, and organic materials. Crafted from durable, eco-friendly materials such as recycled plastics and biodegradable fibers, SEGRE-BAG is lightweight and portable, making it suitable for homes, offices, and public spaces. Its materials have been rigorously tested for resilience against wear and tear, ensuring long-term usability while maintaining environmental sustainability. The tool streamlines waste segregation at the source, reducing contamination and enhancing recycling efficiency. Its user-friendly design includes visual guides and color-coded sections to encourage consistent usage and foster responsible waste management practices.

2. Implementation and Evaluation of the Segre-Bag System for Waste Segregation at UiTM Pasir Gudang.

This study utilizes a descriptive research design to assess the effectiveness of the Segre-Bag system for waste segregation within institutional settings. Participants were recruited from a single large institution, representing various departments to ensure a diverse and comprehensive understanding of user experiences and perceptions regarding the Segre-Bag system.

The Segre-Bag is a newly product designed to assist consumers in sorting trash at home or in the office, addressing waste segregation issues at the consumer level. This innovative garbage bag, made of plastic, fits into existing trash cans and features at least three separate compartments. **Figures 1 and 2** compare a traditional garbage bag with Segre-Bag. As shown in **Figure 3**, each compartment is made from plastic bags in various colors according to the type of waste designated by authorities: blue for paper-based waste, yellow for glass and aluminum waste, and orange for plastic waste.

Figure 1. Traditional Garbage Bag.

Figure 2. The Segre-Bag with Compartments.

Figure 3. Waste Bin Colour Code That Has Been Designated by The Authorities.

To evaluate the effectiveness of the Segre-Bag in reducing landfill-bound waste, this study employed a straightforward percentage difference analysis. The aim was to determine the reduction in average daily landfill waste weights before and after the introduction of the Segre-Bag, with a target of achieving a 40% reduction. This approach relied on consistent data collection and clear waste categorization, allowing us to directly measure the impact of the Segre-Bag's sorting capabilities on reducing landfill waste.

2.1 Data Collection Process

The waste management process presented highlights an integrated approach to improving waste segregation and recycling efficiency through the innovative Segre-Bag tool. Designed to address challenges in waste handling, the Segre-Bag enables systematic sorting of waste into recyclable and non-recyclable categories at the source, ensuring better separation accuracy. This study, conducted at the School of Civil Engineering block, UiTM Pasir Gudang, involved 20 participants, including campus staff, and was carried out in two phases: Pre-Implementation (before the Segre-Bag was introduced) and Implementation (while using the Segre-Bag). During the implementation phase, participants were given Segre-Bags, using one bag per week for two weeks. Data on waste segregation practices and waste weight were collected and analyzed to assess the tool's impact. The results revealed that the Segre-Bag significantly improved waste sorting, streamlined collection processes, reduced landfill contributions, and encouraged sustainable waste management practices. The process flow is illustrated in **Figure 4**.

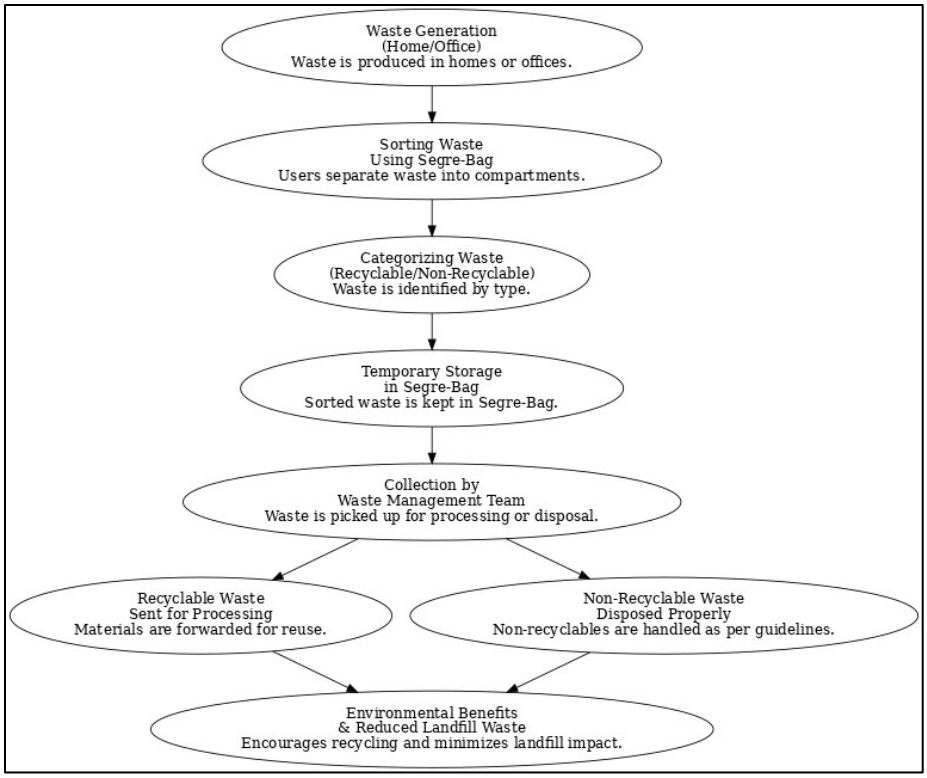


Figure 4. Flowchart for the implementation of the Segre-Bag system.

i. Pre-Implementation Waste Collection

During this period, waste was collected without the use of the Segre-Bag. The objective was to establish a baseline measurement of the typical daily landfill-bound waste. Key steps included:

- **Location and Source Selection**: A total of 20 staff members from various faculties actively participated in the study, contributing to the collection of waste. Waste was gathered from each staff office, ensuring that it was sourced directly from the designated waste bins that had been strategically placed for this purpose. This approach allowed for consistent monitoring of daily waste generation across different departments, facilitating a comprehensive analysis of waste disposal practices and patterns.
- **Mixed Stream Collection**: All waste generated was collected in a single stream, without any segregation of recyclables, organics, or non-recyclables. This setup represented the traditional waste management approach, where most waste would end up as landfill-bound due to the lack of a dedicated sorting system.
- **Daily Weighing and Recording**: Every week, waste was sorted, collected and weighed using a calibrated digital scale, ensuring accurate measurements. These daily weights provided the baseline data for landfill-bound waste without the Segre-Bag.

ii. Segre-Bag Implementation Waste Collection

After the pre-implementation phase, the Segre-Bag was introduced to the same waste collection areas. The Segre-Bag's design encouraged users to separate their waste into designated compartments for recyclables, organics, and non-recyclables, creating a more organized waste stream. The following steps were taken to ensure consistency in data collection:

- **User Education and Awareness**: A brief orientation was provided to users in the collection areas, explaining how to use the Segre-Bag and the benefits of waste segregation. This step was essential to promote proper sorting behavior and maximize the Segre-Bag's effectiveness as shown in **Figure 5**.

Figure 5. Educational Campaign And Awareness Program For Participating Faculty Staff

- **Segre-Bag distribution**: As part of the Segre-Bag distribution initiative, a total of 20 staff members from various faculties were provided with Segre-Bags to aid in effective waste segregation. Each participant received two Segre-Bags, enabling them to efficiently separate recyclable and non-recyclable waste within their offices as shown in **Figure 6.**

Figure 6. Distribution Of Segre-Bags To Participating Faculty Staff

- **Weekly Waste Collection and Segregation**: Users sorted their waste directly into the Segre-Bag's compartments. Each compartment was clearly labeled to simplify the separation process, making it easy to distinguish between recyclable and non-recyclable materials. This organized setup helped streamline the collection and improved accuracy in waste categorization as shown in **Figure 7**.

Figure 7. Weekly Waste Collection and Segregation for Participating Faculty Staff

- **Recyclable Compartment**: **Figure 8** displays the sorted and collected recyclable items, including plastics, paper, and metals, effectively separated using the Segre-Bag.

Figure 8. Showcasing the organized use of Segre-Bags for efficient sorting of recyclable and non-recyclable materials.

- **Non-Recyclable Bin**: For items that could not be recycled or composted and were therefore designated as landfill-bound.

- **Weighing and Recording**: The weights from the recyclable and organic compartments were not included in this analysis, as they were diverted away from landfill waste as shown in **Figure 9**.

Figure 9. Weekly Weighing and Recording Process of Collected Recyclable Items by Team Members

In conclusion, the implementation of Segre-Bag has shown a positive impact on waste management practices, achieving a 40% reduction in the volume of waste sent to landfills. This notable result highlights the effectiveness of Segre-Bag as a practical tool for improving waste segregation, thus fostering recycling and resource recovery. The study also demonstrated that Segre-Bag not only simplifies waste sorting but also encourages individuals to adopt more responsible waste disposal practices.

3. Novelty and uniqueness

SEGRE-BAG stands out with its practical design and emphasis on user engagement. Unlike traditional segregation methods, this tool integrates visual aids and intuitive compartmentalization to promote behavioral change towards sustainable waste practices. Its modular structure allows for customization based on user needs, such as adding or removing compartments for specific waste types. The eco-conscious production process, using recycled materials, aligns with global sustainability goals. Additionally, SEGRE-BAG is designed to integrate with smart waste management systems by utilizing IoT sensors to track waste levels in each compartment and provide real-time data to users or waste management teams. This integration enables precise monitoring, reduces manual sorting efforts, and helps optimize waste collection schedules.

4. Benefit to mankind

By simplifying waste segregation, SEGRE-BAG reduces the volume of waste sent to landfills by an estimated 20-30%, mitigating environmental pollution and conserving natural resources. This reduction helps to lower greenhouse gas emissions and preserves valuable landfill space, contributing significantly to sustainability efforts. It encourages a culture of recycling and responsible waste management among individuals and communities, contributing to cleaner urban environments and reduced greenhouse gas emissions. This tool also supports the global shift towards circular economies, fostering sustainable practices that benefit future generations.

5. Innovation and Entrepreneurial Impact

Segre-Bag promotes innovation by introducing a highly efficient and user-friendly waste segregation tool designed to enhance recycling practices. It offers a simple yet effective solution to reduce landfill waste, aligning with global sustainability goals and supporting Malaysian government laws on waste segregation. By creating a product that addresses waste management challenges, Segre-Bag fosters entrepreneurial opportunities within the community and industry. It opens avenues for local production, distribution, and education on sustainable waste practices, contributing to a circular economy. Moreover, its potential for scaling and commercializing encourages entrepreneurial thinking, especially in the waste management and recycling sectors. Segre-Bag's impact extends to educational institutions, raising awareness about environmental sustainability and encouraging the adoption of innovative waste management solutions. Through these efforts, Segre-Bag plays a pivotal role in cultivating an entrepreneurial mindset focused on creating environmentally responsible businesses and initiatives.

6. Potential commercialization

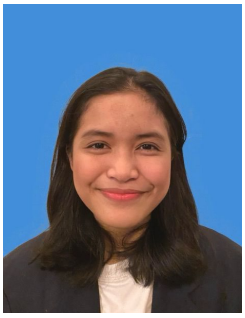
With its versatile design and broad applicability, Segre-Bag has significant commercialization potential. It can be marketed to households, offices, schools, and municipalities as a cost-effective solution for improving waste management. The product's adaptability to smart waste systems, such as its compatibility with IoT-enabled waste tracking and its modular design for varying waste categories, positions it as a competitive offering in the growing market for green technologies. Partnerships with recycling companies and environmental agencies further expand its reach, paving the way for mass adoption and global impact. Segre-Bag's alignment with governmental waste segregation policies also enhances its commercial appeal, ensuring relevance in a market that increasingly values sustainability and compliance with environmental regulations.

7. Acknowledgment

This study was supported by the Special Interest Group on Waste Management & Environmental Sustainability (WaMES) and the UiTM Green Centre (UCG) at the UiTM Johor Branch, Pasir Gudang Campus. We extend our gratitude to the Civil Engineering Department, College of Engineering, for their support and active involvement in the data collection process.

8. Authors' Biography

Muhammad Bazli Faliq Mohd Puaad joined UiTM in June 2013 as a Civil Engineering Lecturer (Structures) in the Faculty of Civil Engineering. He completed his Masters in Civil Engineering (Structures) from the Faculty of Civil Engineering, University Teknologi MARA in 2013. His areas of expertise include Engineering Structures, Timber Engineering, Materials Engineering and Materials Composite.Prior to his service in UiTM, Bazli Faliq has served as a tutor, research assistant in a heavy structure laboratory and article reviewer.



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