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

"Fostering a Culture of Innovation and Entrepreneurial Excellence"



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23 January 2025
PTDI, UiTM Cawangan Johor
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Electrical Engineering Studies, College of Engineering
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Kampus Pasir Gudang
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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.

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B-ST066: HF-WIP: A MACHINE LEARNING APPROACH FOR BEHAVIORAL INSIGHTS AND SUSTAINABLE FOOD WASTE MANAGEMENT

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ABSTRACT

The Household Food Waste Intention Predictor (HF-WIP) is an advanced tool designed to predict behavioral intentions for effective food waste management. This study analyses nine critical demographic, economic, and behavioural aspects using data from 505 respondents to identify factors that influence food waste reduction practices. Developed with a rigorous approach of nine non-linear models, including fine-tuned SVR (RBF), Random Forest, Gradient Boosting, and Neural Networks, HF-WIP demonstrates robust accuracy and adaptability. Its novel approach bridges analytics with personalized recommendations, enabling actionable insights for users. The HF-WIP's primary advantage lies in its capacity to identify tailored strategies for households, while supporting policymakers with data-driven interventions and assisting retailers in reducing supply chain inefficiencies. This integration of predictive capabilities with practical applications fosters sustainable practices at multiple levels. The tool's usefulness can be extended to food waste reduction education through interactive materials and smart platforms. The commercialization potential is immense, ranging from subscription-based apps for households to partnerships with organizations and retailers. HF-WIP aligns directly with sustainability development goal (SDG) by promoting responsible consumption, aimed at reducing food waste and reducing environmental impact. As a transformative solution, it offers innovative, scalable benefits to address the pressing issue of global food waste.

Keywords: Food Waste Management, Predictive Analytics, Behavioral Insights, Sustainable Consumption, Data-Driven Interventions

1. Product Description

The Household Food Waste Intention Predictor (HF-WIP) is an innovative tool designed to predict users' intentions toward effective food waste management, as illustrated in **Figure 1**. Built with a robust model based on data from 505 respondents, the system analyzes nine (9) key attributes, such as gender, age, education level, occupation, income, household size, type of household, weekly food expenditure, and grocery shopping frequency, to identify the behavioral drivers influencing food waste reduction intentions. To ensure accuracy, the model was built comparing nine (9) non-linear model as shown in **Figure 3** The non-linear

models used in this analysis were Support Vector Regression (SVR) with Radial Basis Function (RBF), polynomial, and linear kernels, Random Forest Regressor, Gradient Boosting Regressor, and three Neural Network architectures (NN -small, medium, and large) with different hidden layer configurations. **Figure 1** illustrates the operational flow of HF-WIP, starting with user input of key demographic details (focus on the first block). The model processes the data to predict food waste reduction intentions of the user (Step 1-3), enabling personalized recommendations. These predictions act as a foundation for designing learning materials on food waste awareness (Step 4) and transitioning into customized food waste management apps (Step 5) which is to be deployed in the near future. Additionally, **Figure 1** highlights the broader applicability of HF-WIP for policymakers and organizations aiming to create targeted waste reduction strategies and for retailers optimizing inventory and reducing waste.

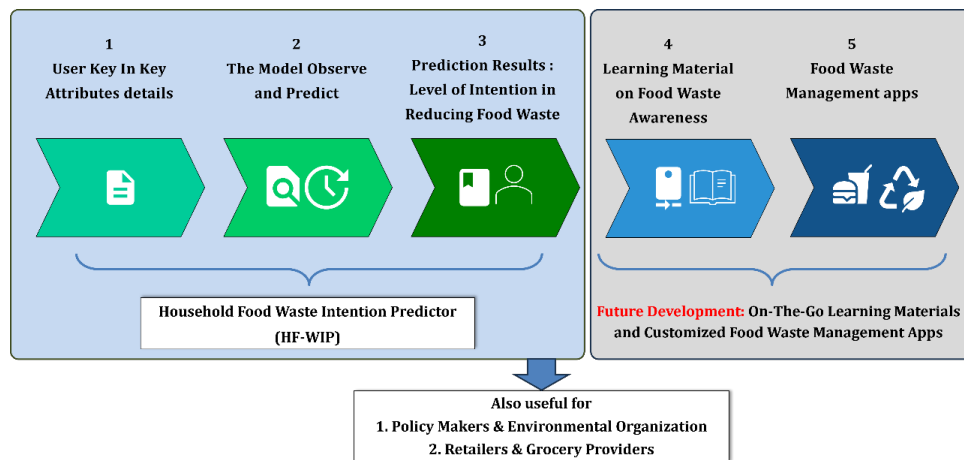


Figure 1. Flowchart of HF-WIP from user input to predictions, learning materials, and waste management apps for sustainable living.

2. Model Development Flow Chart and Performance Results

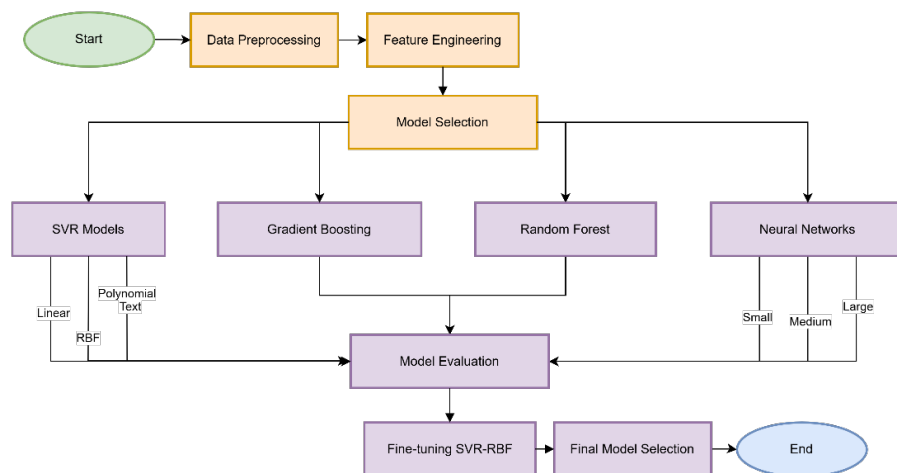


Figure 2. Workflow Diagram for HF-WIP Model Development

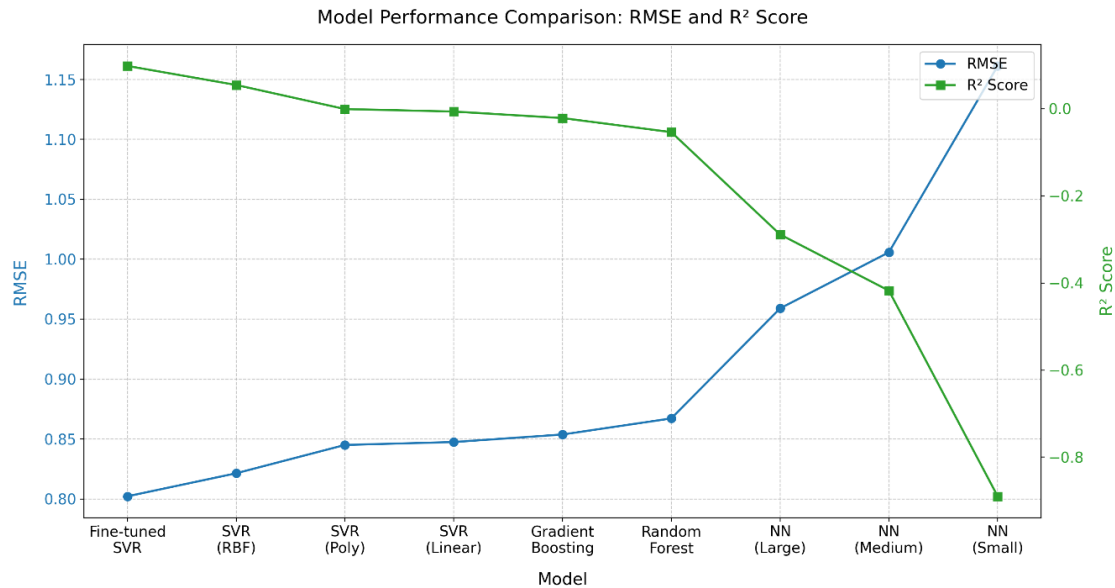


Figure 3. Performance Comparison of Models.

3. Novelty and uniqueness

The Household Food Waste Intention Predictor (HF-WIP) demonstrates its novelty through a robust approach that integrates interactions among nine key demographic, behavioral, and economic attributes. By focusing on the relationships between factors, such as the connection between weekly food expenditure and shopping habits, the HF-WIP provides deeper insights into the behavioral drivers of food waste reduction. This innovative methodology distinguishes it from traditional models reliant on generic waste metrics as shown in the workflow diagram in shown in **Figure 2**. The uniqueness of HF-WIP lies in its rigorous testing approach, which compared nine models to identify the best performer. **Figure 3** depict the fine-tuned SVR (RBF) emerged as the top model (RMSE: 0.802, R^2 : 0.098), while tree-based methods showed moderate results and Neural Networks underperformed (RMSE: 0.959-1.161, R^2 : -0.289 to -0.890). The modest R^2 values highlight the complexity of food waste behavior. With its advanced analytics and user-friendly platform, the HF-WIP delivers tailored, actionable solutions for households and policymakers.

4. Benefit to mankind

The HF-WIP offers significant benefits to humanity by addressing the pressing issue of food waste, a critical challenge in achieving global sustainability. By integrating demographic, behavioral, and economic factors, HF-WIP provides tailored insights to reduce household food waste effectively. This directly supports the United Nations Sustainable Development Goal (SDG) 12: Responsible Consumption and Production, aimed at reducing food waste and minimizing environmental impact. Its innovative approach empowers households with actionable recommendations and enables policymakers to design targeted interventions,

fostering sustainable practices. The HF-WIP represents a practical, scalable solution to combat food waste and enhance global food waste strategies.

5. Innovation and Entrepreneurial Impact

The HF-WIP introduces groundbreaking innovation by integrating advanced predictive analytics, behavioral science, and sustainability into a transformative tool addressing global food waste. Its focus on nine key attributes provides actionable, context-specific insights, driving impactful change. By fostering interdisciplinary collaboration, the HF-WIP inspires entrepreneurial ventures, including waste tracking apps and smart shopping tools, while enabling partnerships with tech companies and sustainability-focused industries. Its ability to localize data empowers community initiatives and policy development. As a catalyst for eco-friendly technologies, the HF-WIP promotes responsible consumption models, paving the way for startups and industries to lead in sustainable food waste management solutions.

6. Potential commercialization

The HF-WIP offers strong commercialization potential by catering to three key sectors. For households and individual users, it can be a subscription-based app providing personalized strategies to reduce waste, save money, and track progress. Policymakers and environmental organizations can use its analytics to design targeted interventions and waste reduction campaigns. Moreover, retailers and grocery providers can also leverage insights to optimize offerings and minimize supply chain waste. Its modular design supports integration with smart home systems and grocery platforms, broadening its appeal. Positioned for a global market, the HF-WIP bridges user intentions with actionable solutions, aligning with the growing demand for sustainability tools.

7. Acknowledgment

The authors would like to express their heartfelt gratitude to MJIIT-UTM for providing the research facilities and resources necessary for the completion of this study. Special thanks to UiTM Johor Branch, Pasir Gudang Campus and UiTM Shah Alam Branch for their invaluable guidance and support throughout the research collaboration process.

8. Authors' Biography



Norul Hajar Nordin currently researcher at Universiti Teknologi Malaysia (UTM), specializing in sustainability and waste management. With a PhD in Environmental Science, Master of Science (Environment and Development) and Degree of science (Environmental Science) she has led significant research projects on household food waste reduction and environmental safety. Her expertise spans environmental sustainability, food waste, food safety, and governance compliance. She has published multiple papers in respected journals and actively contributes to international conferences also committed to developing solutions for environmental challenges through research and community engagement.



Aznilinda Zainuddin obtained both her bachelor's degree and master's degree in electrical engineering from Universiti Teknologi MARA (UiTM), Shah Alam, Malaysia. Her research activities are centered on engineering education, inventive problem-solving, and space weather. Currently, she is a senior lecturer at the Electrical Engineering Studies, UiTM Johor Branch, Pasir Gudang Campus and her current research focuses on the development of prediction models for geomagnetically induced current.



Zuleikha Nawal is an experienced UI/UX designer and researcher with a strong background in branding and visual media. She holds a Master's degree in Visual Communication and New Media from UiTM and a Bachelor's degree in Design and Visual Communications from Limkokwing University. Zuleikha has worked with renowned organizations, including Farmbyte and TheLorry, where she contributed to innovative design solutions and user-friendly interfaces. Her achievements include a Silver Award for "Zero Waste Cycle Mobile Branding Application" and two published articles. Currently, she is pursuing a PhD in Art & Design, focusing on mobile branding applications.