Physical composition of household and industrial solid waste under a rigorous statistical and case study analysis approach based on Python

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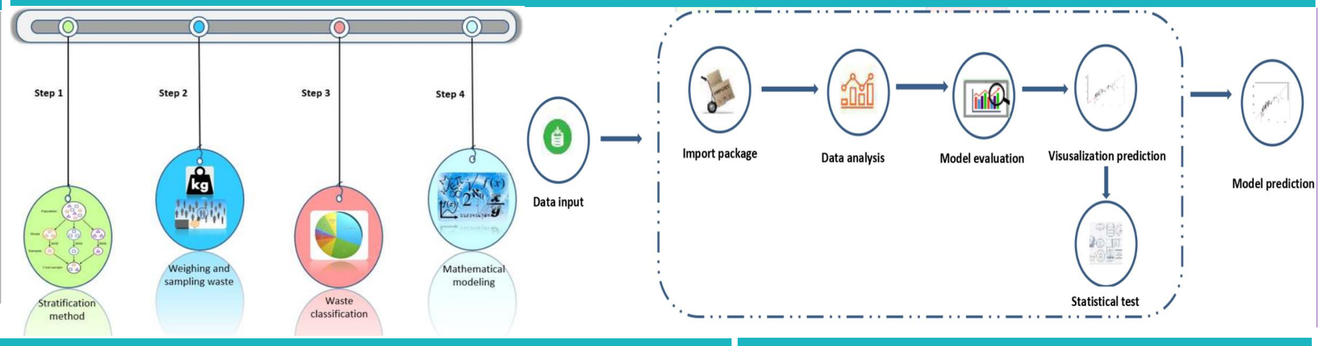
INTRODUCTION

- ✓ Solid waste management is a growing concern due to rising urbanization and industrialization;
- ✓ Waste composition, sampling, and characterization are essential for selecting collection and treatment methods;
- ✓ Sampling methods impact data accuracy, with direct collection and vehicle loading methods being common but lacking specificity;
- ✓ Research inconsistencies hinder waste data comparability globally, necessitating improved characterization methods for better waste management and recovery (Dahlen et al., 2007b) (Phuong et al., 2021).

METHODS



RESULTS

Variability in Daily Household Solid Waste Ratios and Factors Influencing Composition

- ✓ we noted a progressive increase in food waste from 43% (Tezano et al, 2003), 38.66 (Haro K et al, 2008) and in 2023 50.97% in our current work;
- ✓ Waste generated per day : 0.66 kg/d/pers;
- ✓ Middle-range homes contained significantly more food waste;
- ✓ Socio-economic parameters significantly unfavorable to industrial household solid waste;
- ✓ Individual fraction parameters significantly unfavorable to MSW

Python-based model creation

Socio-economic parameters: Hight, Medium and low standing

$$HWGRit = -0{,}216Mit + 1{,}076Wit + 0{,}767URit + 11{,}365Eit - 5{,}202Aduit - 0{,}316Chiit - 4{,}222Revit + 0{,}899nbr\_famit - 43{,}943it \quad (1)$$

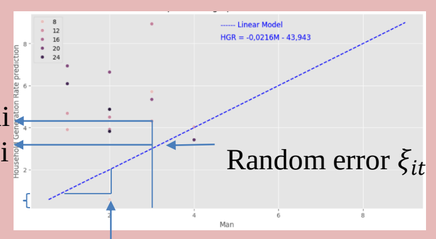
$$HWGRit = -6{,}983Mit - 7{,}420W - 1{,}306URit - 11{,}178Eit - 0{,}2328Aduit - 3{,}7137Revit + 9{,}028nbr\_famit + 131{,}439it \quad (2)$$

$$HWGRit = 19{,}681Mit + 10{,}958Wit + 0{,}333URit + 8{,}771Eit - 22{,}245Aduit - 17{,}644Chiit + 0{,}0001Revit + 3{,}744 nbr\_famit + 0{,}607it \quad (3)$$

Physical parameters of solid waste composition

$$WGRit = 0{,}022FWit - 1{,}046Papit - 0{,}266WBit - 0{,}482Texit + ,0{,}309Metit + 0{,}895WNCCit + 0{,}529Othit + 2{,}539it \quad (4)$$

Cracteristics of the model



Observed value of Y for Xi

Predicted value of Y for Xi

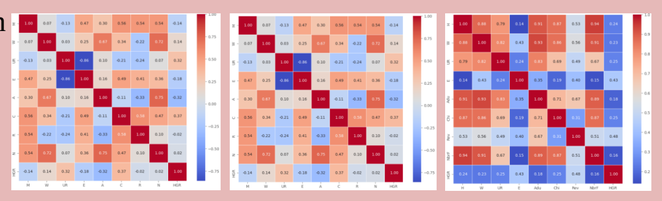
Intercept = γ_{i0}

Random error ξ_{it}

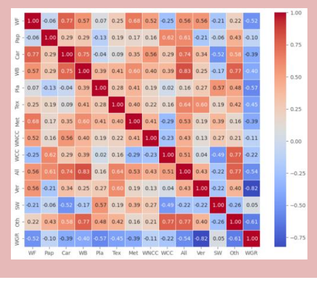
Slope = β_{ia}

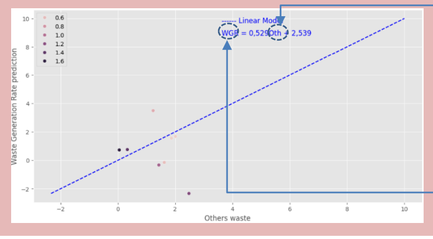
- ➢ Correlation between HWGR and relevant socio-economic factors

High-Standing | **Medium-Standing** | **Low-Standing**



- ➢ Correlation between WGR and fractions individual waste factors





Endogenous variables vary according to the socio-economic parameters of the solid waste communale

Exagenous variables vary according to the physical parameters of the solid waste composition

DISCUSSION

- ❖ Model shows that the presence of family members in every household leads to an increase in Household Waste Generation Rate (HWGR). Thus, socioeconomic parameters significantly influence HWGR;
- ❖ The research revealed a weak correlation between the depedant and independent variables. Furthermore, the individual percentage composition of FW, WNCC, GL, SW, and Oth is not significant in WGR, indicating that manual sorting of these waste types is not necessary.

CONCLUSION

This study analyzed waste management , emphasizing detailed sorting and composition analysis. Linear models with nine variable Eq. (1) (2) and (3) and Eight variables Eq. (4) were used to predict waste production with unemployment having a significant impact . Future research should include dry season characterization and skilled worker-involved sorting.

ACKNOWLEDGEMENTS

BANQUE MONDIALE