

Characterization of the Transportation System of an Urban City in a Developing Country using System Dynamics: A Sustainability Perspective

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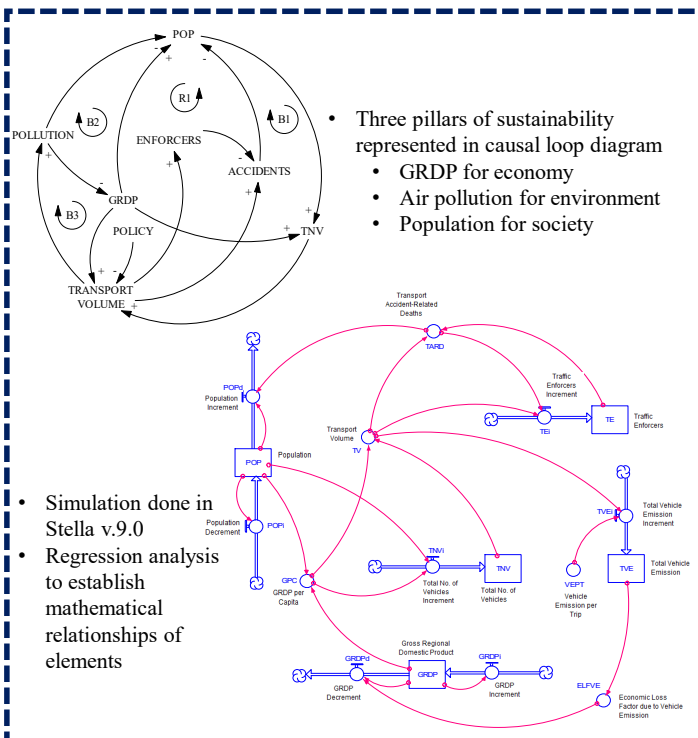
ABSTRACT

This study aims to determine and establish the baseline characteristics of the transportation system of an urban city of a developing country, with Metro Cebu as the case study. A systems dynamics modelling approach was used to develop the causal relationship of the elements of the transportation system. A stock-and-flow diagram was developed to mathematically establish the relationship between the elements. The model was simulated from 2024 to 2040. The results show that the increase in total vehicle emissions is expected to rise but will eventually stabilize or decline starting 2035. The increase in road fatalities also showed a decline throughout the simulation. The results help establish a goal for determining the drivers in establishing a sustainable transportation system in Metro Cebu.

INTRODUCTION

- UN developed sustainability agenda in 2015.
- SDG 11 (sustainable cities and communities) as one of the foundations of sustainable development in PH.
- Transportation system as one component of SDG 11.
- SDG 11 in PH still of minimal progress.
- Characterization of transportation system a key step in developing strategies to contribute to the achievement of SDG 11.
- System dynamics modelling as an approach to evaluate the transportation system.
- Metro Cebu as a case study.
- Sensitivity analysis to determine impact of changes in system behavior by certain scenarios.

METHODOLOGY

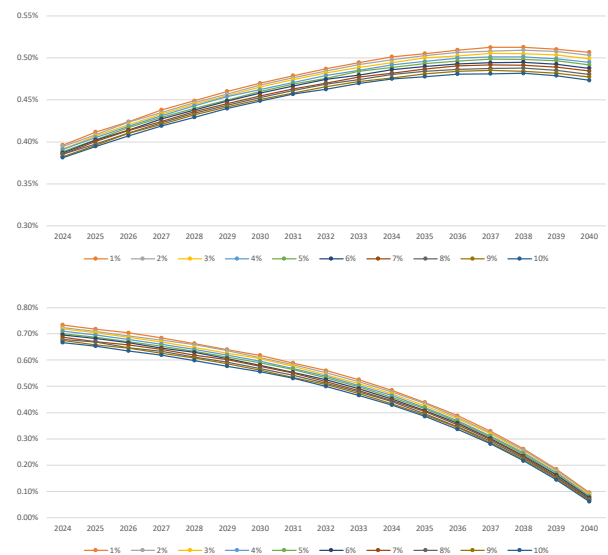


RESULTS AND DISCUSSIONS

- Total vehicle emission and transport accident-related deaths simulated from 2024 to 2040
- Expected increase in trends due to an increase in number of vehicles brought about by urbanization
- Lack of policies to regulate vehicle ownership can be attributed

Year	Total No. of Vehicles (in thousands)	Total Vehicle Emissions (in millions)	Fatalities
2024	248.38	772.69	251
2025	260.56	794.44	262
2026	272.77	816.22	275
2027	285	838.06	288
2028	297.26	860.04	304
2029	309.54	882.22	321
2030	321.84	904.68	340
2031	334.16	927.53	362
2032	346.49	950.88	388
2033	358.84	974.87	418
2034	371.2	999.67	452
2035	383.57	1,025.49	493
2036	395.96	1,052.56	541
2037	408.36	1,081.19	600
2038	420.76	1,111.76	670
2039	433.17	1,144.75	756
2040	445.59	1,180.74	863

- Vehicle emissions sensitive to increases in vehicles within first 10 years; decreasing sensitivity on road fatalities



CONCLUSIONS

The results of the simulation showed expected improvements in the behavior of specific output elements of the transportation system in Metro Cebu. This implies that the efforts of the government are expected to show positive outcomes in the years to come. However, within the sustainability context, much is still needed to be done to achieve it, especially in the environmental aspect.