The Current Status of Vehicle Management and Future Projection of Vehicle Ownership in Samoa

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Introduction

Samoa is a typical Small Island Developing State (SIDS) and is considered a least developing country (LDC) by definition under the United Nations, i.e., one of the lowest income earning countries in the Asia Pacific Region. Located in the south west of the Pacific, Samoa is particularly vulnerable to climate change and its natural environment is one of its highest valued resources. The effects to the natural resources and environment are of highest concern in researching on vehicles and vehicle waste.

Dissemination and management of vehicles is deeply associated with economy development as well as the environment in any country, however vehicle management in SIDS such as Samoa mostly involves a one way stream with regards to life cycle of vehicles. Like most other Pacific Islands, Samoa imports all vehicles with very few means available for the material recovery and recycling of vehicle waste and poses a great concern for the small Pacific Island. A study on vehicle ownership and future projection of vehicle importation, vehicle ownership and vehicle waste could greatly benefit Samoa in terms of planning and policy development for the environment, transportation and waste management sectors.

This paper particularly looks into the current situation on vehicle ownership from importation and registration data using population growth models as the initial stages to a research on vehicle ownership and vehicle waste projection. Vehicle ownership here is modeled and projected for necessary planning by the respective sectors by population growth models namely the Gompertz and Logistic functions. The two models are used to estimate the vehicle ownership, and the results are compared and discussed in this paper.

Current Status

Past and present data on population, GDP, vehicle imports and registration were used to model the vehicle ownership in Samoa, however limited reliable data hinders this process so that rough estimations were carried out for some parameters of the two models. Vehicle registration has been administered by three different government ministries over the years, which causes poor data management and archives.

Dramatic increase in used vehicles imported was evidently observed after the Road Switch in 2009, where the government switched the driving side from right to left to allow cheaper and affordable vehicles to be imported from Australia, New Zealand and Japan instead of USA. Data collected from primary sources suggests that most vehicles are disposed of with little or no treatment in the country, while minimal recycling involves scrap metals being sent overseas. The scrap becomes uneconomical in the markets at most times due to the fluctuation of the scrap metal market price, but largely due to the remote location of Samoa from these markets. It is obvious that the national system of vehicle registration and inspection plays a critical role for management of vehicles both in use and after abandonment. The current system in Samoa, however, does not account for vehicles to be unused or discarded, and needs major upgrading to put them into a scope of a life cycle management of vehicle from its import to disposal.

The Models

Previous studies by Dargay et al [1] and Ogut [2] carried out on vehicle ownership were used as baseline for this study. The Gompertz curve expressed by the following function determines vehicle ownership:

\[ v = \gamma \cdot \exp[\alpha \cdot \exp(\beta x)] \]

where \( v \) is vehicle ownership per 1,000 population, \( x \) is the major independent variable which is GDP per capita, \( \alpha \) and \( \beta \) are negative parameters defining the shape or curvature of the function, and \( \gamma \) is the saturation level of vehicles measured in vehicles per 1,000 population.

Also, the following Logistic curve was calculated for estimating vehicle ownership:

\[ v = \frac{K}{1 + \alpha \cdot \exp(\beta x)} \]

where \( K \) is the saturation level, \( \alpha \) and \( \beta \) are model coefficients, and \( x \) is independent variable being GDP per capita.

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Results and Discussion

Data of actual vehicle ownership shown in the below left figure indicate distinct discontinuity which could be explained by changing administrator to manage vehicle registration and data archives. Gompertz curve has a tendency to most rapidly increase ownership when measured against GDP per capita which does not fully reflect the growth of vehicles in a low income country. This leads us to believe that Logistic curve is the better function to model vehicle ownership for Samoa as a low income country. Linear regression was also used to model the growth, however it is applicable only around a range of GDP where actual data used for the model estimation exist. In particular, the future saturation is not taken into consideration for linear regression, which is a disadvantage for this method. The growth of Samoa’s vehicles and vehicle ownership is without a doubt increasing. With increasing GDP per capita it should follow the growth shown in the below right figure, however it is a challenge and the next step for this research to forecast when this growth will occur and when Samoa will reach saturation.

![Vehicle Ownership against GDP per capita from 1995-2011](image)

Vehicle importation as shown in the left figure was calculated using regression analysis with independent variables of GDP per capita and human population growth. It shows a fairly scattered trend despite a vague linear growth from 2002 to 2011. The earliest set of data on imported vehicles starts from 2002 when the current data management system commenced, hence we were not able yet to clearly depict a trend or pattern in importation. With better calculated values of imported vehicles, discarded vehicles can be calculated using vehicle ownership as well as some other underlying factors, and eventually future projections can also be calculated. Such plan is in the future pipeline of this research.

![Actual vs Estimated Imported vehicles using multiple regression from 2002-2011](image)

Conclusion

Out of the models and methods used to estimate Samoa’s vehicle ownership, it was found that the Logistic curve best represents the growth with changing GDP per capita. Vehicle importation is another important factor being considered in this research, and with calculated vehicle ownership to continuous growing GDP an estimation of vehicle waste generation should be calculated as well as future projections, which are the ultimate goals for this research.

References
