

# Using Uncertainty and Sobol' Sensitivity Analysis Techniques in the Evaluation of a Composite Provincial Level Food Security Index

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A composite provincial level food security index can measure food security at the sub-national level which can be helpful in policy making. However, it can be non-robust due to the uncertainties involved in the choice of input factors to be used in its construction, namely: different sources of data, normalization methods, weighting schemes, aggregation systems, and the level of importance placed on the different dimensions of food security i.e. availability, accessibility, utilization, and stability. In this study, uncertainty analysis technique was employed in order to assess the robustness of the index constructed through the conventional approach. Sensitivity analysis was done in order to quantify the influence each factor has in the index building process, identify factors that should be prioritized and can be fixed in the successive development of the index, and determine which levels of factors are responsible for producing the desirable model outcomes. The study had been exploratory in considering the ratio with mean normalization technique and a combination of the additive and geometric aggregation methods as potential inputs in the index construction. In computing for the Sobol' sensitivity indices, the formulas suggested by Jansen et al. (1994) and Nossent and Bauwens (2012) were investigated and compared under varying sample sizes. The results can provide a more appropriate choice of procedure in computing for the Sobol' sensitivity indices at an optimum sample size, and likewise insights in the future development of a uniform and more defensible composite provincial level food security index.

*Keywords:* uncertainty analysis, sensitivity analysis, Sobol' sensitivity index, Monte Carlo integral, composite index, food security

## 1. Introduction

The paradox in the treatment of composite indices is that composite indices, simply put, are just single-valued numbers. Yet, it is able to communicate to the readers a meaningful array of interpretations because of its ability to summarize complex or multidimensional issues, reduce the size of a list of indicators, and