Visualizing Subjectively Weighted Lifestyle-Based Social Equity

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Household consumption has the greatest effect on emissions in terms of lifecycle environmental impacts (environmental footprints) when we consider national consumption from initial raw material procurement through to final consumption. For this reason, many studies have analyzed household footprints to date, and recently, particular attention has been given to the relationship between income and environmental footprint size and the emergence of social inequality as a result. In order to address this issue, incorporating lifecycle thinking, it is necessary to undertake both quantitative assessments, in terms of environmental footprints, and qualitative assessments which consider stakeholder preferences.
In this study, we propose an input-output analysis-based sustainability evaluation framework (Chapman and Shigetomi, 2018a) which quantitatively assesses social inequity caused in part by household income inequality, cognizant of householder preferences. Previous research investigated the issue of an aging, shrinking population in Japan and social inequity outcomes without stakeholder weightings, in order to develop a visualization metric. Building on this research, and in order to focus on societal fairness, the research question to be addressed the evaluation of social inequity overtime through the estimation of future household environmental footprints including factor importance weighting derived through stakeholder engagement.

The proposed IOSEF methodology utilizes multiple data types including, socio-economic statistics and input-output life cycle inventory (IO-LCI) data, and, stakeholder preferences, extracted from a large-scale national survey. The first part of the methodology includes an estimation of household consumption footprints from 1990 to 2005 based on data in the Japanese Input-Output Tables, and, to enable future projections from 2005 to 2040, data from the National Institute of Population and Social Security Research regarding the number and income class of future households is used. The second part consists of stakeholder (households) weighting of critical consumption-based footprints, derived from an evaluation of precedential literature regarding environmental injustices. These six footprints, representing public bads which cause social inequity include greenhouse gases (GHG), energy, water resources, waste, particulate matter (PM2.5), and rare metal (neodymium) usage risk. Stakeholder weightings are drawn from a large-scale national survey conducted in 2018 (Chapman and Shigetomi, 2018b).
Finally, an assessment of social inequity is undertaken to quantitatively define both the overall level of inequity resulting from household consumption, as well as the origin of the consumption burden in terms of income level.

The findings of this research suggest that from 1995 onwards, consumption burden will most heavily impact upon households with incomes below the national average. This phenomenon is due to two factors, firstly, through an aging society which increases the number of households in the low-income brackets, and, secondly, due to the consumption patterns of higher income households. In terms of overall social inequity, the peak is experienced in the year 2010, after which social inequity decreases. This trend is interesting because it is different from the majority of footprints, which peak around 2020 and we assume that this is due to the demographic shift which increases the number of lower income households. When contrasting business as usual and weighted scenarios post 2020, we find that social inequity is decreased further suggesting that peopleâ€™s preferences, and therefore their likely future behavior will have a positive effect on both the environment and social equity outcomes.