Article

The Ecological Footprint of Happiness: A Case Study of a Low-Income Community in the City of São Paulo, Brazil

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Abstract: An ecological footprint is an accounting tool that reports the balance between resource supply and demand to assess environmental sustainability. Among the many available indicators of social progress, happiness reflects how a person feels about their quality of life. We combined these two approaches to assess the ecological efficiency of social performance in the low-income community of Felicidade, in São Paulo, Brazil, in 2019. We assessed the ecological footprint and gross domestic happiness (GDH) through questionnaires. We found that the community has a lower environmental footprint than higher-income communities in Brazil. However, the per capita ecological footprint in the community is still above what is available per person globally. We found that the community has a high level of life satisfaction (GDH = 0.86) and that the main contributor to happiness is health, time use, psychological wellbeing, education, good governance, and community vitality. The results suggest that other contributors unrelated to income are more robust determinants of happiness. In Brazil, despite higher footprints characterizing higher-income communities, further efforts in low-income communities are needed to reduce environmental footprints, ensure dignified income, and nurture the underlying conditions for high levels of happiness and social capital.

Keywords: ecological footprint; happiness; gross domestic happiness; social capital; low-income community; environmental sustainability

1. Introduction

Brazil is one of the unequal countries in terms of income and wealth distribution. In the 2018 United Nations World Income Inequality Database (WIID), Brazil was the most unequal of 45 countries by considering four different indicators. Its Gini coefficient (54 in 2018 and consistently above 50 since 1981) is largely surpassed only by South Africa. In 2018, the bottom 40% of the population in Brazil held only 10% of national income, while the top 10% held over 40% [1,2].

As an effect of inequality, poverty, and ineffective public housing policies, the low-income population in Brazil tends to concentrate in communities—named *favelas*—on areas unsuitable for construction, such as on hilltops and slopes or riverbanks. This exposes people living in favelas to high environmental risk [3] and a lack of basic services and infrastructures. In 2019, the average monthly income per capita in the Brazilian favelas was R$734.10 (US$170), which is around 40% of the national average [4,5]. Notwithstanding these unfavorable environmental and economic conditions, solid communal ties among favela residents suggest high social capital and happiness levels. Undergraduate students were evaluated by examining behaviors and found it is possible to increase happiness with minimal ecological footprints [6]. A 2013 study found that 85% of favela residents such as where they live, and 70% would continue to live in their communities even if their income doubled [7]. Another study in 2014 found that 94% of favela residents state that they are happy [8].

Within the city of São Paulo, over 2 million people live in favelas, representing around 11% of the total population in São Paulo and about 6% of the total population in Brazil [9]. Studying these communities presents some challenges, including difficulties in accessing the community and, often, the hostility of community leaders. In the surrounding areas of favelas, there is diffused lack of public services, health care facilities, schools, cultural facilities, public transport, and a general lack of security. The favelas and their surrounding areas have higher crime rates and tend to be areas of drug trafficking.

Some background aspects related to the use of social and environmental indicators and the choice of indexes were explored in at least 80 years of scientific debate on many wellbeing indicators arising from the specific literature on the subject. Among those, it is worthy of citing indicators related to basic needs, income and happiness, psychological wellbeing, and social capital developed by Maslow, Easterlin, Kahneman and Deaton, and Putnam [10–14].

A perspective on favela communities is essential to provide a comprehensive picture of wellbeing and sustainable development in Brazil, including in the context of the UN Sustainable Development Goals (SDGs), which have to be achieved at all levels of society, including all sex, age, race, and income groups [15].

Data collection in low-income communities, including for calculating indicators able to assess progress toward multiple goals, is a need and challenge at the same time [16,17]. The relationship between economic influence, quality of life, and environmental implications of production and consumption activities is a recurring theme in discussions on sustainability [18]. In the study, sustainable wellbeing indices must be more effective and complete for the evaluated audiences, unequally portraying what he intends to evaluate [19]. The ecological footprint as an indicator of sustainability has been used in works that relate to happiness or wellbeing [19–22]. Considering socioeconomic aspects in research that relate wellbeing to environmental elements [22].

Additionally, new combinations of existing indicators can be explored for designing indexes able to track synergies and trade-offs among SDGs, addressing two-way interactions between, for example, health and wellbeing (SDG 3) and sustainable production and consumption (SDG 12) [23,24]. The per capita income, happiness, and human development significantly impact the ecological footprint [20]. This study was about ASEAN countries spanning a period of 30 years. In this context, this research explores how the environmental impacts of consumption by residents on their level of happiness can be evaluated in a low-income community [20].

The subject of this study is the *Felicidade* community in the São Luiz neighborhood in the southern part of the city of São Paulo. Unlike other favelas in São Paulo, this favela is easy to access. Several social programs have been developed in the community in the past, involving some of the authors of this study. This facilitated to approach of residents and the collection of survey data.

This paper aims to investigate the relations between the environmental impacts of consumption of residents of the *Felicidade* community and their happiness level. For this purpose, we assessed social progress using the gross domestic happiness index (GDH) and measured environmental stress using the ecological footprint (EF).

2. Methods

A total of 784 families reside in Felicidade's community [25]. We calculated the EF and the GDH from survey data, using the question-set from the Ecological Footprint Calculator (https://www.footprintcalculator.org/ (accessed on 5 April 2019)) and the questionnaire and indicators developed by the Centre for Bhutan Studies and Gross National Happiness (GNH) Research (http://www.grossnationalhappiness.com/ (accessed on 9 July 2019)), later adapted [26] for case studies in Brazil.

We calculated the size of a representative sample with Cochran's formula, assuming maximum variability ($p = 0.5$) and a 95% confidence interval. This returned a sample size of 157 families. The families were classified into five socioeconomic categories (i.e., A,

B, C, D, E) using the classification parameters described in ABEP [27]. This division of ABEP [27] was considered because it is a study for socioeconomic classification criteria for Brazil, using parameters of the lifestyle of the people studied. These parameters include counting household appliances purchased, loaned, or rented, as well as a measure of householder education and access to public utility services. The community does not have class A residents, being divided according to the criteria of ABEP [27] of its questionnaire B1: 38–44 points, B2: 29–37 points, C1: 23–28 points, C2: 17–22 points and D–E: 0–16 points. In addition, the sex of the respondent householders was also noted. The respondents were selected voluntarily in a number proportional to the size of the family. Data were collected door-to-door by a team of 10 students who received specific training. This research occurred in the year 2019. The demographic characteristics of the community are presented in Table 1.

Table 1. Demographic characteristics of the community.

Aspect Group	Stratification	Participation (%)
Gender	Male	40
	Female	60
Age range (year)	20–25	21
	26–35	33
	36–45	26
	46–55	12
	55	8
Education	Illiterate	29
	Elementary School	52
	High school	18
	Higher education	1
Employability	Employee	25
	Partially employed	48
	Unemployed	27
Socioeconomic class	B	4
	C	75
	D–E	21

About the EF, we transferred the responses to the survey in the Ecological Footprint Calculator online (https://www.footprintcalculator.org/ (accessed on 5 April 2019)). This returns the "number of planets" that would be needed to sustain human consumption if every person on the planet would consume as much as the respondent's household. According to ecological footprint accounting, this is calculated by comparing the equivalent area needed to support one's consumption (the EF) with the area available on the planet for resource supply and to absorb wastes generated by consumption in one year (the biocapacity) [28,29]. The aspects of consumption accounted for by the calculator are food, housing, and transport. The maximum sustainable "number of planets" for consumption is 1, as any value above 1 indicates that current consumption levels are extracting resources and producing waste at a rate that is faster than our planet's ecosystems can regenerate and absorb [30,31]. The result of the ecological footprint will be expressed in planets necessary to supply a lifestyle of the people evaluated, the ratio of the ecological footprint in global hectares per person to the earth's biocapacity per person.

The questionnaire we used for the calculation of the GDH [26] is structured in 107 questions and allows for the analysis of 25 indicators into 9 core areas: psychological wellbeing, health, time use, education, cultural diversity, good governance, community vitality, ecological diversity, and living standards. A description of the study objective of the 9 core areas is presented below:

1. Psychological wellbeing: Encompasses contentment, mental health, and satisfaction with all elements of life. In this indicator, spirituality activities, family satisfaction with aspects such as health, the standard of living, and the relationship of family members;

2. Health: Health indicators assess the population's physical and mental health status. Health status indicators include self-assessment health, disability, activity limitations, and healthy days rate. Indicators include risky behavior patterns and exposure to risky conditions, such as consumption of prohibited drugs and not banned;

3. Time use: The questions were directed to obtain information about what people do in their lives and how they divide their time between work and personal life;

4. Education: The difference between traditional and this domain is that it evaluates the different types of knowledge, values, creativity, and skills that people have acquired over the course of life, such as history, culture, citizenship, ecology, and abilities, which are, in most cases, acquired informally;

5. Cultural diversity: The domain of culture takes into account the variety and the number of cultural facilities and usage patterns. The questions aimed to learn manual skills, family members' participation in sociocultural activities, and the existence of these activities in the community;

6. Good governance: The governance domain assesses how people perceive various government functions in terms of effectiveness, honesty, and quality. The assessment of "good governance" was directed to know the perception of the interviewees about the services basic services they receive, such as medical care, garbage collection, water and electricity, and political participation;

7. Community vitality: The community vitality domain focuses on the strengths and weaknesses of community relationships and interactions. He examines the nature of trust, feeling of belonging, the vitality of affective relationships, security in the home and the community, and the practice of giving and volunteering;

8. Ecological diversity: Questions about environmental awareness and attitude enter the aspects covered by the indicator. In this domain, there were aspects such as concern for the care of nature, such as water pollution, noise pollution, reduction in flora and fauna, soil erosion, and wildlife damage;

9. Living standards: An individual's standard of living is essential in determining their wellbeing or happiness. Encompasses so much income, as well as possessions and housing conditions. The domain of life covers the basic economic status of citizens. These indicators assess levels of family income, possessions, and housing quality.

For each question, the respondent is asked to express satisfaction with specific aspects of the household's life. A score is assigned to the answers to calculate the household's overall happiness level. There are 3 answer alternatives for each question, each of these answers being several points for your analysis:

(a) Not at all satisfied: 3 points;

(b) Not satisfied nor unsatisfied: 6 points;

(c) Fairly or very satisfied: 9 points.

In this way, the greater the number of points or satisfaction regarding the questions, the greater your level of happiness. The questionnaire takes about 30 minutes to complete. According to the GNH adapted [26], values of GDH above 66 (expressed as 0.66) correspond to high levels of happiness, while values below that threshold indicate a condition of unhappiness. Further details on this questionnaire and how it is built as a context-dependent questionnaire for Brazil [26]. The questionnaire has been revised and approved before use by the Research Ethics Committee of Universidade Paulista (São Paulo, Brazil). Each respondent signed a consent form.

3. Results and Discussion

The community of *Felicidade* has, on average, an EF of 1.6 planets, highlighting a condition of environmental unsustainability. This EF is, however, smaller than the average EF calculated for the whole city of São Paulo, of 4.4 planets [32], and Brazil, of 2.9 planets.

Among the aspects accounted for by the EF, the largest impact comes from food (thus affecting resource flows provided by cropland and pasture—Figure 1). Differently from what was observed for the whole of Brazil (and across most of the world countries), the share of carbon footprint over the total footprint of the community is relatively low, reflecting modest energy use and reduced transportation. Other low categories of impact are those related to fisheries and built-up land, the first reflecting dietary choices and available options, the second indicative of poor infrastructures and housing conditions.
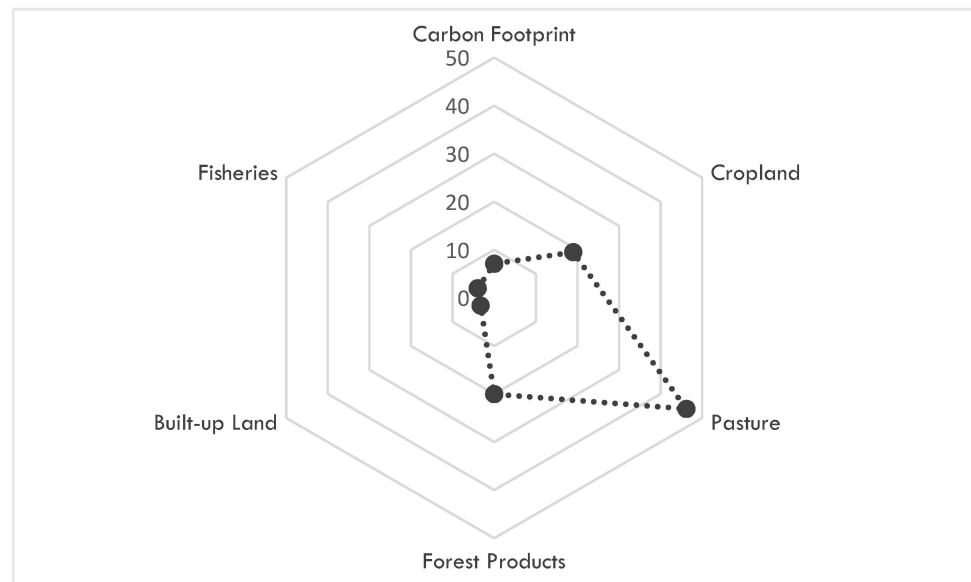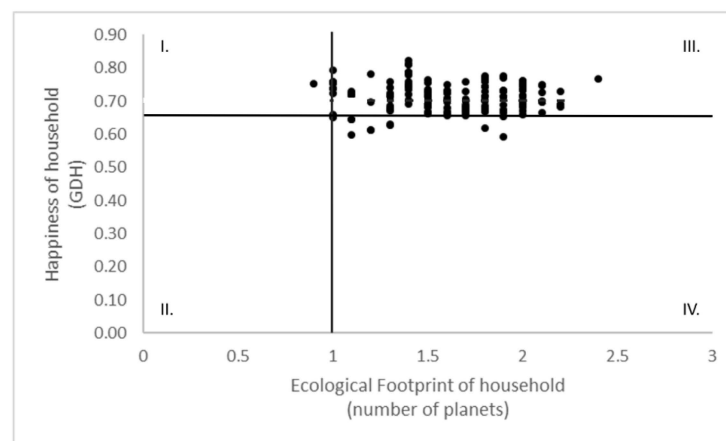

Figure 1. Ecological footprint of households in the community of *Felicidade* (São Paulo, Brazil) on different land types. Values are in global hectares per household.

The average GDH in the community is 0.86, which denotes high levels of happiness [26], with higher contributions from health, time use, psychological wellbeing, education, good governance, and community vitality (Figure 2).
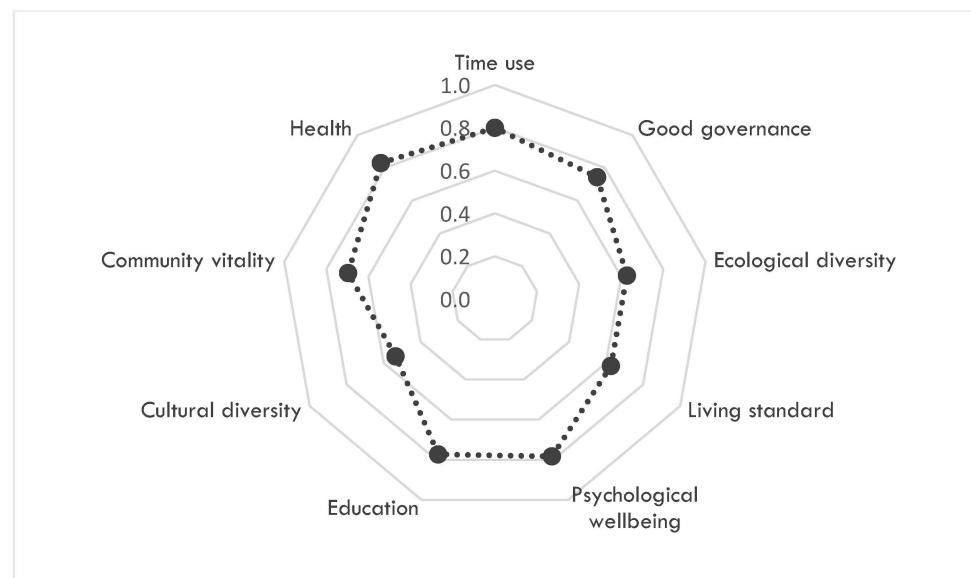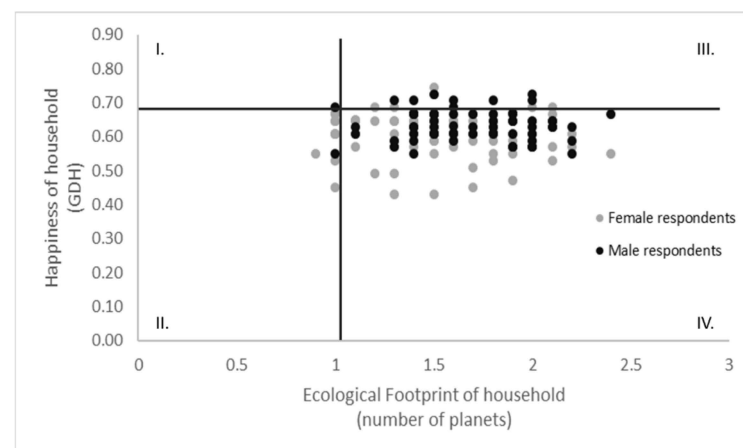

Figure 2. Happiness level of households in the community of *Felicidade* (São Paulo, Brazil) across nine core areas.

By considering threshold levels of happiness and EF, it is possible to characterize households within one out of four categories or quadrants (Figure 3). Households with happiness values above 0.66 and an EF lower than 1 are to be considered happy and environmentally sustainable (quadrant I—Figure 3). Households with happiness above 0.66 and EF higher than 1 are happy but unsustainable (quadrant II—Figure 3). Households with happiness values below 0.66 are unhappy and can be sustainable, for EF values lower than 1 (quadrant III—Figure 3), or unsustainable, for EF values higher than 1 (quadrant IV—Figure 3). This categorization can be carried out for the aggregate assessment of happiness across the 9 core areas (Figure 3) and for each of the 9 areas separately (e.g., Figures 4 and 5).
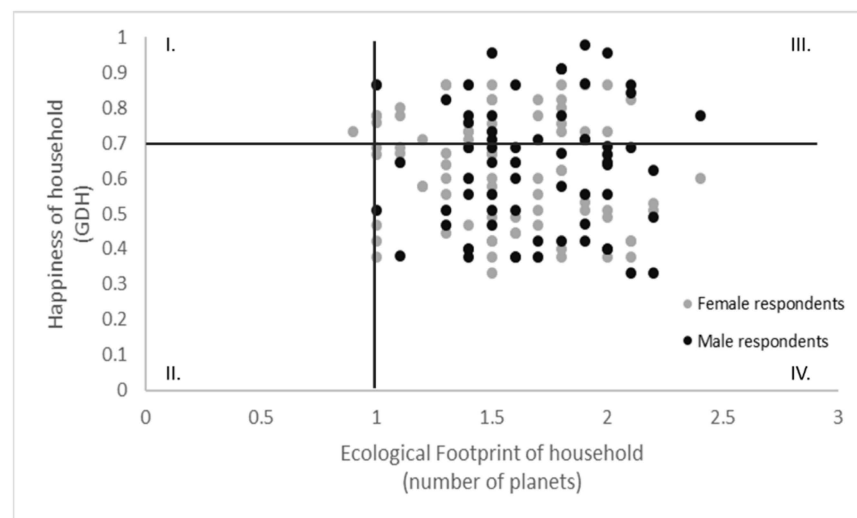

Figure 3. Ecological footprint and happiness levels of households in the community of *Felicidade* (São Paulo, Brazil). Lines indicate thresholds for sustainability (below 1 planet) and happiness (above a happiness score of 0.66). Households can be characterized into four categories, or quadrants, depending on above/below threshold values.

Figure 4. Ecological footprint and happiness levels of households about living standards in the community of *Felicidade* (São Paulo, Brazil). Lines indicate thresholds for sustainability (below 1 planet) and happiness (above a happiness score of 0.66). Households can be characterized into four categories, or quadrants, depending on above/below threshold values.

Considering the entire distribution of survey responses in the 9 areas, household happiness in the community goes from 0.67 to 0.84. The EF varies between 0.9 and 2.5 (Figure 3). Notably, all socioeconomic groups have, on average, very similar EFs—from 1.5 to 1.6—indicating how income distribution across community households plays a minor role or is balanced by other factors in defining the environmental impact of consumption. One of these factors is formal education, as respondents with a university degree have

an average EF of 2, compared to an average EF of 1.55 and 1.57 for respondents without any formal education or with primary education, and an EF of 1.66 for respondents with a high-school degree. Analyzing the community by socioeconomic groups, the EF for classes B, C, D, and E was 1.6 planets. All socioeconomic groups showed the same consumption for the ecological footprint methodology. Happiness for the socioeconomic groups were: B = 0.73, C = 0.72, D = 0.71, and E = 0.72. There was no significant difference in the level of happiness evaluating the classes considered happiness. While further research is needed to understand the dynamics and mechanisms behind this observation, this result suggests that at least educational programs in the community are falling short in raising environmental awareness. At the same time, better education is related to increasing consumption levels in a context characterized by low consumption levels, thus indicating a potential improvement in living conditions.

Figure 5. Ecological footprint and happiness levels of households about ecological diversity in the community of *Felicidade* (São Paulo, Brazil). Lines indicate thresholds for sustainability (below 1 planet) and happiness (above a happiness score of 0.66). Households can be characterized into four categories, or quadrants, depending on above/below threshold values.

While most survey responses for the whole community denote unsustainable and happy households, the distribution of household responses in the areas of living standards and ecological diversity return a more varied picture. About living standards, we found a higher prevalence of responses characterizing unhappy and unsustainable households (with the lowest happiness scores associated with female respondents) (quadrant IV—Figure 4). The fact that we did not observe any relation between happiness levels and EF in this area questions the supposedly linear link between increasing consumption and life satisfaction. In fact, by extracting results from this single area, we rule out the effect of social, cultural, and other factors unrelated to consumption levels, considered instead in some of the other areas.

Regarding ecological diversity, we found a more balanced distribution, denoting a high prevalence of unsustainable households but an almost equal representation of happy and unhappy households (quadrants II and IV, respectively, Figure 5).

Our results show that happiness in the low-income communities in Brazil derives from high levels of social capital with good quality relations in a thriving and vital community, despite low levels of income and poor environmental quality. High levels of social capital contribute to good psychological wellbeing and a feeling of using time in productive and enriching ways.

These results provide important information for policymakers and city planners, indicating improvement in living standards and environmental quality as major areas of intervention for potential requalification of favelas. On the other hand, policy and programs

should consider and maintain tight social bounds that constitute the core element that makes communities resilient and happy while reducing environmental impacts. Furthermore, despite low-income levels and structural barriers, favela communities achieve high levels of happiness with an average 50% lower footprint than higher-income communities in Brazil. While favelas could be taken indeed as a bad example when it comes to economic development, housing, and environmental health, the specific dynamics that create and reinforce high levels of social capital in these communities can be taken as positive examples to learn from and replicate in other, more disconnected, communities.

4. Conclusions

In this paper, we assessed the level of happiness (or life satisfaction) and environmental impact in a low-income community in the city of São Paulo (Brazil). We assessed happiness using a modified approach for calculating the gross domestic happiness index (GDH), adapted for case studies in Brazil. We assessed environmental impacts using ecological footprint (EF). We found that the community under study is happy and unsustainable, despite EF values much lower than higher-income communities in São Paulo. By analyzing levels of happiness in 9 different areas, we found that most people in the community are unhappy regarding living standards and ecological diversity. However, low happiness levels in these areas are compensated by much higher happiness levels in other areas, connected to quality relations and social capital. The main contributions of this paper are two: 1) the method developed can be used to assess more communities at different income levels that can be classified as happy/unhappy and sustainable/unsustainable; 2) the results inform policymaking as to which areas possess a stronger potential for affecting life satisfaction in low-income communities in Brazil (i.e., economic development including housing and infrastructures, and environmental health), and which areas should be preserved while implementing requalification plans and other programs (i.e., quality relations and social capital). Finally, this paper contributes to the exploration of complex relationships between life satisfaction and environmental impacts, which is of increasing importance for redesigning development for wellbeing in the context of approaching planetary boundaries and achieving the SDGs.

This research is limited to the studied community, where the results presented represent the lifestyle of people in the studied community. It is also limited to the ecological footprint indicator to assess people's consumption and the modified happiness indicator, evaluating nine related aspects. The happiness level assessment instrument is an adaptation for the surveyed public, considering 9 core areas of study and 25 indicators. Future research may explore cause-and-effect relationships between people's consumption and the identified happiness level. Levels of dependence between happiness and consumption can be explored by demographic aspects for better guidance in decision making.

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