UNIVERSITY OF GHANA – COMPUTER SCIENCE DEPARTMENT

DSCD 611 – PROGRAMMING FOR DATA SCIENTIST 1

AN EXPLORATORY ANALYSIS OF FOOD INSECURITY PATTERNS IN GHANA.

FINAL PROJECT WORK – GROUP B6

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AN EXPLORATORY ANALYSIS OF FOOD INSECURITY PATTERNS IN GHANA.

Topic and Research Objectives.

Our project investigates food insecurity patterns or trends in Ghana a comprehensive analysis using the Afrobarometer Round 9 survey dataset from 2023. Food insecurity is defined as the lack of consistent access to adequate, safe and nutritious food. This affects approximately 36.6% of Ghanaian households, however, this national average does not show the wide differences between the various regions, social and demographic groups.

Our research sought to answer five critical questions. They are:

1. How does food insecurity vary across all the 16 regions in Ghana?
2. What is the relationship between asset ownership (household wealth) and food security?
3. How does education level influence food insecurity risk?
4. Do different types of deprivation such as food, water, income cluster together?
5. How does food insecurity patterns differ between urban and rural areas?

Our questions were designed to uncover the multidimensional nature of food insecurity, identify the vulnerable populations and provide interesting insights for policy interventions. Our aim was to create a comprehensive understanding of food insecurity through five dimensions which are education, geography, wealth, multiple deprivations and urban-rural dynamics.

BACKGROUND

The Food and Agriculture Organization (FAO) estimates approximately 282 million people to be food insecure in Sub-Saharan Africa. In Ghana, food insecurity remains stubbornly high particularly in the Northen regions. Existing literature establishes the correlation between these five dimensions. Unfortunately, most literature do not examine their interconnections with other deprivations. Our project seeks to address this gap by simultaneously examining multiple dimensions of food insecurity and comparing the urban and rural patterns using nationally representative data.

RELEVANCE

Our topic is relevant for some compelling reasons. First off, the scale of our problem is food insecurity. We have over one-third of Ghanaian households suffering with food insecurity. This affects more than 800,000 families. Another interesting insight is policy urgency. Ghana's government has committed to the SDG goal of zero hunger by 2030, however, the progress has been very slow requiring some evidence-based recalibration of strategies which our project provides. Above all, aside the policy relevance, our project demonstrates how powerful data science tools are in addressing social challenges. We applied exploratory data analysis, visualization and correlation analysis to a dataset to show how we can transform data into actionable insights.

DATA DESCRIPTION

We utilized the Afrobarometer round 9 dataset (2023) that covers all 16 regions in Ghana and employed standardized questionnaires. The original dataset contains 2400 respondents and 398 variables. We performed data cleaning and preparation that yielded the final dataset of **2368 respondents (samples) and 17 key variables (features).** The cleaning process removed "Don't know" and "Refused" responses which were coded as 9, 98,99 from the food insecurity variables. Our key variables included geographic location, education level, asset ownership and other deprivations. We created derived variables to help us facilitate our analysis. These include a binary food insecurity indicator, readable region names mapped from numeric codes, education categories and asset ownership score.

METHODOLOGY AND TOOLS

Our project employed python as our primary programming language. We used pandas for our data loading, cleaning, transformation and aggregation operations, NumPy for numerical and array operations. For our data visualizations, we employed Matplotlib and seaborn to create our plots. The exploratory analysis was conducted in a Jupyter notebook with markdown explanation and a python file for reproducible codes. Our analysis followed a systematic exploratory data analysis workflow.

Data preparation involved loading our dataset and selecting 17 relevant variables, handling missing values and creating derived variables.

Descriptive analysis which involved calculating frequencies and percentages for categorical variables, means and median and cross-tabulations for examining relationships between variables.

Correlation analysis involved Pearson correlation coefficients to quantify the relationship between different types of deprivation.

Visualization techniques were carefully selected to match the questions. ***Bar charts*** displayed food insecurity rates across regions. ***Box-and-whisker plot*** compared asset ownership distribution between rural and urban groups. ***Line chart*** illustrating the downward trend in food insecurity as education level increases. ***A correlation heatmap*** displayed the relationship between four deprivation types using color intensity. ***A pie chart*** showing the distribution of households by number of simultaneous deprivations. Each visualization was designed with clear labels and appropriate colors to ensure accessibility to all types of audiences.

RESULTS AND SOCIETAL IMPACTS

Our analysis yielded five major findings with some relevant implications.

Finding 1: Food insecurity varies across the regions from 4.3% in Bono-East to 93.6% in Savannah showing a 21-fold difference. This shows that Savannah region faces critical food

insecurity crises requiring immediate attention while successful regions like Bono-East can serve as models for effective food security strategies.

Finding 2: Asset ownership correlates with lower food insecurity, but the relationship was weaker than expected. We recommend programs that target income flow and livelihood strategies.

Finding 3: Education is the strongest factor identified in reducing food insecurity risk by 42%. Universal secondary education could be an effective food security intervention.

Finding 4: Food insecurity strongly correlated with medical care shortage and water shortage. We recommend programs that address multiple needs.

Finding 5: Rural areas showed higher food insecurity than urban areas. This suggests that, rural areas need agricultural support and infrastructure investments while the urban needs upgrading.

Our findings propose the development of targeted interventions. We propose a policy framework to support the zones in crises and a long-term in education and social protection nationwide.

TEAM MEMBERS CONTRIBUTIONS

Masuda Tuntaya Mashoud coordinated the overall project workflow and team meetings, acquired the dataset, research questions and coordinated the final integration of the report.

Bernard Kofi Ofori Essiamah assisted in the data cleaning and preparation scripts and the visualization refinement.

Cephas Amoako Dakwa assisted in debugging codes and conducted the education analysis, also contributed to the literature review section.

Philemon Elikem Kordorwu contributed to policy recommendations development and reflections.

REFLECTIONS

Our project provided valuable learning experiences across technical and conceptual dimensions. We enhanced our programming proficiency, particularly data manipulation, data visualization with Matplotlib and Seaborn, and working with real-world datasets. We understood how data analysis helps explain social issues better. We were surprised by some of our findings, particularly the extent of regional inequality. We understand better how food insecurity is not a simple problem with a simple solution but a multidimensional problem that requires detailed attention.