



DATA SYNERGY

FINDINGS REPORT




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We, the undersigned members of the above Project Group, collectively and individually certify that the above Project Deliverable, as submitted, **is entirely our own work**, other than where explicitly indicated in the deliverable documentation.

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1. EXECUTIVE SUMMARY

The study's findings on Zoe Empower's program and its impact on the self-sufficiency index (SSI) reveal significant correlations and trends across various categories. The linear regression analysis shows that participants experience a steady increase in self-sufficiency throughout the program, with an average gain of 8.3 points per stage. Additionally, constitutional differences in Kenya and Rwanda play a crucial role in improving participants' lives and SSI, with Kenya's focus on human rights enforcement and Rwanda's emphasis on healthcare schemes.

The impact of across eight areas of intervention were explored, starting with health and hygiene. The data analysis indicates that individuals who own houses generally have better access to medical care, while those living in rented homes or with someone providing them with a place to stay exhibit lower access to medical care. However, clean and boiled water usage is prevalent across all living arrangements. This correlation suggests that homeownership positively affects health and hygiene practices, although other factors may contribute to these outcomes.

Food security and nutrition were positively influenced by the presence of livestock or crops, leading to increased meals per day and a lower prevalence of malnourished family members. However, other factors such as income, access to diverse foods, healthcare, and education also play significant roles in food security and nutrition outcomes.

Education was identified as an enabling factor for other aspects impacting SSI, such as food and nutrition standards. Completing higher education levels significantly boosts participants' SSI, but economic limitations and cultural contexts affect the frequency of achieving high educational milestones. By providing skills and tools for higher-income businesses, Zoe Empowers enables families to invest in education for future generations, thereby breaking the cycle of limited educational opportunities.

Economic factors were identified as substantially influencing participants' SSI, with a steady increase as income levels rose. The program's impact on participants' income surpasses the average earnings of small businesses in Kenya, allowing for increased employment and

children's education. Multiple businesses and investments in farming further contribute to income growth and food resources.

Housing plays a significant role in an individual's well-being, as indicated by correlations between living situations and factors such as access to water, help-seeking, livestock or crop ownership, and medical care. Individuals who know their rights and can enforce them and those who know where to seek help exhibit stronger correlations with adequate and safe housing.

Community engagement is positively associated with several factors, including age, access to clean water, adequate and safe housing, knowledge of rights, business ownership, sufficient food consumption, and diversified food consumption. Attending community events and receiving social support positively impact participants' economic and social well-being.

Child rights improve with each progressive year in the Zoe Empower program, indicating its effectiveness in empowering individuals to know and enforce their rights. Furthermore, participants experience a gradual increase in spiritual strength as they progress through the program, regardless of their religious identification.

Overall, the findings highlight the positive impact of Zoe Empower's program on participants' self-sufficiency, well-being, and community engagement. The program's emphasis on education, economic empowerment, and community involvement improves outcomes across various domains. The results underscore the importance of addressing constitutional differences, healthcare access, housing conditions, and social support in empowering individuals and communities.

2. INTRODUCTION

Living in poverty is a harsh reality for many people in sub-Saharan Africa, where almost half the population struggles to survive without everyday essentials like food, water, and shelter.

Orphaned youth are particularly vulnerable, often dropping out of school to seek employment to support their families. However, living on just \$1 a day is often insufficient to make ends meet, leading many to beg, steal, or starve. These children are frequently exploited, abused, sick, and isolated from their communities. Despite receiving temporary aid and being placed in foster care systems that are understaffed and underfunded, their circumstances remain unchanged. As a result, African children cannot envision a better future for themselves, perpetuating the cycle of poverty for generations to come.

Zoe Empowers, a global nonprofit organisation, offers a way out of this inescapable cycle for orphaned youth. Through a locally-led program that spans three years, groups of 60 to 100 vulnerable young people receive microgrants, life skills training, and vocational education to empower them to become secure, healthy, and engaged members of their communities. Zoe Empowers envisions a world where all children have opportunities, not handouts, to unlock their full potential. They empower orphans and vulnerable children to move beyond charity, becoming self-reliant leaders who change entire communities.

To measure the success of this program, DataSynergy partnered with SAS Institute to gather and analyse data directly from Zoe Empowers program participants. By comparing two geographic regions, Rwanda and Kenya, and using the ZOE_SELF_SUFFICIENCY_INDEX dataset, DataSynergy was able to understand the effectiveness of the Zoe Empowers program across eight areas of intervention: health and hygiene, food security and nutrition, education, economy, housing, community engagement, child rights, and spiritual strengths. The resulting findings shed light on the positive outcomes that can be achieved through Zoe Empowers' program, highlighting the factors contributing to self-sufficiency and positive change in the participants' lives.

3. SELF-SUFFICIENCY INDEX (SSI)

Self-sufficiency increases with membership status improving. At an encoded value of

- 1 = Member less than 3 months
- 2 = Member 1 yr - 2 yr
- 3 = Recent Graduate (less than 3 months)

With this linear regression showing that participants start at around 5.55 self-sufficiency and gaining approximately 8.3 points per stage. ($SSI = 8.30 * Membership - 2.75$) Definitely showing that participants progress in their self-sufficiency throughout Zoe Empower's program.

4. CONSTITUTIONAL DIFFERENCES

Across many categories the most significant factors for the improvement of participants' lives and SSI were due to Zoe Empower's understanding of the countries they are working with.

- Kenya's most impactful was knowing rights and how to enforce them
- Rwanda's most impactful was understanding their health insurance schemes

Through external research we found that there was a constitutional difference. Kenya guaranteed the right to basic human rights while Rwanda did not. However Rwanda has a focus on incredible health care and citizens can use that to improve their lives. The trends in the data show that these variables are the most important indicating that Zoe Empower's understands their importance.

5. IMPACT OF CATEGORIES

5.1. HEALTH AND HYGIENE

The following bar graph presents "Where do you Live", "I have Access to Medical Care", and "I use Clean and Boiled Water".

- “Where Do You Live” illustrates the distribution of individuals across different living arrangements.
 - “I have Access to Medical Care” indicates the proportion of individuals in each different living arrangement who have access to medical care.
 - “I use Clean and Boiled Water” to explore potential correlations between the variables.
- For instance, determine if areas with higher access to medical care also exhibit a higher proportion of individuals using clean and boiled water.

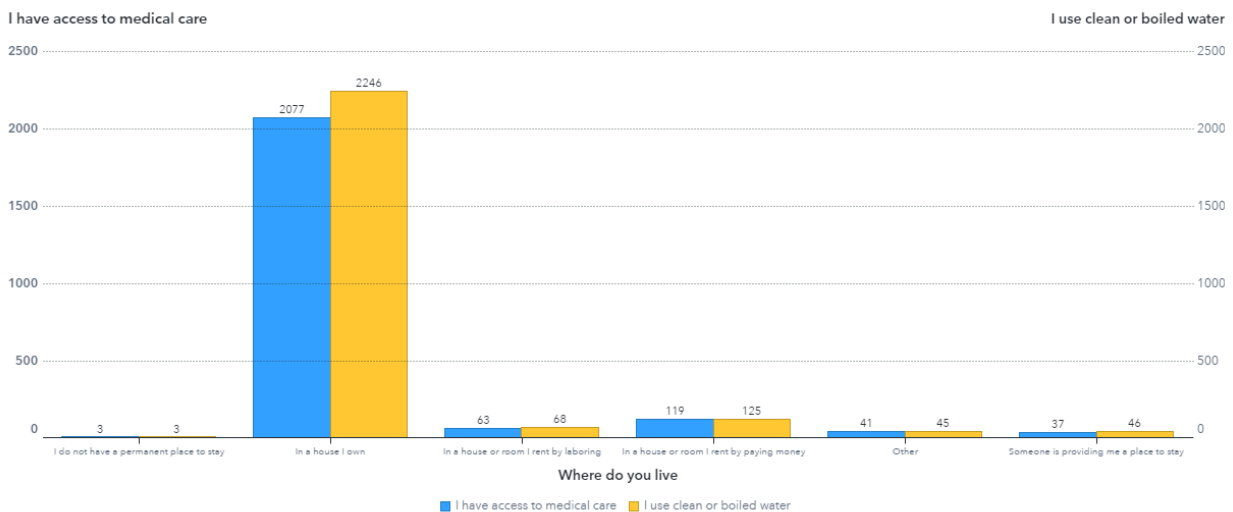


Figure 1 : Bar chart of Access to Medical and Access to clean water

The data shows that individuals who own a house have the highest proportion of access to medical care, indicating that homeowners generally enjoy better healthcare services compared to individuals in other living arrangements. On the other hand, those living in rented houses or rooms, those with someone providing them with a place to stay, and those without a permanent home to stay exhibit relatively more minor levels of access to medical care. However, it is important to note that the smaller bar heights in these categories may be due to fewer individuals living in these arrangements. Regarding using clean or boiled water, most individuals across all living arrangements report using clean or boiled water, which is a positive practice for maintaining hygiene and preventing diseases. Interestingly, the observation that individuals who own a house have higher bars for both "I use clean or boiled water" and "I have access to medical care" suggests a potential correlation between homeownership and better health and

hygiene practices. This correlation implies that owning a house may provide individuals with improved conditions for maintaining their health and access to clean water. Furthermore, despite the smaller bar heights in other living arrangements, the equal bar heights for "I use clean or boiled water" and "I have access to medical care" within these categories indicate that individuals within these arrangements also exhibit similar levels of access to medical care and use of clean or boiled water.

5.2. FOOD SECURITY AND NUTRITION

The bar graph provides insights into the relationship between “I have livestock or crops”, “Number of meals per day” and “Family members malnourished”. The x-axis represents the number of meals per day, while the y-axis indicates whether families have livestock or crops. The data is further categorised based on the presence of malnourished family members, with "N" indicating not malnourished and "Y" representing malnourished.

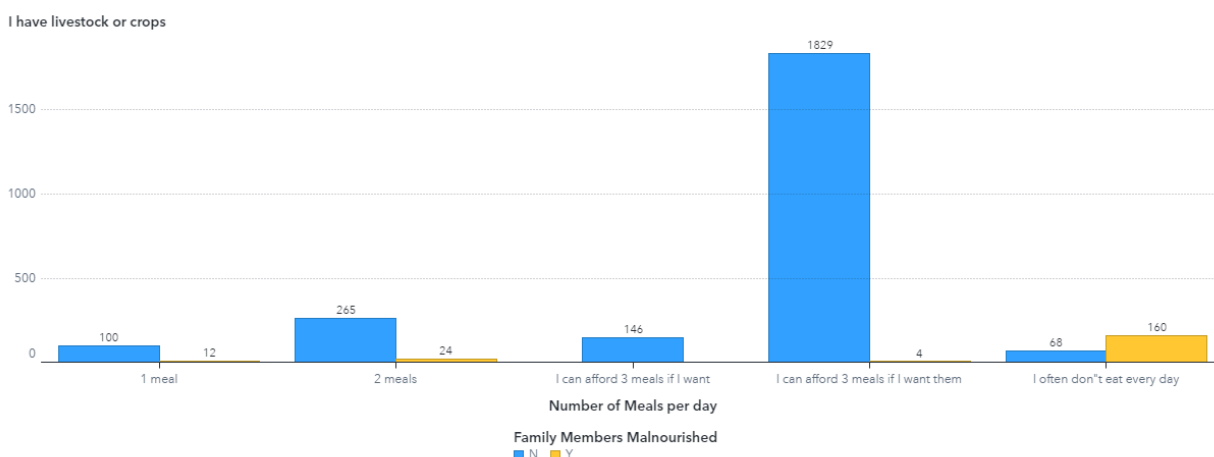


Figure 2 : Bar chart of Ownership of Livestock or crops and Number of meals per day

From these findings, we can infer that the presence of livestock or crops plays a significant role in promoting food security and nutrition within families. Families who have access to livestock or crops are more likely to have an increased number of meals per day, resulting in a lower prevalence of malnourished members. However, it is important to recognise that while livestock or crops can contribute positively to food security, they are not the sole determining factor. Other aspects such as income, access to a diverse range of foods, healthcare, and education also influence food security and nutrition outcomes.

To address food security and nutrition comprehensively, interventions should focus on ensuring not only the availability of livestock or crops, but also addressing broader socio-economic factors that contribute to overall well-being and access to a nutritious diet for all family members.

5.3. EDUCATION

Within the cross sectional analysis survey conducted there are no specific questions provided in relation to education. Therefore it is necessary to look towards education as an aspect of enabling other aspects which will have a heavy impact on an individual's SSI.

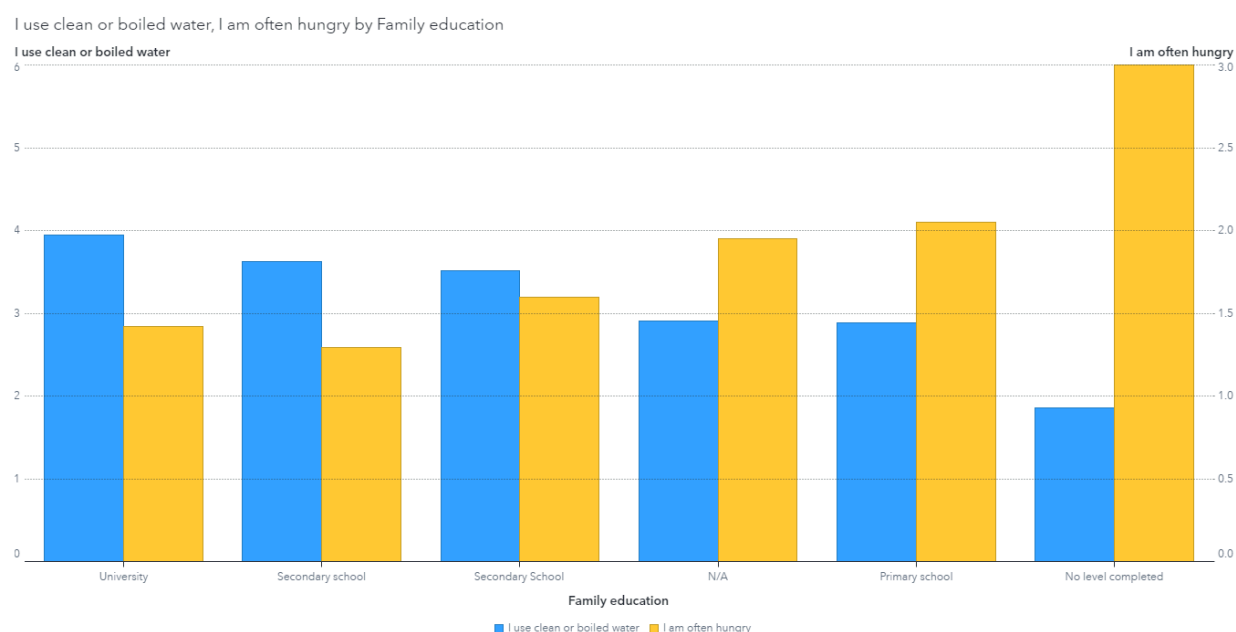


Figure 3 : Bar chart of Access to Water, Family education and Hunger status

Immediately the impact of education standards can be easily understood through a dual axis bar chart displaying the education levels completed as they relate to food and nutrition standards. We know that anything to do with food and water are the largest influencers of an individual's SSI so by proxy any educational standard which raises their average access to these areas need to be

considered major impacts to an individual's wellbeing.

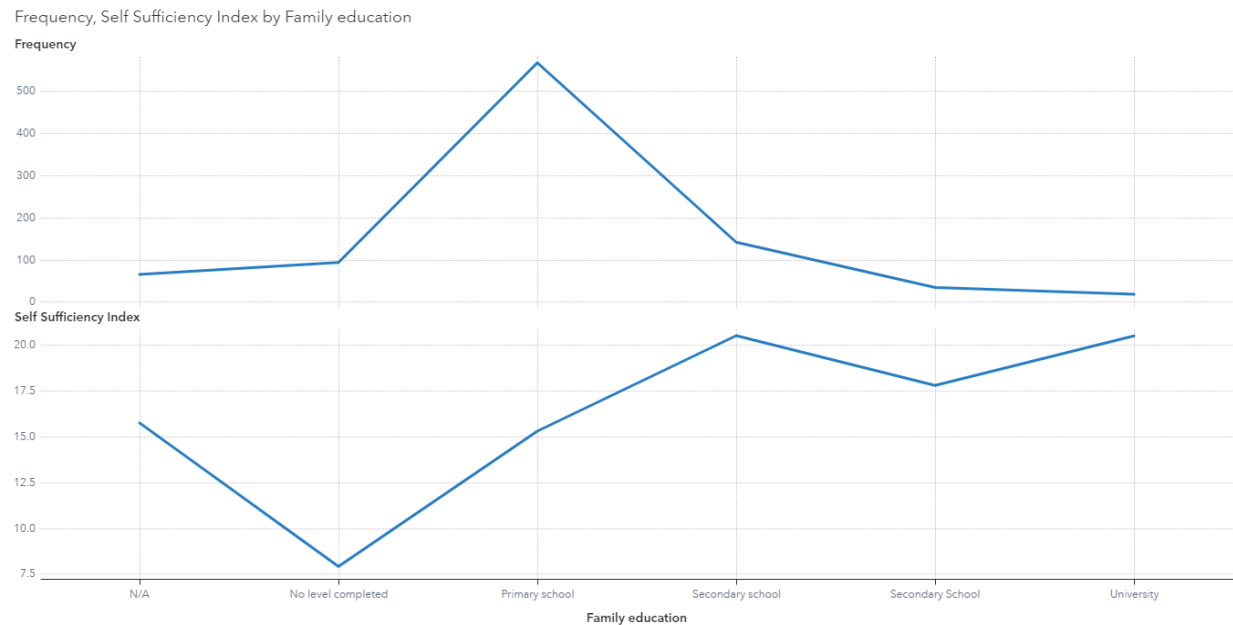


Figure 4 : Double-line axis of SSI by Family Education

Compared directly to the SSI it is again clear how on average completion of a higher education standard significantly boosts a participants SSI, what is also prevalent however is a large drop of the frequency of those achieving high educational milestones. This is probably very much to do with the economic landscapes of these two largely impoverished nations where a large financial investment is needed to send a child to secondary school or university with many leaving school to help family business or work on farm environments. By providing the skills and tools needed to maintain a high income business the Zoe Empowers program provided the groundwork needed for a family to eventually in a future generation start sending children to further education institutions.

5.4. ECONOMY

Within the provided impact data economical factors are shown to upturn drastically with the sampled population as they complete the course.

Survey Item	Percent Agreeing			Number of Cases
	Incoming	Midpoint	Graduate	
I can pay all the expenses (fees, uniforms, books) for all of the school-aged children in my household.	27	77	96	4736
I hire orphans/vulnerable people to help with my business/crops.	1	61	75	3780
Through my work, I can provide sufficient food, clothing, school expenses, and other necessities for my household.	2	87	99	5432

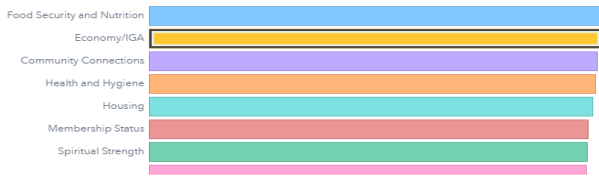
Figure 5: Description table of Survey items

With the sample data provided it would be assumed that these economical conclusions would also be able to be replicated and visualised properly using the Viya platform. Immediately though the use of the automated explanation feature it is outlined that economical factors alone have the second highest influence on the participants Self-sufficiency index, not even accounting for the fact that many aspects of how a participant can acquire the food and resources they need are all influenced by their economical status. The data shows a steady increase in an individual's food security score as their allocated income range increases, with a severe drop off when an individual is earning less than \$5 per week, at this metric we can also assume that they are begging or stealing for food which is not a sustainable way of living.

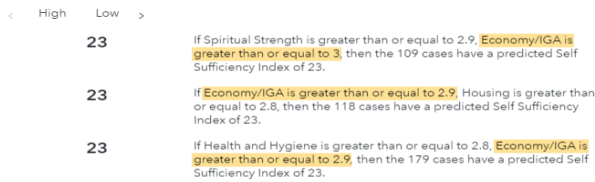
What are the characteristics of Self Sufficiency Index?

Self Sufficiency Index ranges from .96 to 24. Average Self Sufficiency Index is 16. Most cases (737 of 922) have a Self Sufficiency Index between 2.9 and 23. Housing best differentiates the highest (top 10%) and the lowest (bottom 10%) Self Sufficiency Index cases.

What factors are most related to Self Sufficiency Index?



What are the groups based on Economy/IGA by the average value of Self Sufficiency Index?



What is the relationship between Self Sufficiency Index and Economy/IGA?



Self Sufficiency Index may have a strong positive relationship with Economy/IGA. It appears to be a cubic relationship. Average Economy/IGA is 2, and it ranges from .14 to 3.

Figure 6: Automated Explanation of SSI vs Economy/IGA

Food Security and Nutrition by Household Weekly Income

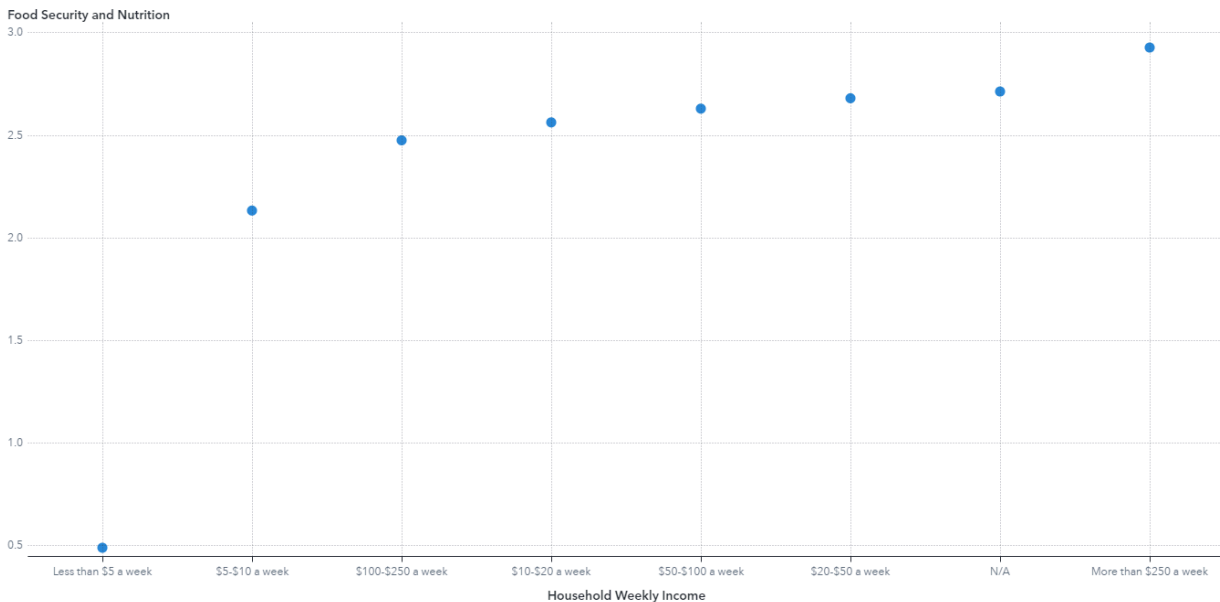


Figure 7: Dot plot of Food Security by Household Weekly Income

A survey done by Financial Sector Deepening Kenya, an independent trust allied with the Bill and Melinda Gates foundation with the aim of delivering inclusive digital economy solutions for micro and small enterprises reported that the average small business in kenya is earning around \$48 in profit per month, with over 98% of these all being operated by self employed owners

without any employees or assistance (Financial Sector Deepening Kenya, 2021). With this information it is impressive that the Zoe Empowers program is enabling participants to hit the average sole trader income margins and also in many cases surpass it quite substantially, with the ability to provide employment to others and also pay for their children's education (Financial Sector Deepening Kenya, 2021).

The provided data also shows how a participant with multiple businesses may see their income increase. The decision tree format of the data represents the frequency that an individual will be in a higher income bracket on whether they satisfy the multiple business requirement.

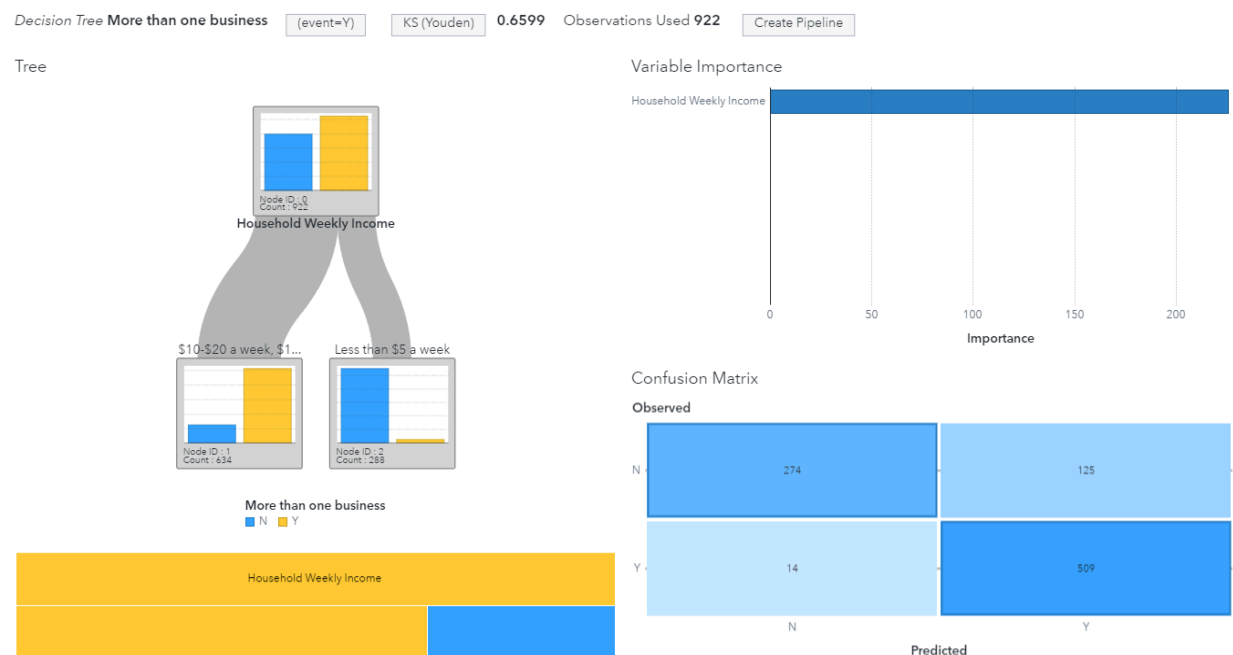


Figure 8: (Combination of data objects) Decision tree of business ownership, bar chart of household weekly income and confusion matrix

The expendable income generated by the businesses that Zoe Empowers enables is what will also enable the participants to then invest into some form of farming. This factor has some of the most dramatic SSI improvements as these farm animals and materials can be sold for much more money while also providing the family with a source of food or other materials for free.

5.5. HOUSING

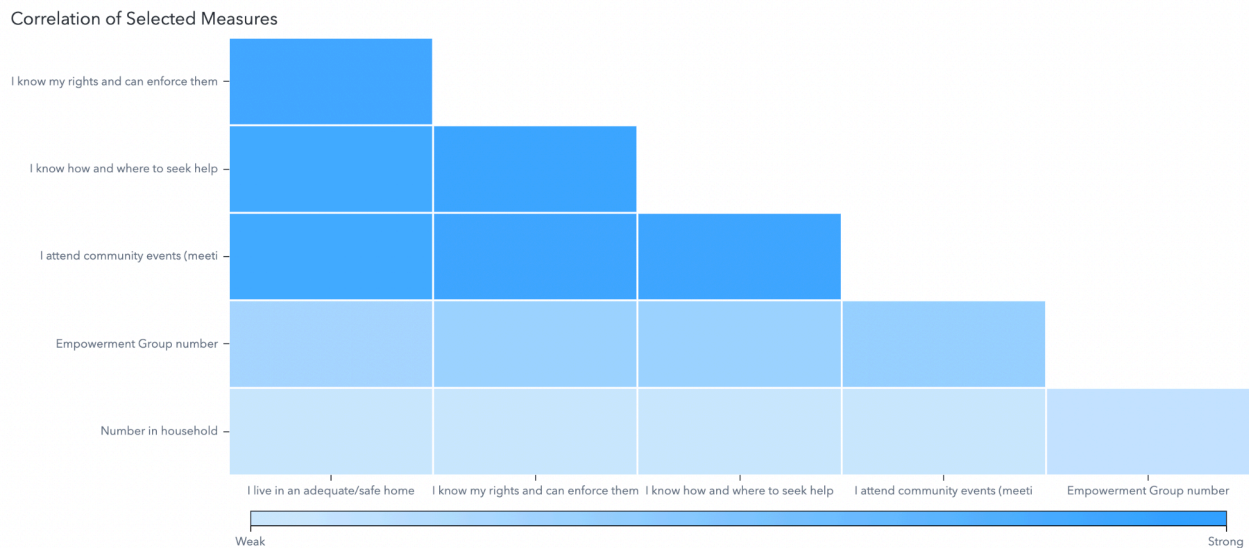


Figure 8: Correlation Matrix with constant measure ‘I live in an adequate/safe home’ vs variety of measures

The following correlation matrix takes the constant measure ‘I live in an adequate/safe home’ and compares it to the measures of community engagement, empowerment group number, individual rights and ability to seek help. The following correlation coefficients were produced:

I know my rights and can enforce them	0.8871
I know how and where to seek help	0.8826
I attend community events	0.8840
Empowerment group number	-0.2411

From the following results we are able to rule out that an individual's empowerment group number has a weak negative correlation of (-0.2411) to their living situation as opposed to the other factors. Alternatively we are able to observe that an individual knowing both their rights

and where to access help has a strong correlation as to how they feel in regards to their living situation.

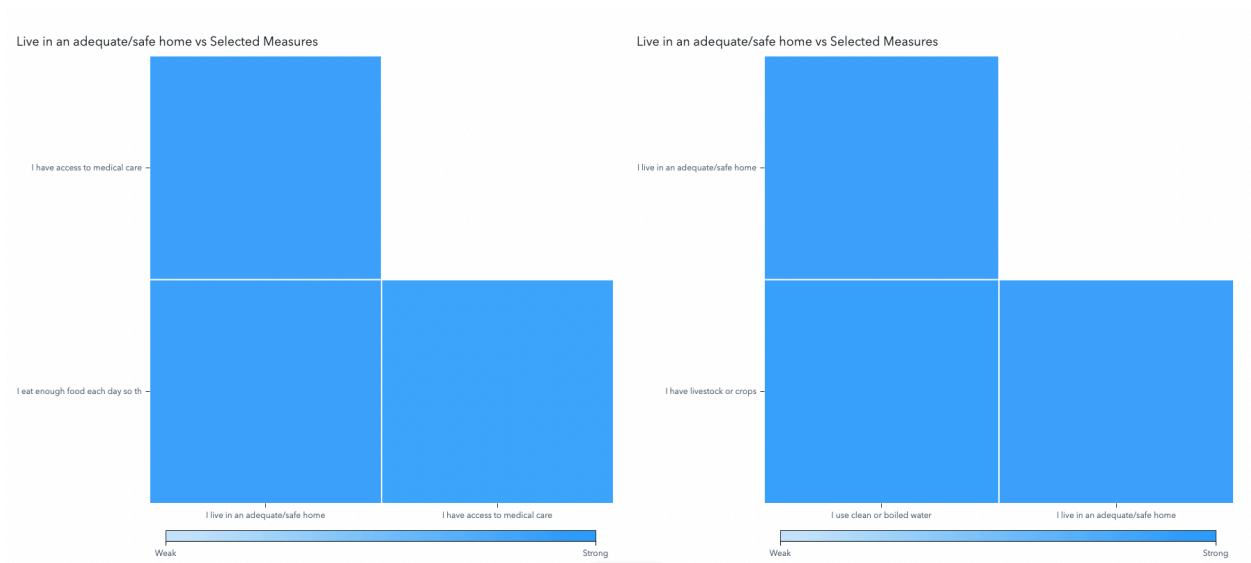


Figure 9: Correlation Matrix with constant measure ‘I live in an adequate/safe home’ vs selected measures

Figure nine takes the constant measure ‘I live in an adequate/safe home’ and compares it to multiple factors including ownership of livestock, the ability to attain and use water, access to medical care and having enough food to consume daily. These conjoined data representations were generated to establish if there was any correlation between the listed factors and an individual's safety when investigated locally to accommodation. In order for an individual to survive they must be able to sustain themselves using food and water which may possibly be sourced from their own livestock/crops and water sources. The following correlation matrix shows a strong positive correlation between the investigated variables and the constant.

I use clean or boiled water	0.8750
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I have livestock or crops	0.8761
---------------------------	--------

I have access to medical care	0.8700
I eat enough food each day	0.8899

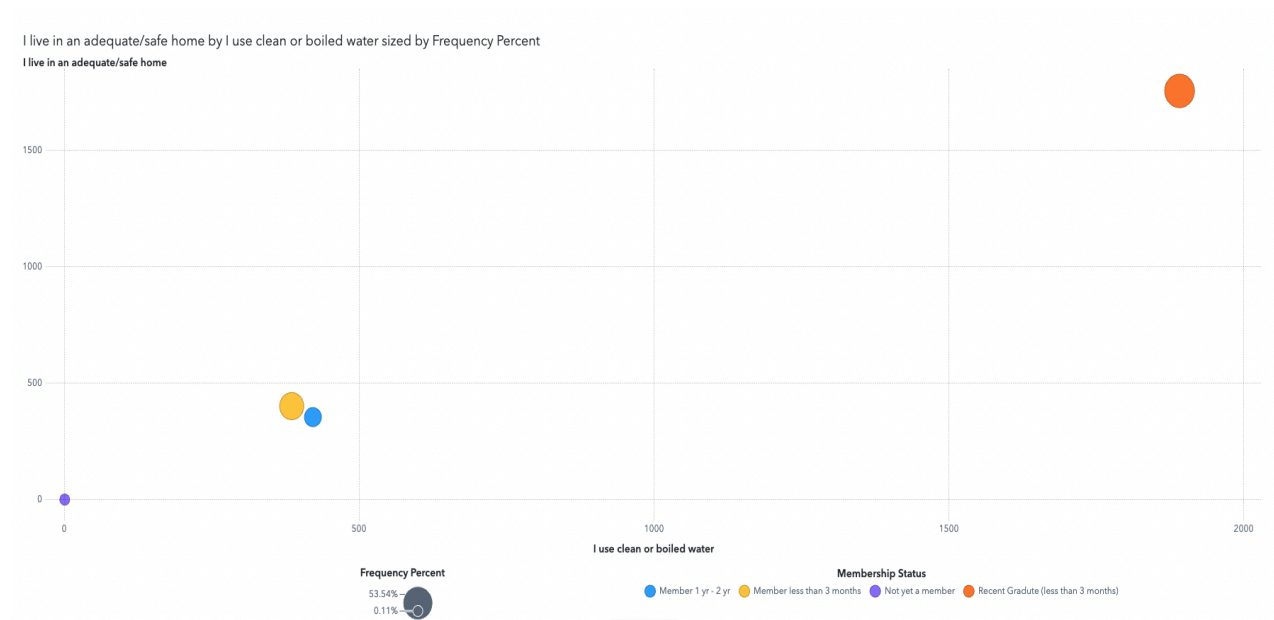


Figure 10: Bubble plot of ‘I live in an adequate/safe home’ vs Access to water

A bubble plot was utilised to visualise the relationship between the constant and the variable ‘I use clean or boiled water’ demonstrating a positive linear relationship that increases with membership status in the program. The frequency percent in the order of the bubbles is:

- Non a member - 0.11%
- N/A - 0.54%
- Member less than 3 months - 33.08%
- Member 1 yr - 2 yr - 13.02 %
- Recent graduate - 53.25%

There is a notable discrepancy between the membership status of less than three months and one to two years with a decrease of 20.06%. It is suggested that further investigation and analysis will be needed to determine cause and impact to the program and its par

Aside from this, both the described matrices' coefficients and bubble plot results demonstrate positive impacts of owning and obtaining resources and an individual's housing status. It also implies that the program has positive impacts across the lifetime of its program aiding an individual's ability to sustain and increase their SSI.

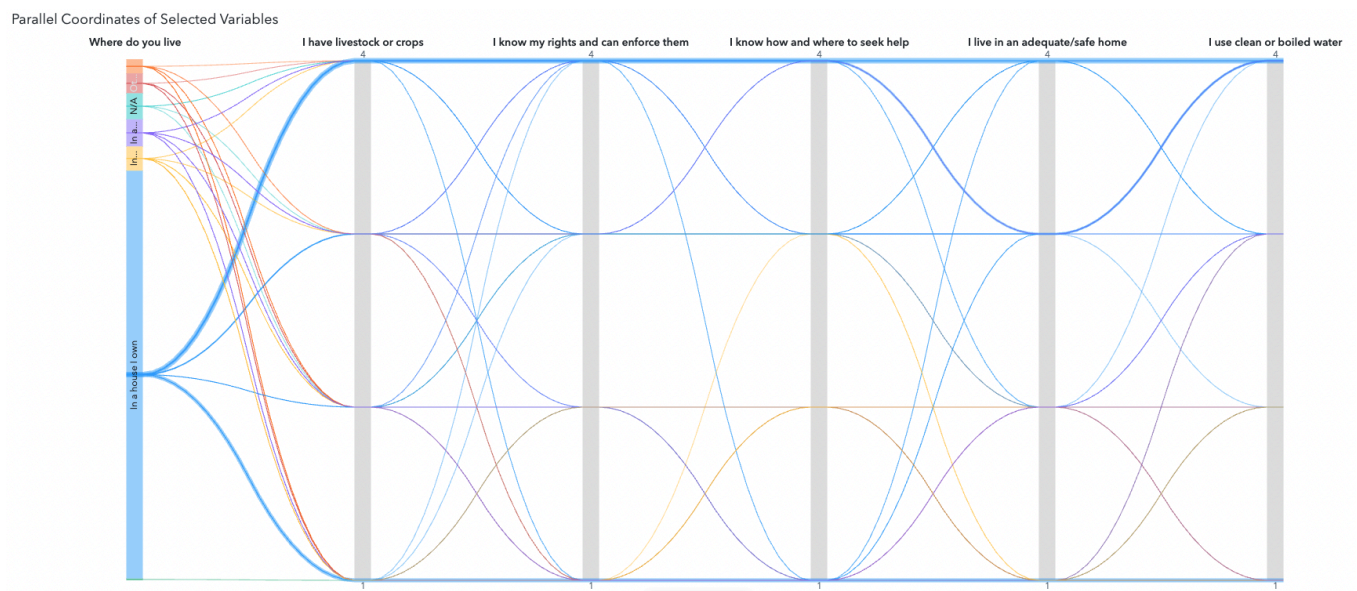


Figure 11: Parallel Coordinates of Individual's accommodation

The following Parallel Coordinates visual demonstrates findings around an individual's accommodation situation in the category 'Where do you live' and the following factors of accessibility to water, help, ownership of livestock or crops and living situation. As portrayed by the visual we are able to observe where an individual lives and where they sit with other selected variables. The colours correspond with the answer of the constant category ('Where do you live') and it is drawn across the answered correspondence with other variables, where the lines are seen to be darker this corresponds to a higher number of responses in line with those measures.

The colours and ‘Where do you live’ answers are as follows:

Blue	In a house I own
Yellow	In a house or room I rent by labouring
Purple	In a house or room I rent by paying
Mint	N/A
Red	Other
Orange	Someone is providing me a place to stay

By selecting each answer you are able to highlight the paths of participants' answers and where the strongest of answers lie on the parallel coordinates.

5.6. COMMUNITY

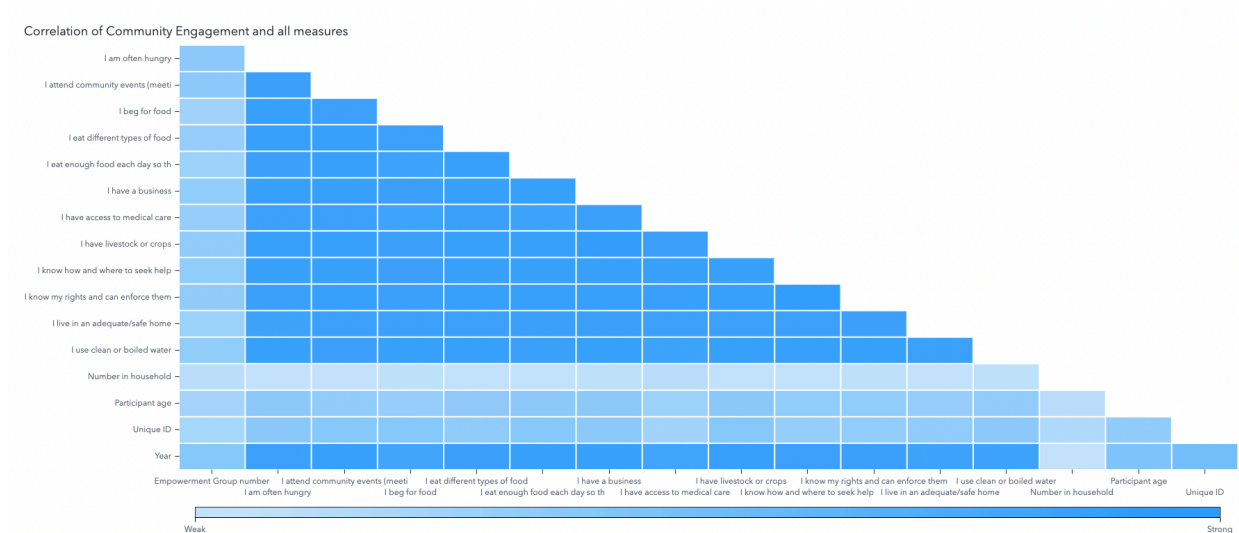


Figure 12: Correlation matrix of constant ‘Community Engagement’ vs all measures

The following correlation matrix involves all measurement type data compared to the factor ‘I attend community events’. It shows a great mix of results with the darker blues representing

strong correlation (both negative and positive) and lighter blue with weak correlations (both negative and positive). Upon further investigation on the interactive space the negative correlation data is as follows:

Year	- 0.9022
Unique ID	-0.3582
Number in household	-0.0012
I beg for food	-0.8794

In addition to this the positive correlation data is as follows:

Participant Age	0.33
I use clean or boiled water	0.8869
I live in an adequate and safe home	0.8840
I know my rights and can enforce them	0.9131
I know how and where to seek help	0.9100
I have livestock or crops	0.9075
I have access to medical care	0.8776
I have a business	0.9162
I eat enough food each day	0.8959
I eat different types of food	0.9043

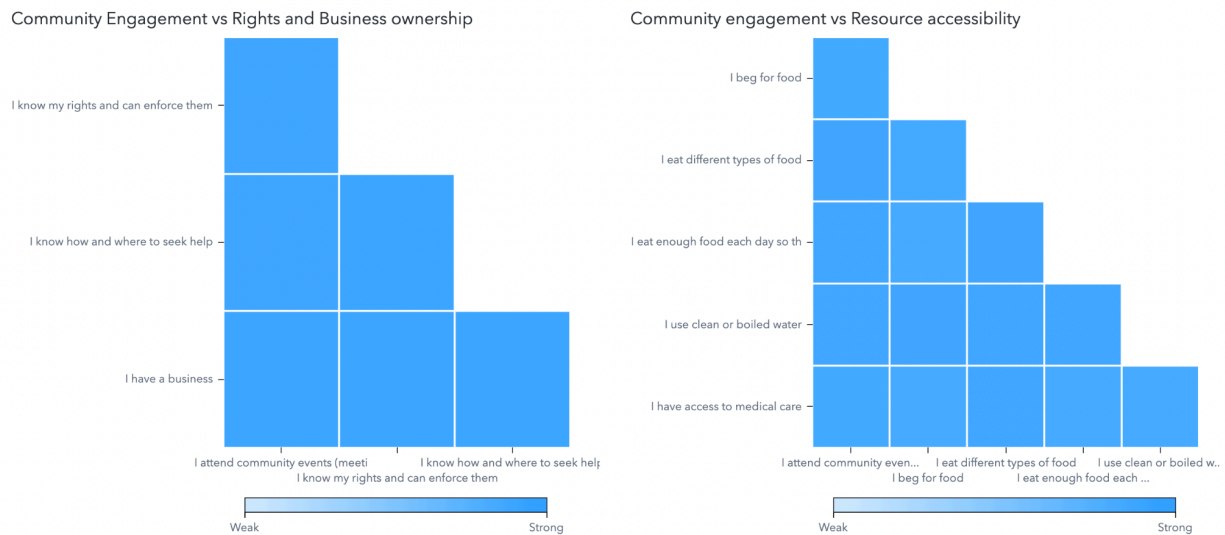
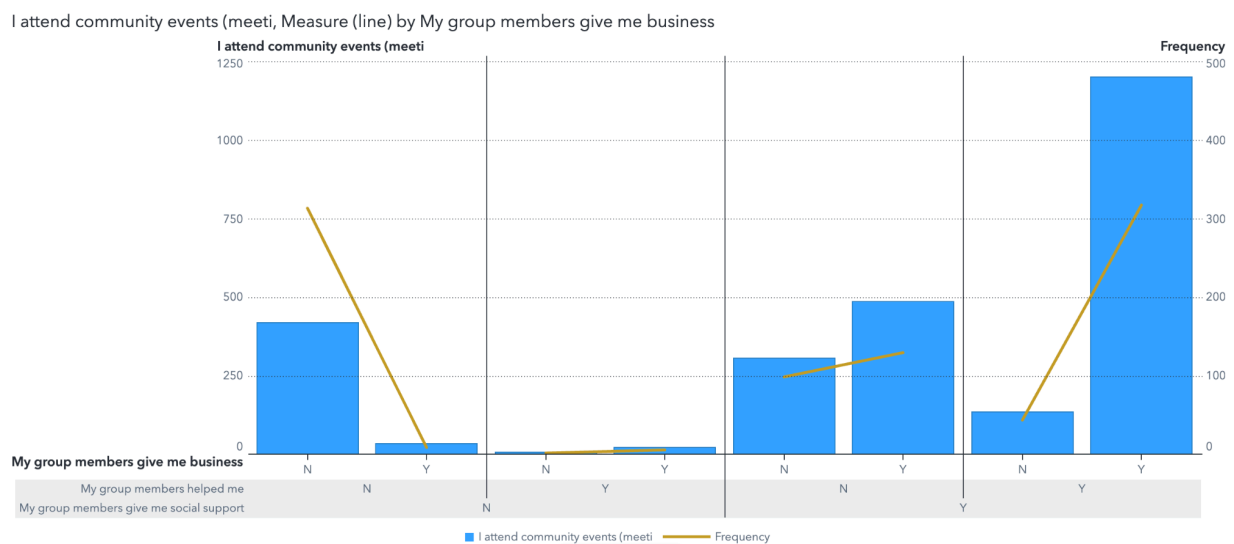


Figure 13: Correlation matrices of Community Engagement and dominant measures

When the negative data measures are removed we are able to see matrices like the above two that demonstrate positive correlation all around. Being able to break the positive factors into two groups of ‘Business ownership’ and ‘Resource accessibility’ allows readers to rationalise the importance of these measures in accordance with an individual’s SSI. Where an individual is able to generate steady income and acquire help when need be they are also able to obtain food, access to medical and food through income earnt, in essence the two groups depend on each other due to the intersectionality of positive correlations.



My group members give me business	My group members give me social support	▼ My group members helped me	I attend community events (meet
Y	Y	Y	1203
Y	Y	N	487
N	Y	Y	135
N	Y	N	308
N	N	Y	7
Y	N	Y	23
Y	N	N	34
N	N	N	419

Figure 14: Dual axis bar-line graph and table ‘Community Engagement’ and Social Support (split images)

The following dual axis bar-line graph and table conveys the patterns around community engagement events and the support an individual’s group members give them in a number of areas. Support from group members can range from giving business, social support and assistance. The graph shows what happens when members do and don’t attend community events, engage social support and when the correlation between those are members giving them business. Where participants answered yes in all three categories the frequency is observed to be much higher than where participants answer no in all three categories. The table acts as a translation to the graph demonstrating higher attendance to community events where participants answer yes to all three questions. Both visuals demonstrate the importance for participants of the program to engage in the community aspects in order to benefit both economically and socially.

5.7. CHILD RIGHTS

Child Rights, I know my rights and can enforce them by Membership Status

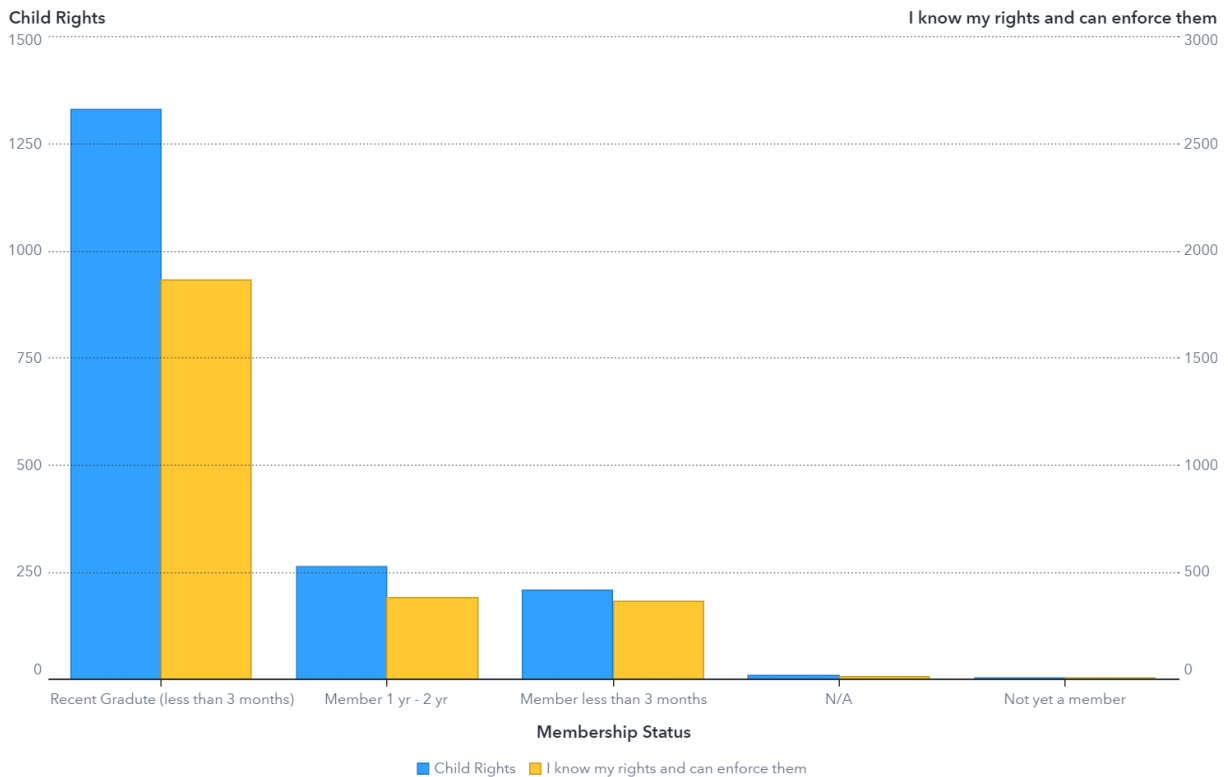


Figure 15: Dual axis bar chart of Child Rights and Membership status

The dual axis bar chart was developed to depict the connection between ‘child rights’ and ‘I know my rights and can enforce them’. The y-axis represents ‘child rights’, demonstrating an increase in an individual’s child rights with each progressive year in the Zoe Empowers program. The secondary y-axis represents ‘I know my rights and can enforce them’, also demonstrating an increase for individuals in the program with each level of membership status. It can be noted that between ‘Member less than 3 months’ and ‘Member 1 yr - 2 yr’, there is little increase. However, with the membership status ‘Recent Graduate (less than 3 months)’ of Zoe Empowers, there is a large increase for individuals that feel they know their rights and can enforce them, highlighting the program's effectiveness.

5.8. SPIRITUAL STRENGTHS

Spiritual Strength by Religion grouped by Membership Status

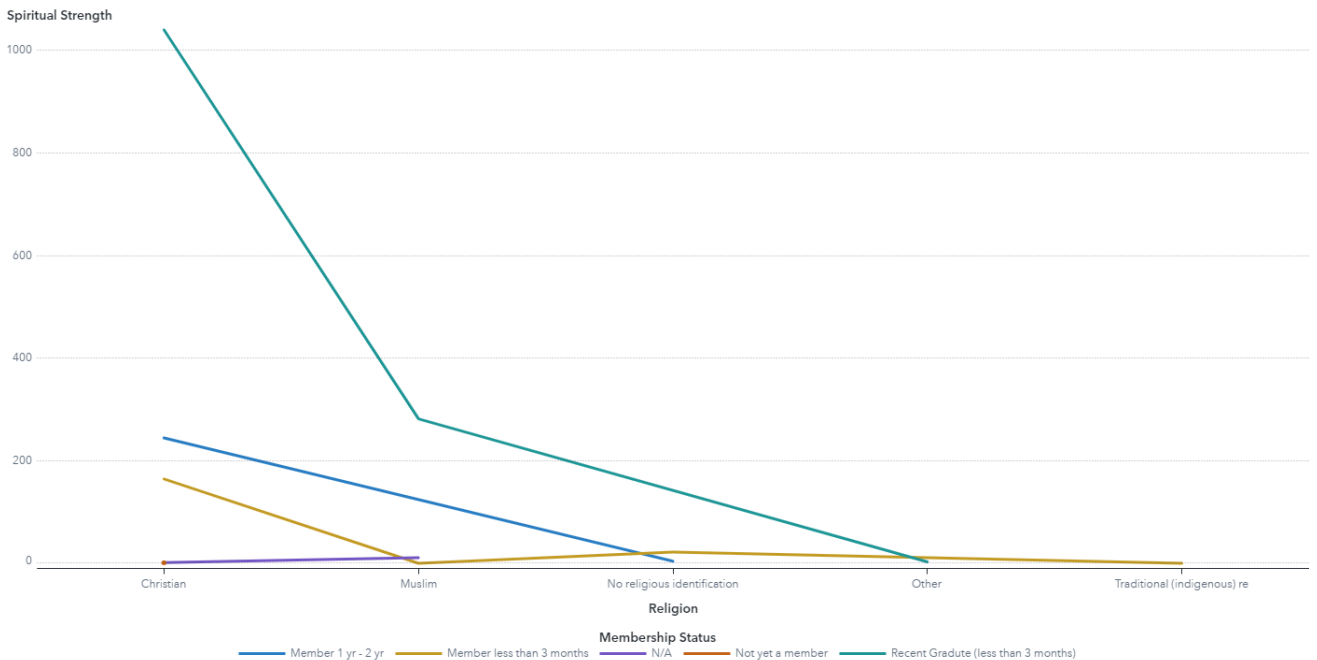


Figure 16: Line chart of Spiritual Strength and Religion

The line chart was developed to measure the level of spiritual strength for individuals across differing religions, and individuals of non-religious/other religious identification, as they progress through the Zoe Empowers program. An evident gradual increase in spiritual strength can be noted as individuals progress. There is a positive correlation between an increasing membership status and spiritual strength and can be seen as a positive output for individuals completing the program who are of Christian, Muslim, or no religious identification.

Assessment for individuals in groups of 'traditional (indigenous) re', and 'Other' have little to no increase in spiritual strength during their progression of the program. Where spiritual strength would be logically a more prevalent measure in religions, measurement for groups 'traditional (indigenous) re' and 'Other' proves accurate, but has little to no effect on proving the effectiveness of the program on spiritual strength unless of Christian, Muslim, or No religious identification. The participation in the Zoe Empowers program improves the individual's SSI.

Religion (Christian)

Membership Status	Spiritual Strength
N/A	1.5
Less than 3 months	164.3
1 yr - 2 yr	244.4
Graduate (less than 3 months)	1039.75

Religion (Muslim)

Membership Status	Spiritual Strength
N/A	11
Less than 3 months	0
1 yr - 2 yr	140 approximately
Graduate (less than 3 months)	281.5

No Religious Identification

Membership Status	Spiritual Strength
N/A	0
Less than 3 months	22.05
1 yr - 2 yr	4
Graduate (less than 3 months)	150 approximately

6. CONCLUSION

In conclusion, the data findings presented in this report offer valuable insights and contribute to the comprehensive understanding of the self-sufficiency index, its breakdown and the eight categories. Using SAS's Viya platform, Data Synergy were able to conduct a considerable examination of the three prescribed data sets including the SSI, Kenya and Rwanda. Data synergy was able to identify a number of trends across the SSI and its 8 categories. From the findings observed the team was able to build a strong foundation and understanding of the data to assist in the development of the analysis and recommendations to follow. These findings provided meaningful insights to the team and will be used in the respective analysis and recommendations reports to provide further examination into specific and meaningful data insights that SAS would benefit from and further recommend appropriate solutions to the programs future intakes.

7. RESOURCES

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