Draft Report

The State of Ghanaian Resilience II

Measuring the Dimensions of Vulnerability and Adaptation In Three Districts in Ghana

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Prepared by The West Africa Resilience Innovation Lab (WA RILab)

in collaboration with the

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EXECUTIVE SUMMARY

The West Africa sub-region is currently challenged by rapid urbanization, climate change and food insecurity which have negatively affected the resilience of cities, towns and communities. The West Africa Resilience Innovation lab (WA RILab), consistent with the ResilientAfrica Network (RAN) theory of change, set out to strengthen the resilience of communities by adopting a data driven approach to identifying resilience dimensions and priorities in selected communities so as to design resilience-strengthening innovative solutions. As a follow up to a qualitative study conducted in 2014. in three geographically distinct communities (Ashaiman Municipal, Greater Accra region; Tamale Metropolitan, Northern region; and Kassena-Nankana Municipal (Navrongo), Upper East region) to understand the distribution of challenges people face and, based on the evidence, set indicators for measuring change over the life of the project.

Data collection and tools

The Navrongo Health Research Centre approved the quantitative study protocol and the data collection tools prior to the conduct of the study. The sample of 1,200 (400 per study site) was scientifically determined based on enumeration area maps obtained from the Ghana Statistical Service. Strict community entry and engagement from the period of the qualitative study, was observed which facilitated data collection. At the end of data collection, 1,198 individuals representing over 99 percent of the targeted sample. The questionnaires were processed using Epi-Data software. To ensure data quality, four (4) data entry clerks were paired, each pair initially entering approximately 300 questionnaires and then swapping with their paired counterpart for double entry, thereby making each to enter 600 questionnaires. The step-wise analysis guide provided by RANSec was used in the analysis. Basic tabulations were conducted to estimate frequencies and undertake regression modelling to tease out relationships.

RESULTS

Socio-demographics

The results show that 564 (47%) of respondents were female and 634 (53%) male. Most respondents were married with the percentage married, ranging from over half (52.75%) in Ashaiman to nearly four-fifths (78.43%) in Tamale. This hardly surprising since Tamale is predominantly a Muslim community while Navrongo is predominantly rural, both attributes known to be associated with high levels of marriage. The age distribution of respondents across the different locations is skewed towards the youth and younger adults between 18-60 years. Religiosity is high and diverse. Nearly one out of ten (87.25%) are Christian in Ashaiman; almost all (94.7%) in Tamale are Muslim whereas half are Christians in Navrongo with early the other half (45.96%) practice traditional religion. Less than 3% across all sites said they had no religious affiliation. An overwhelming number of respondents (87.75%) in Navrongo is into farming whilst respondents in Ashaiman (43.5 %) and Tamale 32.2% are engaged in 'buying and selling'. Consistent with expectation, Navrongo has the largest percentage of the poorest respondents (54.12%) as compared to Tamale (47.10%) and Ashaiman 39.47%. Two-thirds (66%) of the respondents from Navrongo and 57% from Tamale have never been to school as compared to 7.25% from Ashaiman. The low levels of educational attainment could largely attributed to poverty levels of the two locations. People from typically migrant communities like Ashaiman tend to have some basic level of education which is what partially motivates them to migrate. In terms of occupation, respondents in Navrongo were predominantly farmers while those from Ashaiman and Tamale are mainly traders.

Resilience dimensions

A principal component analysis was conducted using a series of related variables captured under the different dimensions in the framework developed in the qualitative study. These were, Wealth, Security/Protection, Natural Resources/Environment, Human Capital, Social Capital, Psychosocial Health, Infrastructure, Health/Health Services, Governance, and Spirituality (RAN/WARILab, 2014). The principal component analysis was used to generate composite

scores for the various dimensions. Thereafter these were used to generate coefficients and then Spider graphs which provided the opportunity to identify prominent resilience dimensions by study location. In Navrongo the most prominent dimensions are spirituality and food insecurity. In the case of Ashaiman, the key dimensions of resilience are wealth and community networks, whereas for Tamale, the key ones are wealth, community networks, natural resources or environment, and social capital. Significantly, these findings are consistent with the results of the qualitative study that formed the basis for the quantitative study.

Wealth

The wealth score on an ordered logit model was estimated because the response variable is categorized into quintiles that are ordinal in nature. The differences with respect to wealth or SES by location of residence were statistically significant. As expected, residents of Ashaiman have a better SES compared to Navrongo (odds ratio of 1.235). Whereas no statistically significant differences were found between residents of Navrongo and Tamale, surprisingly, the odds of being in a better SES scale were lower in Tamale than in Navrongo.

Food security

In terms of food security, a quarter of the households in Navrongo are the most food insecure whereas Ashaiman and Tamale are close to being food secure. Four out of five (79.15%) respondents in Navrongo said they did not have adequate food within the last one month prior to the survey (food insecure) whereas 25.71% and 37.25% respectively reported for Tamale and Ashaiman. Significantly, the quantitative survey results are consistent with the qualitative data with respect to the dimensions of resilience (RAN/WARILab, 2014). In Navrongo the main dimensions of vulnerability are related to spirituality and food insecurity. In Tamale, the main dimensions of vulnerability are related to wealth, natural resources and the environment, while in the case of Ashaiman, wealth is the key dimension of vulnerability. Generally, the main dimensions of vulnerability among migrants has to do with wealth and natural resources and environment, while that of natives relates to food security, spirituality, and social capital.

Spirituality

With respect to the Spirituality score, a linear regression model was estimated to determine the predictors of spirituality. We first estimated a basic model (model I) where we included only the location variable. The objective was to determine if spirituality is more associated with a specific location, as shown by the qualitative analysis (RAN/WARILab, 2014). The results showed a positive association but that spirituality is predominant and increasing in Navrongo than in Tamale or Ashaiman and this does not change when controlled for the effects of confounders. Thus the overriding conclusion to draw from the quantitative resilience study, which complements the qualitative study, is that, there is a strong correlation between spirituality and resilience. However, whereas spirituality is an underlying driver of vulnerability to some, it strengthens the adaptive capacity of others.

INTRODUCTION

The West Africa region is currently challenged by rapid urbanization, climate change and food insecurity which have negatively affected the resilience of cities, towns and communities. Whereas development and humanitarian assistance over the past decades has responded to immediate need to save lives and meet immediate program objectives during shocks and stresses, they have not paid much attention to increase the capacity of affected populations to withstand future shocks and stresses (i.e. building resilience). This explains why the same shocks and stresses often result in the same consequences on affected communities when they recur.

The West Africa Resilience Innovation lab (WARILab), consistent with the ResilientAfrica Network (RAN) theory of change, set out to strengthen the resilience of communities by adopting a data driven approach to identifying resilience dimensions and priorities in selected communities in the sub-region. On the back of concrete resilience evidence, the WARILab will adopt a design thinking approach to design innovative solutions that will respond to and strengthen the resilience of the selected communities to priority shocks and stresses.

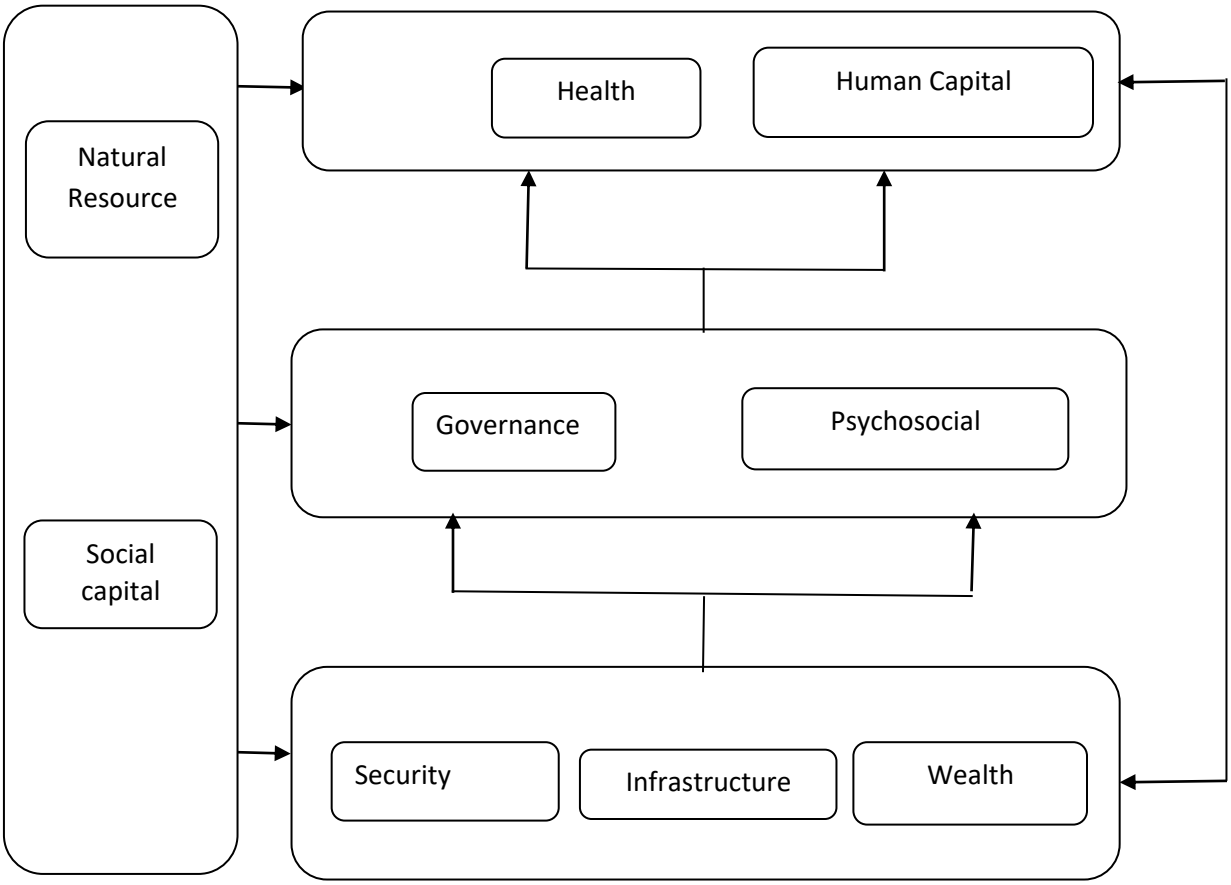
In 2014 the WARILab conducted a rapid qualitative assessment of resilience factors in selected communities in three administrative regions in Ghana, namely Ashaiman municipality in the Greater Accra region, Tamale metropolis in the Northern region and Kassena-Nankana municipality in the Upper East region. The three study localities represent three different geographical areas of Ghana and reflect different but interrelated sub themes of the Lab (Rapid urbanisation, food insecurity and climate change). This qualitative study provided some insights into the range of resilience factors, the underlying drivers of vulnerability and adaptive capacities of the target communities. The three study localities are Ashaiman in the Greater Accra region, Tamale Metropolitan area in Northern region and Kassena-Nankana municipal in the Upper East region.

Context Specific Resilience Framework

The underlying theoretical underpinnings guiding the framing of the resilience work in the three locations in Ghana are anchored on four broad areas: the underlying causes (drivers) of vulnerability, their immediate causes and impacts, their outcomes and finally, the enabling factors that provide the supporting mechanisms to communities for adapting to or coping with the shocks and stressors that result thereof. The qualitative studies conducted in the three sites, the results from which are summarized under the qualitative systems appraisal section, led to the development of area-specific frameworks summarized in the diagrams below (Figures 1, 2 and 3).

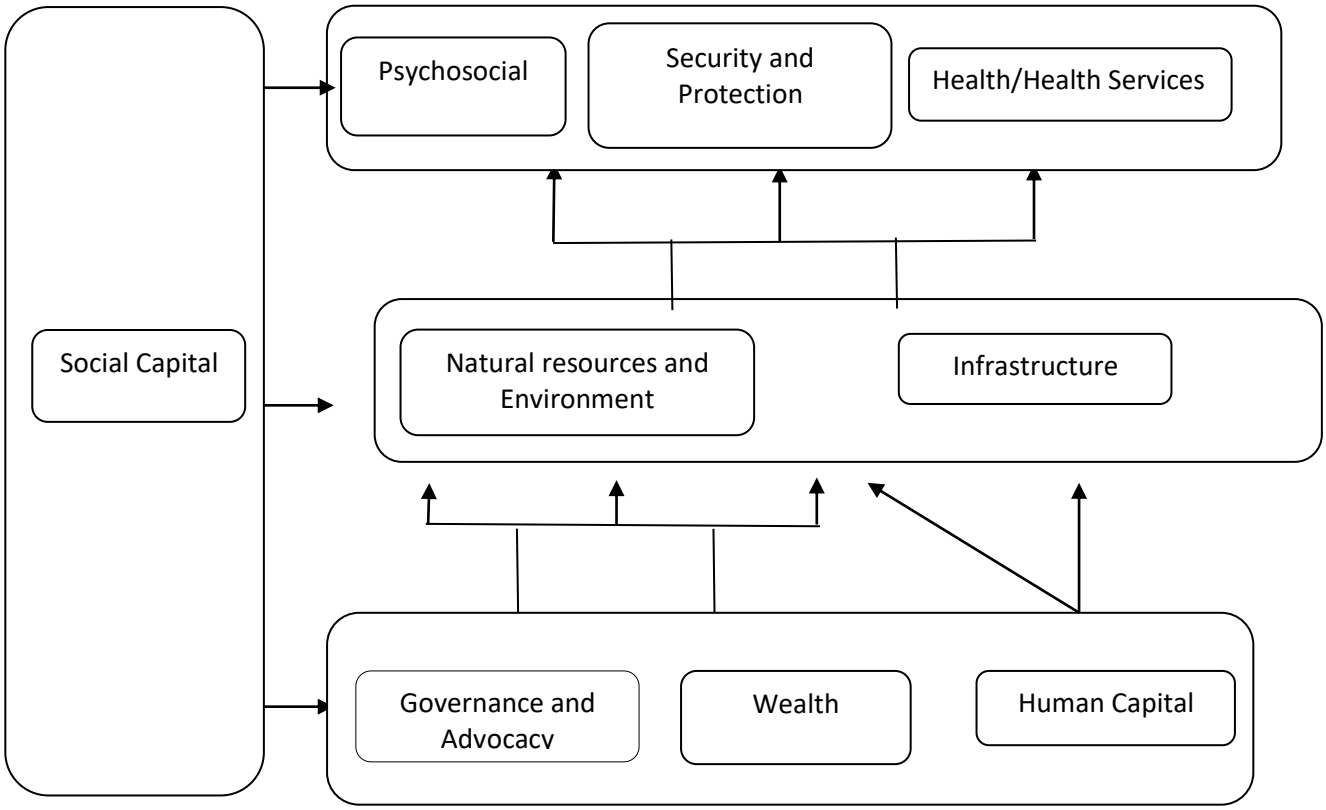
In Ashaiman the drivers of vulnerability revolve around security concerns, lack of infrastructure and problems of poverty. Governance and psychosocial problems were identified as the immediate causes, and the resultant consequences were poor health and human capital inadequacy. However, natural resources in particular using waste-to-energy and social capital were identified as enabling factors and supportive mechanisms.

Figure 1: Resilience Framework for Rapid Urbanization in Ashaiman Municipality



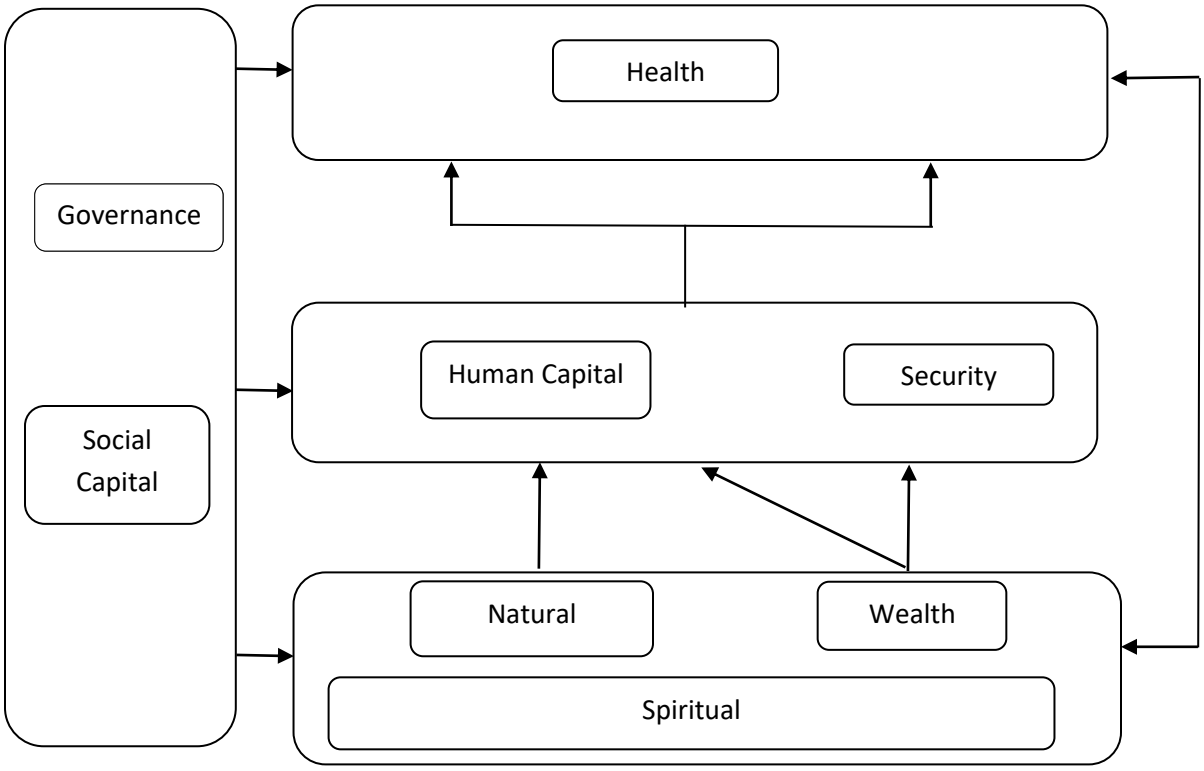
On the other hand, the drivers of vulnerability in Tamale are mainly issues of poor governance institutions, poverty and human capital inadequacy. The immediate causes were lack of natural resources and infrastructure. These result in issues of poor health, insecurity and psychosocial problems. Residents of Tamale think the main mechanism for enabling and supporting them overcome these problems is the development of the human capital of the people.

Figure 2: Resilience Framework for Rapid Urbanization in the Tamale Metropolis



In Navrongo, the underlying causes of vulnerability are lack of natural resources and poverty. Significantly, spirituality - including disrespect for traditional authority and spiritual values - emerged as a major driver of vulnerability because it is directly linked to how natural resources are harnessed to expand livelihood options. However, the immediate causes are lack of human capital and security (theft of livestock). Health was identified as a key outcome whereas social capital and governance and advocacy were seen as the main supporting and enabling factors. The key issues in the three different study locations, as summarized in the framework below (Figure 1), tends to indicate that in Ghana, poverty, human capital and human security are drivers of vulnerability whereas social capital is a supporting factor and health is a desired outcome indicator.

Figure 3: Resilience Framework for Food Insecurity and Climatic Variability in Navrongo Municipality



THE QUANTITATIVE STUDY

The quantitative study was conducted in the three WARILab designated communities where the qualitative study was earlier conducted. These communities are located in the Ashaiman (Greater Accra region), Tamale (Northern region) and Navrongo (Upper East region).

Research Objective

The main objective of the Quantitative Study is to understand the extent to which households and systems are affected by shocks and stressors related to rapid urbanization, climate change and food insecurity identified in three qualitative study locations in Ghana

Specific objectives

The quantitative study is designed to address the following specific objectives;

1. To measure the extent to which households and systems are affected by shocks and stresses identified in the three study sites
2. To measure the extent to which household and systems are capable of enduring or adapting to the identified shocks and stresses
3. To determine the interrelationships between resilience dimension across study sites
4. To identify pathways/entry points for introducing priority interventions to strengthen capacities and minimize vulnerability

Sample Size

The sample sizes for the three locations were determined independently since they are deemed to be independent. In determining the sample size three factors were taken into consideration -- desired level of precision, confidence level and the degree of variability in the population (Kish 1965; Israel 2013). Since the each of the tree locations have large population size (more than 100,000 residents in each case) we decided to use Cochrane's sample size estimation formula (Cochrane 1963), as specified below:

$$n = \frac{Z^2 pq}{e^2}$$

Where*n* is the desired sample size, Z^2 is equivalent to 1.96 assuming a normal distribution, with a confidence level of 95% and a desired level of precision, $e=\pm 5\%$, we can estimate the desired sample size. Now, given that the population size in the three different locations is large (Over 100,000 in each case) and we not know the degree of variability in the population, we assume $p=0.5$, suggesting a maximum variability, we estimated the desired sample size as:

$$n = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2} = 384$$

Given that each of the locations is independent, and again, that they each have a large population size (size of populations described under *Study sites*), we decided to interview 384 people at each location. However, to take care of non-response, this was rounded up to 400 respondents in each location (about 5% of estimated sample size).

Sample selection

Given our estimated sample size, we worked closely with Ghana Statistical Services to draw the sample. For purposes of conducting national censuses and other nationally representative surveys, the Ghana Statistical Service (GSS) has demarcated the entire country into *Enumeration Areas* (EAs). An enumeration area is usually made of populations within geographically defined areas ranging from350 to 700 individuals. These EAs are represented by maps called enumeration area maps (EA Maps), with their associated boundary descriptions. The sampling will be a two-stage process in each location.

Since WARILab has designated communities in the three locations where we are working in, selection of the EAs and households where respondents will be drawn from will be restricted to those communities. Therefore, although the selection of EAs will be done proportional to size, at the first stage we stratified by those geographic areas, as designated by the project. However, within each of those communities the EAs were selected proportional to the size of the population. Similarly, the number of people interviewed within EAs is proportional to the size of the EA.

It is important to note that within the EAs respondents are selected within households. However, since we do not have an updated list of households within EAs we initially sampled residential units within the EAs and within those residential units sample households. This is done using systematic sampling with a random start. All residential units are serially numbered so it is easy to do the systematic sampling. Eligible respondents are adult persons living in the study communities and within the sampled households. Therefore, although individuals were interviewed, we collected information on household attributes and other social and community level characteristics and attributes.

Figure 4: Map of Ghana showing Administrative regions - Navrongo is in Upper East, Tamale in Northern & Ashaiman in Greater Accra

Data collection procedures and tools

Data collection took several stages. First, once we have determined the sample size and determined the enumeration areas where respondents will be drawn and the number of respondents interviewed in an EA, an advance team of enumerators first did a reconnaissance survey by physically going to the field to identify and determine the physical boundary location

of each EA. Prior to the reconnaissance survey, a team of senior officials from the project went to each locality to do the necessary protocols with respect to community entry to ensure cooperation of the community leaders and their people. After identifying the location of the EAs the data collectors are trained on the data collection instrument and to carefully administer questionnaire, fieldwork procedures, including community entry processes and how to conduct themselves appropriately to ensure cooperation and compliance.

A total 1200 completed questionnaires were submitted for data processing and management. Using Epi-Data software, four (4) data entry clerks paired, with each initially entering 300. Upon completion of the initial 300 each of them swap questionnaires with their paired counterpart for double entry, thereby making each to enter 600 questionnaires. Epi-Data has a facility for verification and the possibility of capturing up to 999 fields. Epi-Data also has the ability to transport data into several software packages including STATA, SQL and other database languages. STATA version 13 software is used in the data analysis.

The step-wise analysis guide provided by RANSec was used in the analysis. Also, the specific questions and issues explored in the analysis are location specific. But, in general the analysis seek to determine what make populations vulnerable, what the interrelations are between dimensions within and across the different locations, the effects of shocks on health and well-being of the people, what the coping mechanisms are, etc. We conducted some basic tabulation to estimate frequencies and undertake regression modelling to tease out relationships.

PRESENTATION OF RESULTS

This section presents results from the Ghana study with specific focus on the areas specified in the step-wise data analysis guide provided by RANSec/Tulane. The discussion makes references to results of the qualitative study conducted earlier in 2014.

Socio-Demographic Characteristics

In this section, we present basic descriptive findings of the social and demographic features of the survey respondents. Key indicators of interest include sex, age structure, marital status, level of education, religious affiliation and occupational status of the respondents. These variables are

critical in understanding and interpreting the core demographic and the various outcome measures of interest in this study. As much as possible we tried to present the results by study site, highlighting the key differences and similarities, is possible. The study locations are Ashaiman located along the coastal area of Ghana in the Greater Accra, Navrongo to the extreme north of Ghana in the Upper East region and Tamale in the northern region, also in northern Ghana but a bit closer to the middle belt of the country. Both Ashaiman and Tamale are urban settings while Navrongo is predominantly rural in character, except for Navrongo town.

Sex

Apart from the biological differences between males and females, there a major differences in terms of specific outcomes social and health scientists are often interested in studying. Of the total respondents of 1198 persons interviewed in the three location, 47 percent were females while 53 percent were males. In terms of gender distribution by study location, 41.2 percent of the respondents in Ashaiman were females, 63.9 percent Tamale and 55.5 percent females in Navrongo. The higher number of females respondents in Ashaiman compared to both Navrongo and Tamale could be due to the fact that majority of the people there are mostly migrant traders who are mostly female.

Age Distribution

The age distribution of respondents is skewed towards the youth and younger adults between the ages of 18-60. Beyond age 60 the number of respondents declined monotonically to the point where only 1 person between the ages of 81-95 was interviewed in Ashaiman. In terms of distribution across the three study locations the distribution by age is fairly similar across the different locations.

Level of Education

Formal education has profound implications on individual growth, decision-making choices, empowerment and national development. Education equips the individual with the necessary knowledge and skills that enable him/her take critical decisions and actions to improve one's livelihood. Based on this premise, the respondents were asked to indicate their highest level of education they have attained. As high as 66% of the respondents from Navrongo study site

indicated that they have never been to school and 57% from Tamale. The low levels of educational attainment could largely attributed to poverty levels of the two locations. On the other hand, Ashaiman recorded the lowest percentage of respondents with any formal education of 7.25%. Ashaiman, as noted earlier, is a migrant location and many of the migrants would have had some basic level of education, as reflected in the number of people who completed JHS/Middle 195 (48.75%). For all three study sites the proportion of respondents with progressively higher levels of education dropped drastically.

Table 1: Background characteristics of respondents

Variable	Ashaiman Number (%)	Tamale Number (%)	Navrongo Number (%)
Sex of respondents			
Male	164 (41.21)	253 (63.89)	211 (53.55)
Female	234 (58.79)	143 (36.11)	183 (46.45)
Age of respondent			
18-30	145 (36.25)	78 (20.86)	60 (15.27)
31-40	103 (25.75)	120 (32.09)	79 (20.10)
41-50	70 (17.50)	80 (21.39)	98 (24.94)
51-60	31 (7.75)	55 (14.71)	70 (17.81)
61-70	30 (7.50)	27 (7.22)	48 (12.21)
71-80	20 (5.00)	11 (2.94)	30 (7.63)
81-95	1 (0.25)	3 (0.80)	8 (2.04)
Level of Education			
No Education	29 (7.25)	228 (57.00)	264 (66.00)
Primary	60 (15.00)	25 (6.25)	41 (10.25)
JHS/Middle	195 (48.75)	43 (10.75)	38 (9.50)
Secondary	61 (15.25)	45 (11.25)	24 (6.00)
Tertiary	38 (9.50)	46 (11.50)	24 (6.00)
Other	17 (4.25)	13 (3.35)	9 (2.25)
Marital status			
Single	133 (33.25)	42 (10.66)	31 (7.77)
Married	211 (52.75)	309 (78.43)	291 (72.93)
Widowed	22 (5.50)	42 (10.66)	63 (15.79)
Divorced	17 (4.25)	1 (0.25)	11 (2.76)
Separated	13 (3.25)	0 (0.00)	3 (0.75)
Cohabitation	4 (1.00)	0 (0.00)	0 (0.00)
Religious affiliation			
No religious affiliation	1 (0.25)	(0.00)	9 (2.27)
Christianity	349 (87.25)	15 (3.79)	198 (50.00)
Traditional	3 (0.75)	6 (1.52)	182 (45.96)
Islam	44 (11.00)	375 (94.70)	5 (1.25)
Other	3 (0.75)	0 (0.00)	2 (0.51)
Occupation			
Farming/Livestock rearing	1(0.25)	111(27.89)	351(87.75)
Trading/Selling	174(43.50)	128(32.16)	14(3.50)
Hairdressing	13(3.25)	3(0.75)	1(0.25)
Dressmaking	21(5.25)	13(3.27)	4(1.00)
Housewife	3(0.75)	2(0.50)	0(0.00)
Craftsmanship	20(5.00)	12(3.02)	1(0.25) |
Construction work	17(4.25)	11(2.76)	1(0.25)
Civil/Public Servant	11(2.75)	32(8.04)	6(1.50)
Student	12(3.00)	18(4.52)	12(3.00)
Wage labour	22(5.50)	4(1.01)	8(2.00)
Unemployed	37(9.25)	29(7.29)	1(0.25)
Other	69(17.25)	35(8.79)	1(0.25)

Marital Status

Society is built on families and the desire for everyone to have a family is so high among the respondents interviewed. The survey results indicate that most respondents of the three study sites were married with the percentage married ranging from 52.75 percent in Ashaiman to 78.43% in Tamale. It is not surprising that the proportion married in Tamale and Navrongo are high; Tamale is predominantly a Muslim community while Navrongo is predominantly rural, both attributes known to be associated with high levels of marriage. On the other hand 33.25 percent of the respondents in Ashaiman reported that they have never married, 10.66 percent in Tamale and 7.77 percent in Navrongo. Divorce and separation levels are very low in both Navrongo and Ashaiman and no reported divorce in Tamale. It is important to note that as high as 15.79% of the respondents interviewed were widows /widowers, with Navrongo having the highest of 63. In fact, the 2008 Ghana Demographic and Health Survey, shows that more women than men are generally likely to be widowed, divorced or separated (GSS, GHS & ICF Macro 2009).

Religious Affiliation

Religion is an important aspect of human life because it tends to prescribe codes of conduct which affects the way humans behave and live their lives. Religious believes can lead to preservation of certain species of the environment. Certain religious believes also affect social behaviour such as health seeking behaviour. It within this context that respondents were asked to indicate their religious affiliation. The results show that religiosity is quite high in the studies sites, although they are diverse in terms of denomination. For instance, Christianity is reported to be the dominant religious denomination in Ashaiman (87.25%) while the Muslim region is the dominant religion in Tamale representing 94.7%). On the other hand, 50 percent of the respondent indicated that Christianity is their main religion. It is interesting to note that it is only in Navrongo that a high number of the respondents indicated that they practice traditional religion (45.96%). Less than 3% is recorded for "No Religious Affiliation" and "Others" across all the sites.

Occupation

The occupational status of individuals is an important proxy for determining their socio-economic status. Generally, individuals that are in white colour occupations are often considered to have better socioeconomic status, either in terms of educational attainment or wealth. It also tends to confer better health outcomes owing partly to access to better healthcare or resources. Thus, in the survey, respondents were asked to state the kind of work they mainly do. The main occupation of respondents from the two urban locations are mainly engaged in trading i.e. buying and selling while the main occupation of those in Navrongo is mainly farming (87. 75). In Ashaiman 43.5 % of the respondents reported that they are engaged in trading (Buying & Selling) while 32.2% of respondents in Tamale are engaged in trading. There is a large percentage of public/civil servants in Tamale relative to Navrongo and Ashaiman.

Relative distribution of different dimension by location

In the table below we describe the relative distribution of the various dimensions of resilience indicator scales that we generated using principal component analysis (PCA).

Table 2: Composite Scores for various Scales by location

Variable	Ashaiman Number (%)	Tamale Number (%)	Navrongo Number (%)
Socioeconomic status			
Poorest	1(0.25)	14(4.15)	210(54.12)
Poorer	1(0.25)	105(31.16)	118(30.41)
Poor	45(11.34)	133(39.47)	47(12.11)
Less Poor	163(41.06)	51(15.13)	10(2.58)
Least Poor	187(47.10)	34(10.09)	3(0.77)
Spirituality			
Least Spiritual	397(99.50)	302(84.83)	205(59.08)
Most Spiritual	2(0.05)	54(15.17)	142(40.92)
Health			
Poorest	83(20.91)	180(54.05)	171(44.19)
Poorer	16(4.03)	15(4.50)	32(8.27)
Poor	298(75.06)	132(39.64)	183(47.29)
Least Poor	0(0.00)	6(1.80)	1(0.26)
Social Capital			
Least Social Capital	211(52.75)	37(10.11)	170(43.81)
Less Social Capital	85(21.25)	123(33.61)	66(17.01)
Moderate Social Capital	7(1.75)	36(9.84)	63(16.24)
More Social Capital	59(14.75)	55(15.03)	25(6.44)
Most Social Capital	38(9.50)	115(31.42)	64(16.49)
Community Networks			
Lowest Community Network	338(87.11)	102(69.86)	311(95.40)
Most Community Networks	50(12.89)	44(30.14)	15(4.60)
Food Insecurity			
Lowest Food Insecurity	257(64.25)	242(60.50)	117(29.25)
Moderate Food Insecurity	70(17.50)	133(33.25)	179(44.75)
Most Food Insecurity	73(18.25)	25(6.25)	104(26.00)

Wealth index

The Assets possessions of individuals (Households) is an important proxy for determining their socio-economic status. Respondents in all households were asked if they possessed certain household items (e.g. refrigerators, sound systems, television, radio etc). We used these items to generate a composite index of household socioeconomic status (SES) using Principal Component Analysis. Consistent with expectation, Navrongo has the largest of percentage of respondents in the poorest quintile (54.12%), while Ashaiman has the largest percentage of respondents within the least poor category (47.10%), with Tamale having 39.47% also representing the least poor. Thus, in terms of wealth status, residents of Ashaiman and Tamale are relatively of higher socioeconomic status compared to Navrongo. This is not surprising because both Ashaiman and Tamale are Cosmopolitan populations while Navrongo is predominantly a rural population. As can be seen from Table 2, the proportion of respondents progressively increases from poorest to least poor with less than 1% of respondents in the poorest quintile and 47.10% in the least poor quintile. The picture is directly in contrast with the situation in Navrongo which has the 54.12% of respondents concentrated in the poorest quintile and the proportion of those better off progression decreases with just a mere 0.77% in the least poor quintile. Tamale showed a fairly uniform distribution of respondents in each quintile with majority of respondents being in the poor quintile (39.47) and only 4.15% in the poorest quintile. This could be attributed to the fact that some of the study communities in Tamale were Peri-Urban while most were urban.

Spirituality

Spirituality which is an underlying cause of the effect of wealth and natural resource in the framework of the study is seen to be low in both Ashaiman and Tamale, except in Navrongo where a where as high as 40.92% of respondents are observed to be spiritual. This is consistent with the results of the quality research that we earlier conducted in same locations. It is important to point out there is very little variation in the population in terms of the spirituality scale as the composite scale that we generated could only identify two groups. This will have implications for how we conduct further analysis of the data. The Spider graph which shows the dimensions of resilience by study location also clearly shows that spirituality is much more prominent in Navrongo than the other two locations.

Health

Health outcomes continue to be of prominent importance in developing countries where development is still poor. The extent to which a population is able to cope with other challenges of life depends to a very large extent their health. As a dimension of resilience health feature prominently in the qualitative work that was done and to further explore this theme in we included some questions on health infrastructure and access in the quantitative survey. In conducting the PCA analysis the health score did not work well because the questions that captured health indices were very few. As result, composite index did not capture much variation in on this score. The composite index that we generated had four categories namely Poorest, Poorer, Poor and Least Poor. Tamale scored the poorest on the health scale, followed by Navrongo with Ashaiman showing better on the health scale. As we conduct further analysis of the data, we will do further refinements of some of the analyses.

Social Capital

Social capital is an important concept in social organization and action. Simply put, social capital is anything that facilitates individual or collective action and this is often based on social or community networks. Thus, social capital brings benefits that is based on trust, reciprocity, information and cooperation which is often associated with networks. Participating or belonging to certain social networks such as friends, school/work colleagues, belonging or participation in specific group activities such cultural, sporting or social clubs, church groups, political parties, etc, can bring certain benefits by leveraging influential members of the network to gain some advantages. To that extent, social capital as resilience dimension, is quite important. Thus to investigate this dimension, we asked questions that relate to belonging to social network groups, association or close association with individuals or groups such as school or work colleagues, belonging to cultural, social or political groups and even whether individuals are connected to other members of their community in some way? We used this information to generate a composite scale of social capital which categorized into: Least Social Capital, Less Social Capital, Moderate Social Capital, More Social Capital and Most Social Capital. The results show that Ashaiman has the least social capital with 52.75% of the respondent belonging to this category compared to Navrongo and Tamale. In terms of the location with the most social capital

Tamale leads with 31.42%. Perhaps because of Ashaiman is much more cosmopolitan people tend to be individualistic.

Food Insecurity

Food Insecurity is a vulnerability factor and thus represents an important dimension of resilience. Population that suffer food insecurity become very vulnerable to all kinds of threats including health and security. Thus, to measure food security/insecurity, a lot of questions were asked to respondents that relate to whether households not having enough food to eat, whether members of households slept hungry during specified periods and if they did how often they have had to go without food, etc. The section of the tool that captured information about food security was adapted from tested instruments on food security that have been implemented by the Food and Agricultural Organization (FAO) and other international organizations that conduct research in the area of food security. The results as reported in Table 2 show that households in Navrongo and Tamale were the most food insecure locations among the three study sites. In both locations as high as a quarter of the households most vulnerable to food insecurity. However, households in Ashaiman were the least in with respect to the risk of food insecurity. It important to mention that Ashaiman and Tamale are close to being food secured since both sites had 64.25% and 60.50% respectively.

The spider graph below summarizes the dimensions of resilience according to the three study sites. In Navrongo in the Upper East region, the main dimensions of resilience are spirituality and food insecurity while that of Tamale in the northern region are mainly related to wealth, community networks, natural resources and environment and social capital. On the other hand, for Ashaiman the main areas are wealth and community networks.

Correlation of resilience dimensions

To better understand the data and possible relationships that exist between the various scales created using PCA, we ran a pairwise correlation analysis to test the associations between the various composite scores we created to represent different dimensions of resilience. The correlation analysis is presented below. We put an option that requested STATA to mark star* for any correlations that are significant at 5 percent level (α=0.05 level). The variables we

included in the correlation matrix included composite scores for socioeconomic status (poverty or wealth index), health, spiritual, infrastructure, governance, social capital, community networks, natural resources and food security (or insecurity). We used these indices because they were the main dimensions of resilience we identified in our qualitative research work across the three study locations in Ghana.

The pairs of variables marked * are those identified to show at least a 0.05 percent level of significance in terms of associations between the variables, with the numbers below the first set of values indicating the actual level of significance. To correct for possible Type I errors, we used the Bonferroni and Sidak correction technique in STATA.

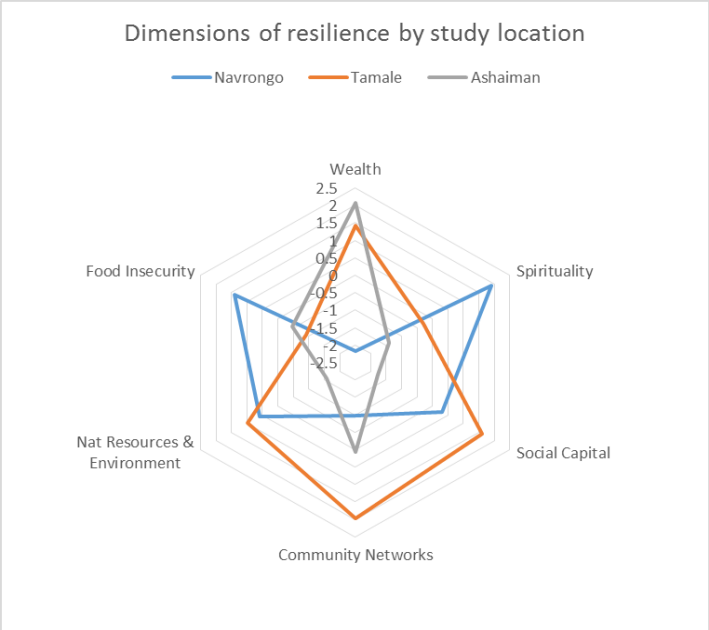
Table 3: Correlation matrix showing associations between different dimensions of resilience

	SES score	**Spiritual score**	**Governance score**	**Social Capital**	**Community networks**	**Natural resources**	**Food security**
SES score	1.00						
Spiritual	-0.20* 0.00	1.00					
Governance	-0.08 0.13	0.18* 0.00	1.00				
Social capital	-0.18* 0.00	0.16* 0.00	0.02 1.00	1.00			
Community networks	-0.10 0.10	-0.11* 0.02	-0.03 0.10	0.21* 0.00	1.00		
Natural resources	-0.21* 0.00	0.28* 0.00	0.17* 0.00	0.12* 0.00	-0.05 0.94	1.00	
Food security	0.01 1.00	0.04 0.99	0.04 0.99	-0.22* 0.00	-0.11* 0.02	0.29* 0.00	1.00

In addition to the correlation matrix, we constructed Spider Graphs to ascertain if the resilience dimensions identified in the qualitative data to be associated with particular locations are confirmed in the quantitative data. The graph below therefore, shows the different dimensions of resilience relative to study location. In Navrongo the main dimensions of vulnerability are related to spirituality and food insecurity, as clearly portrayed by the Spider graph. On the other hand, in Tamale, the main dimensions of vulnerability are related to wealth, natural resources and environment, community networks and social capital, while in the case of Ashaiman in the Greater Accra region, the key dimensions of vulnerability relate to wealth and community

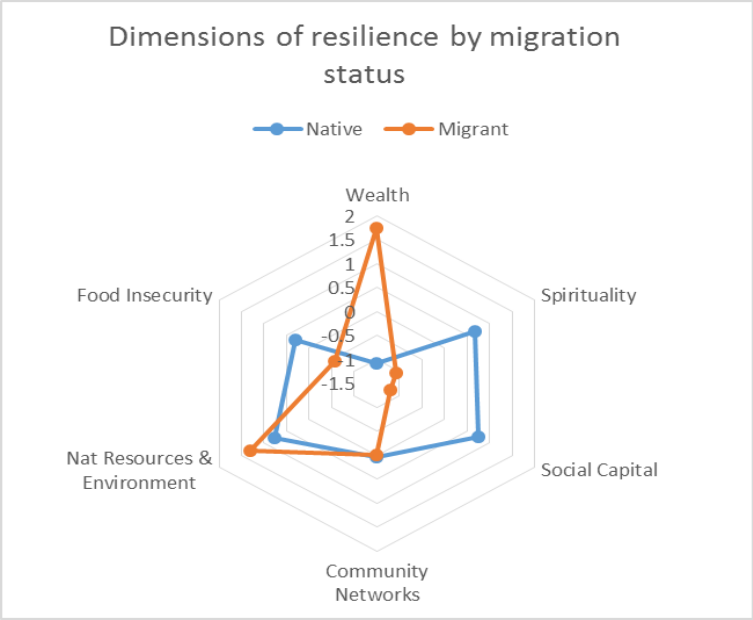
networks. These seem to be consistent to the findings from the qualitative research that was done, as part of the resilience project.

Figure 5: Dimensions of resilience by study location



We also construct Spider graphs to see if there are specific dimensions of vulnerability associated with natives and migrants in the study locations. Migration status is ascertained from the respondents themselves to a direct question as to whether the respondent and his/her household members are native to the location or have migrated there from elsewhere? The graph below shows that the main dimensions of vulnerability among migrants mainly have to do with wealth and natural resources and environment, while that of natives relates to food security, spirituality, natural resources and environment and social capital.

Figure 6: Dimensions of resilience by migration status



Exposure to Stocks and Stressors

In this section, we present data on shocks and stressors households are exposed to in the by study location. The table below depicts data by study location and the types of shocks and stressors household have been exposed to over the past five years.

Rain/windstorms

Rain/windstorms are natural disasters that occur periodically. Most often these occurrences take the people by surprise as early warning systems are either often not available are hardly heeded to by most people. In the survey respondents were asked if they suffered any rain/wind storms in the past five years? In Navrongo 75.25 % of responded indicated that they suffered from rain/wind storm in the last five years while in Tamale 55.03 % reported that they suffered rain/wind storms in the last five years. However, in Ashaiman the percent is significantly lower than in the two northern locations.

Floods

Floods are a common occurrence in many urban areas of Ghana particularly in the coastal parts of the country. They result usually from heavy rains aided by poor drainage systems. In many cases, they follow from heavy rainstorms. Somehow, results of the survey present a surprising

higher percent of floods occurring in Navrongo which is in the northern part of the country where floods are less frequent. Surprisingly, Ashaiman which is located along the coast reported less floors.

Loss of Livestock

Livestock rearing is one of the most important economic activities especially in the northern parts of Ghana. Many families rear livestock both for purposes of selling to generate income or for purposes of using them for traditional sacrifices or for the performance of funeral and other traditional rites. Therefore, to lose livestock represents a huge loss to such people. When asked if households in the lost some livestock in the last five year, about Food crops farmers rely on subsistence agriculture, which can no longer support them because the effects of climate change have made rainfall patterns unpredictable and therefore reducing farming and productivity People rear animals for both domestic use and for sale to earn some income. Loss of Livestock has serious effect in Tamale (55.67%) and Navrongo (45.11%) where most inhabitants are engaged in farming as their main occupation. Tamale has a peri-urban setting and therefore people substitute the livestock for food crop because of land space, whereas Navrongo is typical rural where both activities are pronounced. It is of no significance in Ashaiman which is less than 6%. This is shown clearly in Ashaiman where the respondents stated "No", not prone to loss of livestock.

Loss of Shelter.

Shelter is one of the basic necessities as a fundamental human rights. However, very often because rain and wind storms that often accompany the rainy season, many people tend to lose their shelter especially in the northern part of Ghana where most housing structures in the rural areas are built from mud and thatch. Results from the survey show that Navrongo is more prone to the shock of loss of shelter due to the structure of housing (mud thatched roof buildings) in the area other than the two sites. As high as 44.53% of respondents reported having lost their shelter in the past five years, more than twice that reported in Tamale and over 20 times higher than is reported in Ashaiman.

Drought

Climate change is one of the thematic focus of the WARILab. As such respondents were asked questions in the survey about their experience with respect to drought which is one of the leading environmental challenges to people in this part of the world. Results from the survey reveal that the people in the Navrongo study site are more prone to drought (81/95%) compared to Tamale where 13.51 % people of households reported having experienced drought and even less so for Ashaiman where only 3.04 % reported having experienced drought within the past five years. The results are consistent with expectation since Navrongo is located in the dry savannah region.

Pest and Diseases

Pest and Diseases of both livestock and crops was one of the stressors the survey took into consideration because most of the people in two of the study site are predominantly farmers and are involved in both cultivation of crop and livestock rearing. Therefore, in the survey respondents were asked about pest and diseases. As high as 58.50% respondents in Navrongo reported that they have suffered the loss of crop and animals to pest and diseases. In Tamale 46.45 % of respondents indicated that their crops have suffered from pest and disease infestation. However, Ashaiman residents reported a comparatively lower percentage of pest and disease infestation (17.25%). These results are not surprising because Ashaiman in more of a cosmopolitan setting close to the industrial areas of Tema and little takes place there.

Land Disputes

Land disputes have become a common place within the last two decades as land becomes more and more scarce following increased in housing construction particular in urban areas. In rural areas, land disputes are more associated with the right of ownership, sometimes among families and relatives. When they occur, they bring come along with protracted litigation and in some cases can lead to war situations especially in traditional settings where the right to land is often conferred through inheritance. These in many cases represent a shock or stress to families. Therefore, in the survey we tried to ascertain information about land disputes in the study locations. In Tamale, 10.03 % of respondents reported having encountered land disputes while in Navrongo and Ashaiman the percent of reported cases of land disputes is much lower. This is not

surprising given the fact that Tamale has traditionally been embroiled in land and other chieftaincy related disputes.

Table 3: Food insecurity or inadequate food

Variable	Ashaiman Number (%)	Tamale Number (%)	Navrongo Number (%)
Rain/windstorm			
Yes	172(43.00)	219(55.03)	301(75.25)
No	227(56.75)	177(44.47)	97(24.25)
N/A	1(0.25)	2(0.50)	2(0.50)
Floods			
Yes	158(39.05)	163(41.06)	282(70.50)
No	242(60.50)	230(57.90)	116(29.00)
N/A	0(0.00)	4(1.01)	2(0.50)
Loss of Livestock			
Yes	22(5.50)	221(55.67)	180(45.11)
No	207(51.75)	169(42.57)	218(54.64)
N/A	171(42.75)	7(1.76)	1(0.25)
Loss of Shelter			
Yes	10(2.51)	65(17.15)	171(44.53)
No	379(94.99)	300(79.16)	209(54.43)
N/A	10(2.51)	14(3.69)	4(1.04)
Drought			
Yes	12(3.04)	52(13.51)	327(81.95)
No	318(80.51)	321(83.38)	70(17.54)
N/A	65(16.46)	12(3.12)	2(0.50)
Pest and diseases			
Yes	69(17.25)	183(46.45)	234(58.50)
No	170(42.50)	200(50.76)	164(41.00)
N/A	161(40.25)	11(2.79)	2(0.50)
Land disputes			
Yes	20(5.00)	39(10.03)	20(5.00)
No	370(92.50)	329(84.58)	379(94.75
N/A	10(2.50)	21(5.40)	1(0.25)
Inadequate food			
Yes	149(37.25)	100(25.71)	315(79.15)
No	248(62.00)	274(70.44)	78(19.60)
N/A	3(0.75)	15(3.86)	5(1.26)

Adequate food security is an important assurance that households would be cushioned from starvation and hunger during periods of scarcity or when food production becomes low. To that extent food security is a sure of way of ensuring resilience. On the other hand, if households

have insufficient food to keep households members from hunger then such families become vulnerable to diseases and infirmity. That could also lead to human insecurity because that can make people vulnerable to crime to survive. It is within these context that the study elicited information from households about food security. The results show that 79.15% of respondents in Navrongo indicated that they did not have adequate food and so their household members have not been able to get food to eat during certain days within the last one month prior to the survey (food insecure). However, the percentage of houses in Tamale and Ashaiman that are reported to be have had inadequate food and so slept without food in the last one month is comparatively smaller, 25.71% and 37.25%, respectively. The high percentage of food insecurity for Navrongo could be due to poor performance of crop farming in recent times and being a predominantly rural they are unable to raise the necessary financial resources to secure food from the market.

We also examined specific shocks and stressors that residents of these localities indicated that they are prone to. Respondents in Navrongo and Tamale and less so in Ashaiman reported that they have been exposed to rain and wind storms which has adversely affected them. Surprisingly, floods which we thought would have been a major threat to Ashaiman than the other two locations in the north are rather reported to be a threat to the resident in Navrongo. Residents of Navrongo and Tamale also reported loss of livestock and pest as two major shocks/threat that the have been exposed to. Finally, residents of Navrongo are reportedly more exposed to the loss of shelter and food more than the other two study locations.

To ascertain the determinants of some of the resilience dimensions, we conducted multivariate statistical analysis for two of the resilience dimensions guided by exploratory analysis of associations based on pairwise correlation analysis. The two that we have so far done are the wealth and spirituality scores. We plan to do further regression analysis for the rest when we subsequently update this report.

Regression analysis

In this section we ran a number of regression simple linear, multiple and ordered logit regression models to ascertain the determinants of some of the dimension identified in the quantitative data.

We did this for two dimensions – wealth and spirituality. We must note that we used two different regression procedures depending on the structure of the response variable.

First, we start with the wealth dimension. Because we used the socioeconomic status index (SES) as a proxy for wealth which, is categorized into five quintiles representing respondents from the poorest to the least poor households, we decided to use an ordered logit model. This because of the ordinal nature of the wealth scale. The table below show the results. We estimated two models – the first just a simple model where we examined SES status as a function of function of location. We find statistically significant differences with respect to wealth or SES with respect to location. As expected, residents of Ashaiman have SES compared to Navrongo (odds ratio of 1.235) and the differences are statistically different. While we did not find any significant statistical differences between residents of Navrongo and Tamale, we were surprised in that odds of being in a better SES scale are lower in Tamale relative to Navrongo.

In model II, we introduced a number of controls in the model to see if the differences we observed in model I still persist after controlling for the confounding effects of other variables. In this regard, controlled for level of education, migration status of the household to which the respondent resides, occupation of the respondent, social capital which is a composite scale that we generated based on a number of attributes, access of the household to natural resources and the level of food security the household has. While the results still shows that there are significant differences in terms of household wealth Ashaiman relative to Navrongo (Ref category), the magnitude of the difference declined markedly when we controlled for confounders. With regards to Tamale relative to Navrongo, as observed in the first model, there are virtually no differences.

With regards to the other confounding variables, we did not find statistically significant differences with respect to wealth status of households except for availability of natural resources which, surprisingly is observed to negatively affect the wealth status of households. This merits further investigation.

Table 4: Ordered logit regression of the determinants of wealth by study location

	Model I		Model II	
Variable/Parameter	**Coefficient**	**SE**	**Coefficient**	**SE**
Study location				
Navrongo (Ref)	---	---	---	---
Tamale	-0.081	0.158	-0.015	0.206
Ashaiman	1.235***	0.144	0.705*	0.321
Level of education			0.014	0.043
Migrant			0.349	0.221
Occupation				
Agriculture (Ref)				
Trading/Selling			0.194	0.238
Vocational			-0.276	0.451
Construction			-0.129	0.251
Civil Servant			0.218	0.334
Unemployed			-1.105	1.270
Social capital			-0.138	0.077
Natural resources			-0.177**	0.056
Food security			0.121	0.068
/cut1	0.423	0.109	0.774	0.283
/cut2	2.878	0.147	3.294	0.304

The second regression analysis we conducted is ascertain the determinants of spirituality which is one of the dimensions observed in the data. For this analysis, we implemented a linear regression model and the reason is because of the structure of the dependent variable. Because of lack of enough variation in the raw scores in the scales, we decided not to categorize the spiritualty variable but rather put in the raw scores in the model as the dependent variable.

In the first model (model I), results show that for every additional unit increase in spirituality we can expect a reduction in spirituality in -0.0693 and -0.924 in Tamale and Ashaiman, respectively. On the other hand, since Navrongo is the omitted category whose coefficient is equivalent to the intercept (constant) in the regression equation, it means that for every unit change in spirituality there is an additional increase of 0.558 increase in spirituality there. In simple terms, while spirituality is increasing in Navrongo, it is reducing in Ashaiman and Tamale, respectively. When we allow for the effects of other additional variables, the coefficients in Tamale and Ashaiman increase significantly and in the same direction.

Other variables that are significantly related to spirituality in the model are level of education and occupation. Indeed, the only occupational category significantly related spirituality is vocational which, shows that for every unit change in spirituality we can expect those in vocational occupational category to contribute 0.037 unit change to it. On the other hand, for every unit change in spirituality, level of education reduces it by -0.042 units which means as educational levels increase the level of spirituality goes down.

Table 5: A linear regression to determine the influence of a number of factors on Spirituality by study location

	Model I		Model II	
Variable	**Coefficient**	**SE**	**Coefficient**	**SE**
Study location				
Navrongo	---	--	--	--
Tamale	-0.693***	.0700	-0.951***	.0866565
Ashaiman	-0.924***	.0676	-1.449***	.1408938
Level of Educ			-0.042 **	.0194901
Migration status				
Native (Ref)			---	----
Migrant			0.399	.1040209
Occupation				
Agriculture (Ref)			--	--
Trading/Selling			0.215	.100053
Vocational			0.037*	.202329
Construction			0.085	.1064357
Civil Servant			0.107	.1506085
Unemployed			0.118	.5246623
Social Capital			0.131	.0337341
Food security			-0.134	.0300867
Intercept	0.558	0.0495	0.319	.1296354

The conclusion from this above analysis on spirituality is that while spirituality has increased in Navrongo, it has decreased in Tamale and Ashaiman.

SUMMARY, DISCUSSION AND CONCLUSION

The report summarizes key finding finds of the quantitative survey. A total sample of 1200 individuals were sample across the three study locations, 300 for each location. We were able to interview a total of 1198 individuals representing more than 99 percent of the targeted sample. Of this number, 47 percent were female and 53 percent male. Majority of respondents were skewed in favour of younger adults, predominantly illiterate in Navrongo and Tamale and much less at Ashaiman. Distribution of respondents with respect to occupation vary, with those from Navrongo predominantly farmers while those from Ashaiman and Tamale are mainly made up of traders.

Guided by the initial identification of the various dimensions of resilience captured in the framework developed in the qualitative work and having used to capture data on those thematic areas, we conducted principal component analysis using a series of related variables captured under the different dimension. We then used that to generate composite scores for the various dimensions and thereafter generated coefficients which are used to generate Spider graphs. These Spider graphs afforded us the opportunity to identify from the quantitative data resilience dimensions prominent in specific study location.

The main dimensions of resilience identified include wealth, food insecurity, natural resources and environment, community networks, social capital and spirituality. The Spider graphs allowed for the identification of specific dimensions prominent to each location. In Navrongo in the Upper East region, the main dimensions that are of prominence are spirituality and food insecurity and this is consistent with the quality data that was analysed much earlier. On the other hand, in the case of Ashaiman in at the coastal belt, the key dimensions of resilience are wealth and community networks, while in the case of Tamale, the key ones are wealth, community networks, natural resources and environment and social capital. All these are consistent with the findings from the qualitative report.

For the wealth score, we estimated an ordered logit model because the response variable is categorized into quintiles that are ordinal in nature. We found statistically significant differences with respect to wealth or SES by location of residence. As expected, residents of Ashaiman have SES compared to Navrongo (odds ratio of 1.235) and the differences are statistically different.

While we did not find any significant statistical differences between residents of Navrongo and Tamale, we were surprised in that odds of being in a better SES scale are lower in Tamale relative to Navrongo. Finally, for the spirituality score, estimated a linear regression model to determine the predictors of spirituality. We first estimated a basic model (model I) where we included only the location variable. The objective was to determine if spirituality is more associated with a specific location, as shown by the qualitative analysis. The overriding conclusion drawn from the spirituality result is that spirituality is more predominant and increasing in Navrongo than is the case in Tamale and Ashaiman and these do not change when we controlled for the effects of confounders. Further analysis of the data is continuing.

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