Food and Agriculture Organization
of the United Nations

ANALYSING RESILIENCE FOR BETTER TARGETING AND ACTION

FAO RESILIENCE ANALYSIS No. 6

RESILIENCE ANALYSIS IN THE TRIANGLE OF HOPE

MAURITANIA

2015

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ACRONYMS

ABS	Access to Basic Services
AC	Adaptive Capacity
ACLED	Armed Conflict Location and Event Data Project
AST	Assets
CAPI	Computer Assisted Personal Interviewing
DDI	Dietary Diversity Index
EPCV	Enquête Permanente sur les Conditions de Vie des Ménages
FA	Factor Analysis
FCS	Food Consumption Score
GIS	Geographic Information System
HDI	Human Development Index
HH	Household Head
MIMIC	Multiple Indicators Multiple Causes
ONS	Office National de la Statistique
PASK	Projet de Lutte Contre la Pauvreté dans l'Aftout Sud et le Karakoro
PNDA	Plan National de Développement Agricole
PRAPS	Projet Régional d'Appui au Pastoralisme au Sahel
RAP	Resilience Analysis and Policies (team)
RCI	Resilience Capacity Index
RIMA	Resilience Index Measurement and Analysis
RM-TWG	Resilience Measurement Technical Working Group
RSM	Resilience Structure Matrix
SDSR	Stratégie de Développement du Secteur Rural
SEM	Structural Equation Model
SSN	Social Safety Nets
TLU	Tropical Livestock Units
UNDP	United Nations Development Programme
UP	Primary Units
US	Secondary Units
WB	World Bank

WFP	Word Food Programme
WHO	World Health Organization
ZEP	Zones d'Éducation Prioritaires

EXECUTIVE SUMMARY

Mauritania presents an important regional heterogeneity with regard to poverty and resilience. The regions there of Guidimagha, Tagant, Assaba and Brakna show a poverty rate greater than 40 percent (ONS, 2015) and are considered the most disadvantaged regions. These areas together are referred to as the Triangle of Hope.

Exogenous shocks are a serious threat for households located in the Triangle of Hope. The environment, land and agricultural resources are under increasing pressure as drought becomes more frequent. Drought is a cyclical phenomenon in the south of Mauritania, contributing to food insecurity and malnutrition (Equipe Humanitaire Pays, 2016). In fact, intra-year seasonality strongly affects households' livelihoods in these regions. More generally, the Triangle of Hope is chronically suffering from droughts and other climatic threats like floods and low rainfall.

Furthermore, despite progress over the last ten years, the weakness of national public infrastructure and basic services distresses households' living conditions in the Triangle of Hope. Access to primary services (primary school, drinking water and telephone services) is considered satisfactory at the national level, with a rate higher than 50 percent. Nevertheless, different levels of access to public infrastructure and basic services can be observed between the four regions mentioned above, the national average, and the country's capital, Nouakchott (ONS, 2015).

The regional disparities between the Triangle of Hope and the rest of Mauritania have motivated this resilience analysis. This analysis is based on a household survey implemented ad hoc by the Resilience Analysis and Policies (RAP) team of the Food and Agriculture Organization of the United Nations (FAO) along with the Office National de la Statistique (ONS) of Mauritania. The household survey was conducted in December 2015 in the Triangle of Hope, which again comprises the regions of Guidimagha, Tagant, Assaba and Brakna.

This report aims to identify the key pillars of resilience and related contributing factors at the household level using the FAO Resilience Index Measurement and Analysis II (RIMA-II) methodology. The pillars of resilience considered in this analysis are Access to Basic Services (ABS), Assets (AST), Social Safety Nets (SSN) and Adaptive Capacity (AC), based on consultations with ONS and other local experts, literature review and previous analyses (FAO, 2016c). The second part of RIMA-II explores the role of shocks in explaining resilience capacity and describes the association between factors that contribute to resilience and food security. The final aim is to compare the findings of the resilience analysis with some of the key policies put in place or programmed by the Government of Mauritania, with a specific focus on the regions analysed here. This analysis can therefore be used to critically review policies that affect resilience, which have already been implemented or are set to be implemented.

KEY HIGHLIGHTS

1. **The resilience capacity of households located in the Triangle of Hope in 2015 is highly influenced by Access to Basic Services and Assets.** Both the descriptive and causal analysis of resilience underline the importance of **access to sanitation**, **distances to market**, and **wealth index** for resilience to food insecurity in the Triangle of Hope. Additionally the perceived participation in the decisional process of the community where the household lives plays a relevant role, despite the minor role of AC.
2. **Despite the homogeneity of the poverty rates among the four regions of the Triangle of Hope** (ONS, 2015), **regional heterogeneity in resilience capacity is detected** using the RIMA-II approach. In fact, **Brakna is found to be the most resilient region** (scoring an average Resilience Capaci ty Index (RCI) of 56.3 percent); **Guidimagha is the least resilient** (scoring an average RCI of 34.5 percent); while Assaba and Tagant have an RCI score in the middle. Brakna has better access to infrastructure and shorter distances to markets and schools. Brakna's households seem to participate in more income-generating activities than the other regions; they have an average education level and the greatest degrees of (perceived) participation in public life and decision-making processes. On the other hand, households living in Guidimagha show the worst access to basic services (given they have the highest distances to hospitals, markets and safe water), limited access to livestock and land, the lowest volume of cash and in-kind transfers, and a limited participation in associations.
3. **The positive effect of urban status on resilience capacity characterizes all regions, with the exception of Tagant, which is almost totally rural**. The major difference between urban and rural households is reported through ABS results. In fact, the disparities in terms of access to services with respect to urban status is huge in the surveyed households. **In terms of livelihoods, the least resilient households are the farmers, which are mainly** (87 percent) **localized in rural areas**, while the households classified as urban or other mainly live in the urban areas of the Triangle of Hope. Farmers have low AC, associated with a low level of education (on average), as well as the low share of members who are of working age (greater than 15 and less than 64 years old) in the household. Furthermore, their income is the lowest among those of the different livelihood categories.
4. **Households with female heads**, which are the minority in the sample, **are slightly more resilient than male-headed households**. This difference is relevant only for rural households. Additionally, since female-headed households mainly reside in Assaba and Brakna, which are the most resilient regions, the specific regions where female-headed households are located may contribute to the gender differences in resilience capacity. Female-headed households have slightly higher ABS and higher SSN. Despite a lower level of income, the female-headed households guarantee their members a higher level of food consumption as well as a more diversified diet.
5. **Clashes,**[1] **drought and crop failures are the main causes of reduced food security**. These are the shocks that most strongly reduce food security in the Triangle of Hope. This is a crucial information for being better prepared in case of natural events, which may affect the most food insecure households.

[1] Clashes includes violent conflicts, confrontations, fighting between persons or groups of people; this may originate from political, ethnical, religious and social tensions.

POLICY IMPLICATIONS

The findings of the analysis are examined in relation to major policy initiatives programmed or implemented by the Government of Mauritania over the last decade in the four regions of the Triangle of Hope.

According to the results of the resilience analysis, it should be encouraged that programmes for developing **infrastructure for basic services and productive services should prioritize rural households**.

The development of the rural sector is considered a key aim of the policies programme of the Government of Mauritania. Indeed the Stratégie de Développement du Secteur Rural (SDSR) - Horizon 2025 aims to promote the development of the livestock and agriculture sector; development at the local level; the management of natural resources; and institutional and legal improvement at the national level. Furthermore, the four regions of the Triangle of Hope have been recognized as a specific target in the Politique Nationale de Santé et d'Action Sociale 2005-2015, owing to differences compared to the national average across mortality, malnutrition and fertility rate.

In terms of regional differences, **rural areas of Guidimagha are a potential preferred target for investments in formal education and income diversification activities**.

One of the main objectives of the Projet d'Appui aux Zones d'Éducation Prioritaires (ZEP) implemented by the Mauritanian Ministry of Education is to reduce the differences in both the scholarization rate and the quality of education (which is linked to access to other basic services, such as drinking water) between regions in the Triangle of Hope and the rest of the country. In line with this national plan, the government of Mauritania is implementing the Projet de Lutte Contre la Pauvreté dans l'Aftout Sud et le Karakoro (PASK) II 2009-2017, following the PASK I 2003-2009 and involving some rural districts of Guidimagha and Assaba.

The resilience analysis of livelihood suggests that **farmers and pastoral households, which have the lowest levels of resilience and the most volatile incomes** – because of their reliance on agriculture and the related influence of varying climatic conditions – **should be considered for projects aimed at developing the agriculture and livestock sectors, with specific attention to the effects of geo-climatic variability** (i.e. the climate change and other climatic effects).

From this analysis, the main programming priorities to strengthen the resilience of livelihoods would be the following: food security monitoring systems; provision of productive assets; increasing rural-urban connectivity; natural resources management initiatives; value chain approach for selected crops and livestock; investments in basic services and diversification of income sources.

The Plan National de Développement Agricole (PNDA) 2015-2025 targets selected supply chains (such as rice, wheat, traditional cereals and dates) and is aimed at the integration of the agricultural sector with national and international markets, the creation of employment opportunities, and the application of technological innovation for agricultural production diversification. Within this national framework, the Projet Régional d'Appui au Pastoralisme au Sahel (PRAPS) 2016-2021 specifically targets the pastoralist and agro-pastoralist households located in all the four regions of the survey. The main objectives of the project are to improve (i) access to market and production services for pastoralists, and (ii) pastoralists' capacity to cope with crisis that involves the pastoral sector.

This report encourages **income-generating and diversification activities for female-headed households**, despite the fact that those are slightly more resilient than male-headed households.

This suggestion is in line with PASK II, which pays specific attention to youth and females living in Guidimagha and Assaba, mainly for training and micro-credit projects. In accordance with the results of this analysis which indicate the crucial role of female heads in ensuring a diversified diet, the Mauritanian Ministry of Health - among the measures canvassed in the Protocole National de Prise en Charge de la Malnutrition Aiguë underlines the role of females in education projects for child malnutrition coping strategies.

1 PURPOSE OF THE ANALYSIS

This section introduces background information on the Triangle of Hope, and explains why resilience analysis has been carried out in this region of Mauritania.

The majority of land in Mauritania (more than 75 percent) is desert or semi-desert, with a population of about 3.5 million living across more than 1 billion square kilometres. The national economy has traditionally been driven by exports, mainly of iron and fish. Furthermore, Mauritania has become a modest offshore oil producer (WB, 2013). The service industry has recently assumed relevance due to foreign investment in telecommunications (ONS, 2015).

In recent decades, Mauritania experienced an improvement in its Human Development Index (HDI), which increased from 0.362 in 1984 to 0.506 in 2014. This nevertheless still places the country in the low human development category (UNDP, 2015). The poverty rate is 31 percent at the national level (ONS, 2015).

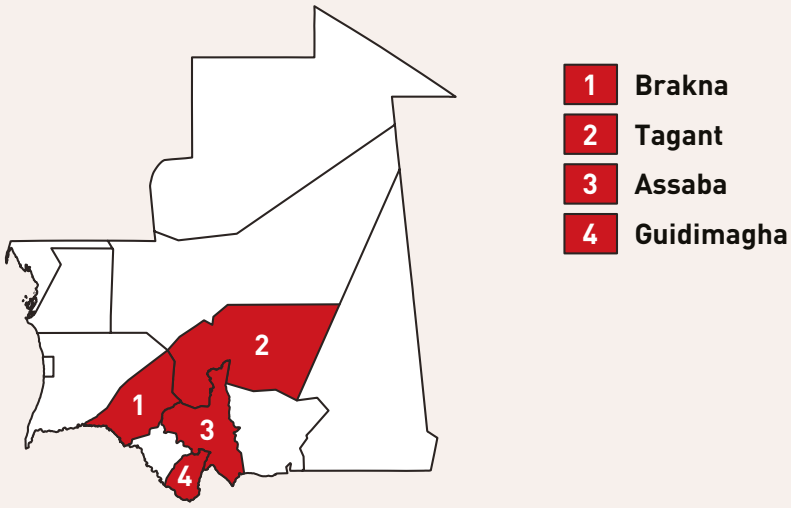
Guidimagha, Tagant, Assaba and Brakna are the poorest regions in the country (ONS, 2015). Together, they are known as the Triangle of Hope. The region is named as such in reference to the poverty faced in that area, located in the southeast of the country. While the above-mentioned regions are official regions of Mauritania with fixed borders, the 'Triangle of Hope' is an unofficial term widely used to refer to this grouping of the poorest regions of Mauritania. Figure 1 shows the regions locates within the Triangle of Hope, drawn up according to the latest poverty estimates.

Exogenous shocks are a serious threat for households located in the Triangle of Hope. The environment, land and agricultural resources are under increasing pressure as drought becomes more frequent. Drought is a cyclical phenomenon in the south of Mauritania, contributing to food insecurity and malnutrition (Equipe Humanitaire Pays, 2016). In fact, intra-year seasonality strongly affects households' conditions in these regions. Indeed, between October and December 2014, the percentage of households suffering nutritional deficiencies was at its lowest rate (22.5 percent), while this rate reached a maximum of over 70 percent between May and June (ONS, 2015). Specifically, agricultural households suffer during the pre-harvest period. In general, the Triangle of Hope suffers chronically owing to droughts and other climatic threats like floods and low rainfall.

Furthermore, despite progress over the last ten years, the weakness of national public infrastructure and basic services distresses households' living conditions in the Triangle of Hope.

Access to primary services (primary school, drinking water and telephone services) is considered satisfactory at the national level, with a rate higher than 50 percent (ONS, 2015). Nevertheless, a different level of access to public infrastructures and basic services can be seen among the four regions of the Triangle of Hope, the national average, and the capital, Nouakchott. For example, in 2014, while the literacy rate for the population aged over 15 years is 81 percent in the capital, the average for the Triangle of Hope is around 60 percent, with the region of Guidimagha scoring only 41 percent. Additionally, while the percentage of vaccinated children is 75 at the national level, in Tagant this is 57 percent and in Assaba 62 percent. The same pattern exists for other indicators of access to services (ONS, 2015).

Figure 1. **The Triangle of Hope's regions in Mauritania (2015)**



This regional heterogeneity is the motivation for carrying out the resilience analysis for the Triangle of Hope. This analysis is based on a household survey, implemented by the FAO RAP team and ONS, which was carried out in the Triangle of Hope in December 2015. The questionnaire collected detailed information at the household and individual levels. The data collection was realized by employing Computer Assisted Personal Interviewing (CAPI) technologies.

This report aims to identify the key pillars of resilience and related contributing factors at the household level using the FAO RIMA-II[2] methodology. The pillars of resilience considered in this analysis are ABS, AST, SSN and AC, based on consultations with ONS and other local experts, literature review, and previous analyses (FAO, 2016c). Another feature of RIMA is the adoption of an indicator for the household head's perception of the decision-making process in the community where the household is located. This is used as a proxy indicator for an institution-enabling environment, which can positively enhance household capacity for managing shocks.

The RIMA-II methodology is composed of two parts. The first is a descriptive part that identifies the importance of the different pillars of resilience and the related factors contributing to resilience, and compares the resilience capacity of different household profiles.

[2] FAO (2016c), cited in the reference list, offers a detailed discussion on the differences between RIMA-I and RIMA-II methodology.

The final purpose of this descriptive part is to provide the reader with a clear idea about resilience composition at a given point in time. The second part of RIMA-II looks at the causal relationship between shocks and resilience capacity; it also describes the main determinants of resilience and food security. The findings are further analysed against some key policies put in place (or set to be implemented) by the Government of Mauritania in the Triangle of Hope. This analysis can therefore be employed in analysing, through the lens of resilience, implemented or programmed government policies.

The report is structured as follows: Section 2 presents the methodology employed to estimate the resilience capacity; Section 3 gives details on the data employed; Section 4 shows the analysis of resilience structure at the national level and of resilience capacity at the regional level, by urban/rural location and gender of household head (HH). Section 5 discusses the main findings of the causal part of RIMA-II, focusing on the effects of shocks on resilience capacity and on an analysis of food security. Finally, Section 6 concludes with some policy indications.

2 RESILIENCE MEASUREMENT

This section introduces the FAO resilience measurement framework. It describes the RIMA-II approach and provides details on the resilience pillars and variables used in the analysis.

Resilience is defined as "the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences" (RM-TWG, 2014).

The RIMA-II approach includes two elements (FAO, 2016c):

- the **descriptive** analysis provides a description of household resilience capacity; it estimates the RCI and the Resilience Structure Matrix (RSM). The RCI can be employed for ranking and targeting households; and
- the **causal** provides an analysis on the determinants of the resilience capacity, and on the effects of shocks on food security and resilience. RIMA-II takes into account negative events that affect both singular individuals and households (so-called idiosyncratic shocks) as well as communities, regions or even entire countries (covariate shocks). While the former are self-reported by the household in the survey, the latter, for example, geo-climatic or conflict shocks, are detected though secondary data. These include both additional datasets and Geographic Information System (GIS) data.

The RCI allows for assessing which profiles of households (by region, urban status, gender of HH, livelihood) are the most resilient. By focusing on the most relevant pillars, according to the RSM, the mean values of observed variables assess why specific profiles of households are the most resilient. Therefore, the two combined analyses shed light on the drivers that ensure higher resilience capacity. Therefore, policy recommendations can be formulated, with a particular focus as to which households need targeting for relevant policies.

The estimation of the RCI is based on a two-stage procedure. First, the resilience pillars are estimated from observed variables through Factor Analysis (FA). Second, the RCI is estimated from the pillars, taking into account the indicators of food security using the Multiple Indicators Multiple Causes (MIMIC) model. The latter are considered outcomes of resilience. The details of the RCI estimation are presented in Annex I.

The definitions of each pillar of resilience and the related variables are reported in Table 1. The choice of the employed pillars is based on consultations with ONS and other local experts, literature review and previous analyses (FAO, 2016c).

Table 1. **Resilience pillars**

Pillars of resilience	Definition	Variables
ABS	ABS shows the ability of a household to meet basic needs, by accessing and effectively using basic services, such as sending children to school; accessing water, electricity and sanitation; selling products at the market.	Electricity; Sanitation; Distance to water source; Distance to school; Distance to hospital; Distances to market.
AST	AST, both productive and non-productive, are the key elements of a livelihood, since they enable households to produce and consume goods. Examples of productive assets include land and agricultural index (e.g. agricultural equipment), while non-agricultural assets take into account the monetary value of the house where the household is located, and its appliances.	Wealth index;[3] Cultivated land value per capita; Tropical Livestock Units (TLU)[4] per capita; Agricultural inputs; House value per capita.
SSN	SSN proxies the ability of the household to access formal and informal assistance from institutions, as well as from relatives and friends.	Cash transfers per capita; In-kind transfers per capita; Participation in associations.
AC	AC is the ability to adapt to a new situation and develop new livelihood strategies. For instance, proxies of the AC are the average years of education of household members and the household perception on the decision-making process of their community.	Average education; Income diversification index;[5] Dependency ratio (active/non-active members);[6] Perception of the decision-making process in the community.[7]

A wide range of food security indicators is employed in the literature (Carletto *et al.*, 2013). The indicators employed in this analysis are: per capita food consumption, Simpson Dietary Diversity Index (DDI) and Food Consumption Score (FCS). Without entering in too many details,[8] RIMA-II employs two or three food security indicators simultaneously; this aims at capturing different aspects of food security: food consumption focuses on the monetary value, while the other indicators focus on the diversity of the diet both in terms of consumed calories (Simpson DDI) and number of food groups (FCS). Table 2 offers details on the indicators employed in the analysis.

[3] Wealth index is created through FA. A list of variables assumes value 1 or 0 is used, depending on whether or not a household has specific non-productive assets, such as a television, radio, lamp, etc.

[4] TLU standardizes different types of livestock into a single unit of measurement. The conversion factor adopted is: 1 camel; 0.7 cattle; 0.55 donkeys/mules; 0.1 sheep/goats; 0.01 chickens.

[5] Income participation index is created through FA. A list of variables assumes value 1 or 0 is used, depending on whether or not a household has been involved in farming activity; any household member has been employed for any kind of payment; a household has been involved of sale of livestock, fish or their products; a household has operated any income-generating non-farm enterprise; a household has received transfers; a household has any other income sources, such as rent or the sale of assets.

[6] The dependency ratio inverted is the share of active members (> 15 and < 64 years old) over the non-active members (of age between 15 and 64 years).

[7] The indicator of perception on the decision-making process in the community ranges from 0 to 4, according to the answer to the following question: "Is the current process of decision-making in your community: based on mutual agreement among all men and women (4); based on mutual agreement but with lesser participation of women (3); based on participation but without agreement (2); elite or leader driven (1); don't know (0)."

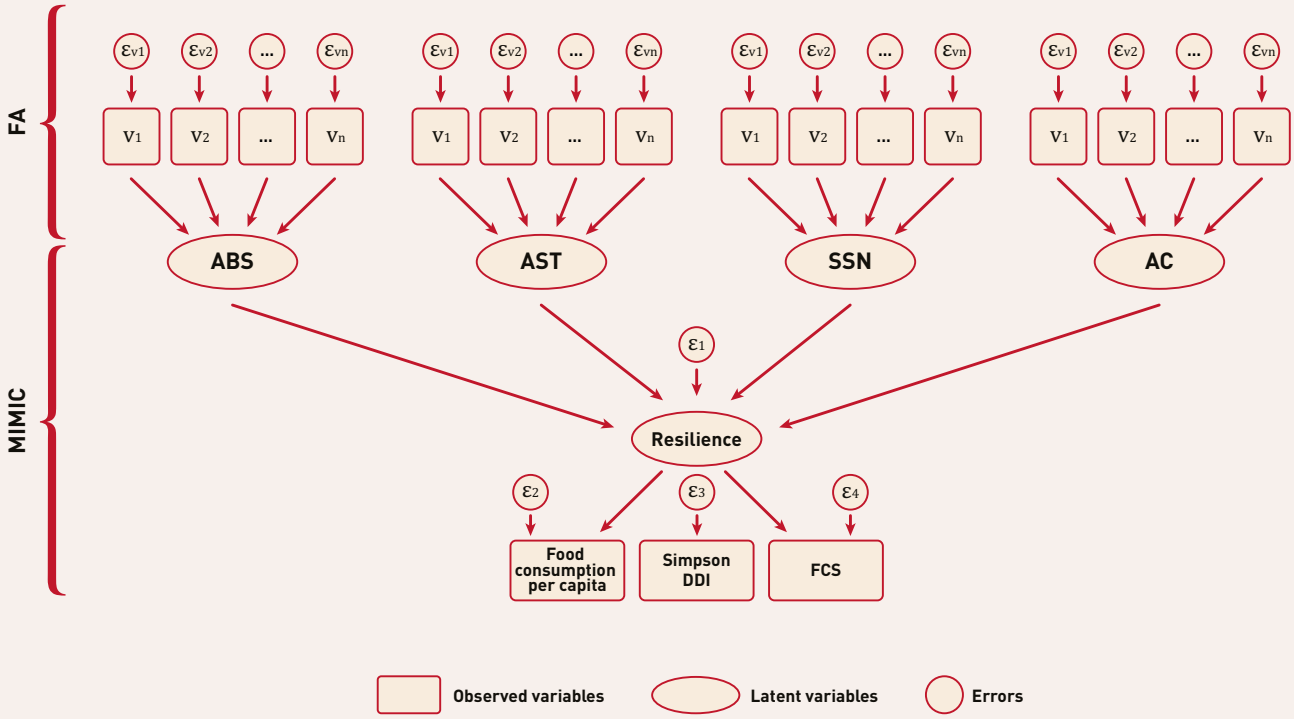
[8] A detailed discussion on why including more than one food security indicator in RIMA is provided in FAO 2016c.

Table 2. **Food security indicators**

Food security indicators	Definition
Food consumption per capita	Monetary value, expressed in US dollars, of per capita food consumption, including bought, auto-produced, received for free (as gifts or part of a conditional project) and stored food.
Simpson DDI	Index that takes into account the number of food group (cereals, roots, vegetables, fruits, meat, legumes, dairy, fats and other) consumed as well as their relative abundance (Simpson, 1949).[7] The index ranges between 0 and 1 where 1 represents maximum dietary diversity and 0 represents no diversity.
FCS	Score calculated summing the weighted frequency of consumption of different food groups consumed by the household during the 7 days before the survey. The standard food groups and weights (in parentheses) are the following: main staples (2), pulses (3), vegetables (1), fruit (1), meat and fish (4), milk (4), sugar (0.5), oil (0.5) and condiments (0) (WFP, 2008).

Figure 2 synthesizes the two-step process that allows for the estimation of the RCI. After estimating the pillars, the RCI is jointly estimated through its pillars and by taking into account food security indicators.

Figure 2. **Resilience index and pillars**



This report initially presents the descriptive measures of resilience and the analysis of the role of shocks on the RCI. A proper analysis of the determinants of food security and resilience recovery cannot be effectively implemented with a cross-section dataset (like the one used in this analysis).[9]

Generally, this is pursued when panel data (FAO, 2016a) or pseudo-panel data (FAO, 2016b) are available, namely in the presence of surveys of the same or comparable observations repeated in time (see Section 3 of this report, which explores the data in detail).[10] However, although these limitations do exist, it remains of interest to see what the main correlates are for the actual level of food security and resilience. This will be presented in the last part of the report.

[9] The Simpson DDI is given by using the equation: $\Psi = 1 - \sum_{i=1}^{n} p_i^2$, where p_i expresses the share of consumed calories of group i in a sample of n food groups (cereals, roots, vegetables, fruits, meat, legumes, dairy, fats and other).

[10] The causal analysis of the determinants of resilience capacity in the Triangle of Hope can be performed in the future as soon as a second wave of the household survey will be available.

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3 DATA

This section describes the dataset employed in the resilience analysis, based on an ad hoc data collection implemented by FAO and ONS in December 2015, and introduces both strengths and limitations of the dataset. Additional data sources on covariate shocks are introduced as well.

The analysis uses an ad hoc household survey, implemented in the Triangle of Hope by FAO and ONS of Mauritania in December 2015. The primary purpose of the data collection was to assess the resilience capacity of the households located in the selected regions by employing the RIMA-II methodology. However, the dataset could also be harnessed for additional research, since it collected a comprehensive set of individual and household information.

The orginal sample of households consisted of 1 600 observations and was designed in order to be representative at the regional and the sub-regional levels. The sample selection was based on a stratified three-stage sampling design using the Enquête Permanente sur les Conditions de Vie des Ménages (EPCV) of 2014. The sampling framework was based on the preliminary count of households by Primary Units (UP) and on the census cartography realized by ONS in 2014. In more detail, a sample of 80 UPs was selected at the first sampling stage, four Secondary Units (US) were selected in each UP, and finally five households were selected from each sample at the third stage.

This analysis adopts the following definition of 'household', as defined by the FAO RAP team, which conducted both the survey and the resilience analysis: "a household is formed by all the people living in the same hut or home, related or not by blood lines (family) and sharing food, food expenses, income and other household assets for at least 6 of the 12 months preceding the interview. Therefore, the membership of the household is defined on the basis of the usual place of residence". The final sample of households used in this analysis consists of 1 515 observations.[11]

The household questionnaire was developed by FAO in collaboration with ONS. The questionnaire was piloted in Nouakchott in November 2015, for which specific training was carried out for the enumerators responsible for interviewing the households. Questionnaire manuals were developed with detailed instructions for field staff for use during training and over the course of the fieldwork. The household questionnaire is comprised of thematic sections. Specifically, it collected detailed information on household characteristics, including food and

[11] Among the 85 missing households, 18 have a non-finalized version of the questionnaire while 67 have not been interviewed (for instance because they refused to be interviewed, enumerators could not find them, etc.).

non-food consumption; coping strategies, shocks and perception; employment, productivity and credit; and agriculture. Although the data collection was structured around a household survey, the data on labour, education and health status were collected at the individual level. Moreover, in some household activities, like credits and loans, the questionnaire recorded the identification code of the members specifically involved in the activity.

The data collection was realized by employing CAPI technologies, using digital tablets for conducting the interviews. These technologies present many advantages compared to the traditional paper questionnaire: they reduce the time of the interview, limit errors during both interview and data entry phases, and allow for collecting GIS information at the household level. The latter can be used for better localizing the household and studying its exposure to covariate shocks.

For the analysis, quantities of food consumption reported in local units are converted into standard units (kilograms). The quantity of consumption has also been converted to calorie consumption based on calorie conversion factors defined by ONS. The total size of land cultivated and livestock owned by households have been converted to hectares (abbreviated as 'ha') and TLU, respectively. The survey also reported estimated values of total size of land cultivated and livestock owned, as well as for durable assets. All data were aggregated at the household level for the analysis.

The main limitation of the dataset used in this analysis is its cross-sectional format. Indeed the households were interviewed only once, during December 2015. A panel dimension of the dataset would provide causal inference on the determinants of the resilience (FAO, 2016c). On the contrary, the cross-sectional nature of the dataset does not invalidate the descriptive part of the resilience analysis (described in the previous section). Furthermore, a panel dimension would allow the resilience analysis to take into account climatic and crop variability during the year. Indeed, the period of the survey fieldwork during December 2015 coincided with the post-harvest season. Despite the fact that questions on crop production refer to both the last harvest season and the last 12 months in order to take into account seasonality, the food consumption module refers only to the seven-day period preceding the interview. Considering the huge inter-year variability in food security of households located in the Triangle of Hope, a comparison with a survey carried out during a different time of year may offer a more comprehensive picture of the selected area.

Additionally, the data were collected only at the household level by employing a household questionnaire. Additional questionnaires, administrated at a different level, such as community questionnaires, would allow for more precisely surveying the infrastructure available in the different communities.

In order to explore how covariate shocks are associated with the resilience capacity of households located in the Triangle of Hope, two additional datasets have been merged with household dataset using the geographic reference of each household. A climatic dataset (provided by the Ministry of Rural Development) including geo-referenced environmental variables provides the coefficient of rainfall variation[12] by districts. A second dataset, Armed Conflict Location and Event Data Project (ACLED), which provides detailed data on conflict episodes for African countries (Carlsen *et al.*, 2010), is used to build a conflict intensity index,[13] as in Bozzoli *et al.* (2011).

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[12] The coefficient is calculated as the difference between the amount of rainfall registered during 2015 and the long-term average (1981-2010).

[13] The conflict intensity index aggregates all the events of violence that happened in 2015, discounting them by the physical distance between the places where the episode happened and where the interviewed household is located. The square of the distance (d) in degrees between the household and each of the events is estimated. The index is given as $\mathrm{Conf} = \sum_{j=1}^{J} e^{-\alpha(d(yj,i))}$, where α is a distance-discount factor. The index therefore captures the number of ''geographically discounted'' events for each individual. As in Bozzoli *et al.* (2011), $\alpha = 10$.

4 DESCRIPTIVE RESILIENCE ANALYSIS

This section provides the resilience analysis results. Firstly, it describes the analysis of RSM in the regions of the Triangle of Hope, elaborating on the relevance of each pillar in explaining the RCI. Then, it presents the results disaggregated by region, urban status, gender of HH and livelihood, identifying and explaining existing differences in resilience capacity between different profiles of households.

This section presents the results of the resilience analysis in the Triangle of Hope in Mauritania during 2015. First, it analyses the RSM, namely the pillars and variable contribution in determining, respectively, the RCI and the pillars. Then, it presents the analysis of resilience capacity disaggregated by regional location, urban status, gender of HH and livelihood. This section aims to identify the differences in resilience capacity between social groups and to isolate the more relevant pillars, as well as variables determining such disparities. Identifying the socio-economic profiles of the least and the most resilient households is of crucial importance for shaping proper policies aiming to increase resilience capacity.[14]

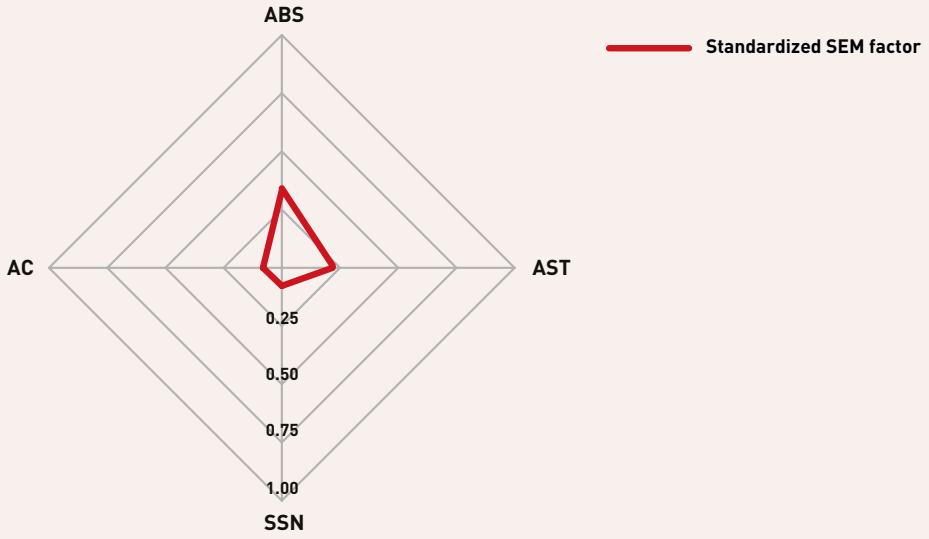
4.1 ANALYSIS AT THE MACRO LEVEL

The most relevant pillar for the Triangle of Hope is ABS, followed by AST. AC and SSN play a more marginal role in determining the RCI.

[14] A note of caution has to be raised with regard to the interpretation of the results. When a pillar and/or a variable are found to be less relevant to the actual resilience capacity level, it does not mean that they may not be relevant in the future and/or are not relevant for resilience in general. When the RIMA analysis is run employing a cross-section dataset, it provides no evidence of resilience dynamics; therefore it only can assess and describe a *status quo*. The descriptive part of RIMA is not intended to be a causal analysis that assesses the determinants of the increase or decrease of resilience and food security. This is provided by a causal analysis, which seeks panel or pseudo panel data.

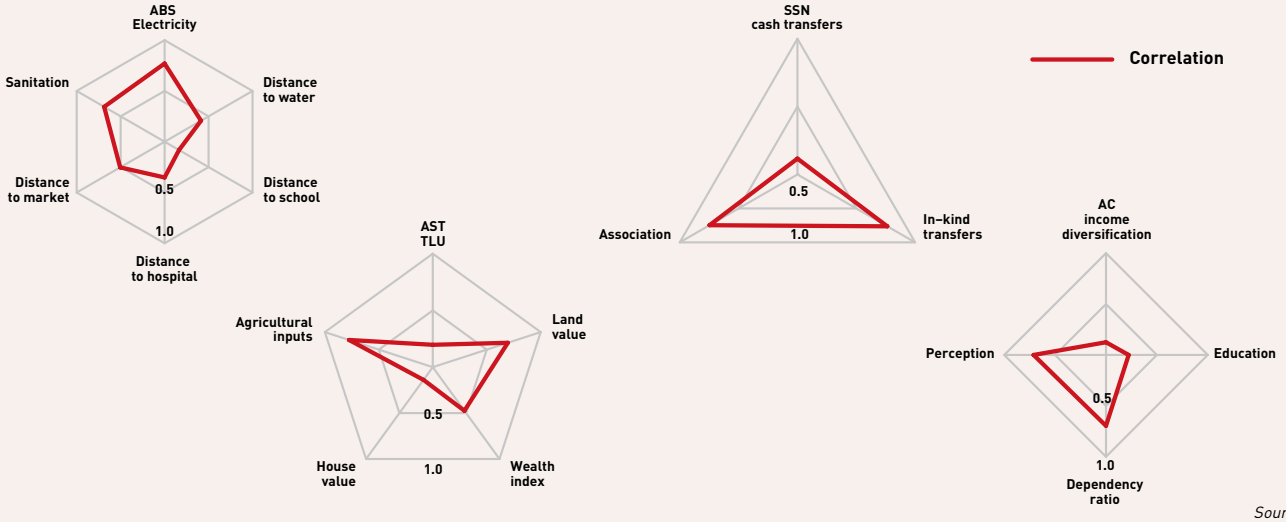
Figure 3 illustrates the pillars' weights with respect to the RCI of households located in the Triangle of Hope.[15] The RSM provides further details on the most relevant variables contributing to each specific pillar (see Figure 4).

Figure 3. **RSM – Loading of factor (SEM) in the Triangle of Hope (2015)**



Source: Author's own calculation

Figure 4. **RSM – Variable weights by pillar in the Triangle of Hope (2015)**



Source: Author's own calculation

[15] The factor loadings of the MIMIC model are reported in Figure 3. Their interpretation is not straightforward. The Betas estimated from the latent variable model cannot be employed for causal inference in the same way as those estimated from a regression model. On the contrary, higher factor loadings explain more than the other the estimated RCI.

Access to electricity and **sanitation** and **distance to market** are the most relevant variables for ABS, the most important pillar of resilience as described above. **Land**, the use of **agricultural inputs** and wealth index are the most relevant variables contributing to AST.

Looking at SSN, which nevertheless shows a limited relevance for resilience – as does AC – the factors contributing most are the receipt of in-kind transfers and the participation in associations on which households rely in case of need. Finally, the dependency ratio and the perception of the decision-making process in the community is of major importance to AC.

In conclusion, the most relevant variables for RCI in the Triangle of Hope are: access to electricity and sanitation, wealth index, and agricultural assets; followed by in-kind transfers, participation in associations, and perception of the decisional process and dependency ratio.

4.2 ANALYSIS AT THE REGIONAL LEVEL

The **four regions of the analysis belong to the cluster of the poorest regions of Mauritania** (ONS, 2015). However, a disaggregated analysis suggests the presence of regional heterogeneity, which shows that **Brakna is the most resilient region** (RCI of 56.3 percent); **Guidimagha is the least resilient region** (34.5 percent); while Assaba and Tagant score a middle-range RCI.

The regional differences between RCIs within the Triangle of Hope are in line with the poverty rate (ONS, 2015) and with the malnutrition rate (Ministry of Health of Mauritania, 2015) reported in other analyses employing different data sources (Figure 5). Among the regions of the Triangle of Hope, Brakna – the most resilient region – is the least poor and has the lowest child malnutrition rate; on the contrary, Guidimagha is not only the least resilient region, but also the poorest and that with highest prevalence of child malnutrition.

Figure 5. **Maps of resilience index, poverty rate and child malnutrition rate in the Triangle of Hope (2015)**

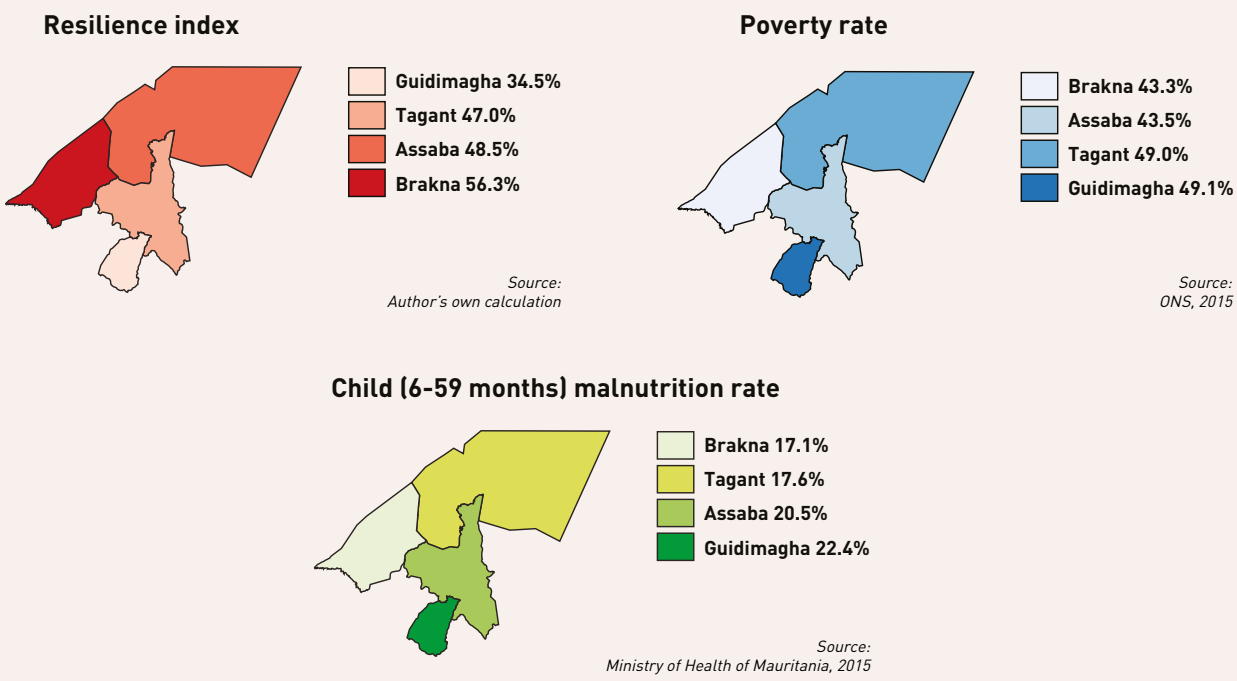
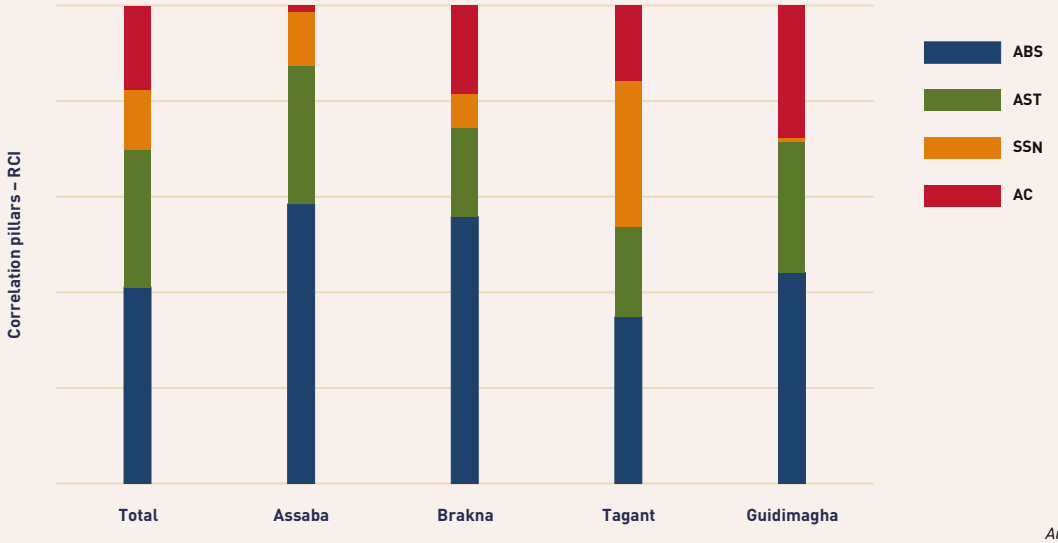


Figure 6 shows the correlation between the pillars and the RCI across regions. It underlines differences in the pillars' relevance according to the regions' resilience capacity.

Figure 6. **RSM - Correlation pillars – RCI over regions**



Source: Author's own calculation

ABS is constantly the most relevant pillar for the four regions, although with infra-regional differences. These differences are mainly explained by different levels of access to services.

Brakna has the highest resilience capacity because it has better access to **infrastructure** and **shorter distances to markets and schools**. Brakna's households seem to participate in **more income-generating activities** than the other regions; they have an average **higher education level**; lastly, they have the greatest degrees of (perceived) **participation in public life and decision-making processes**, meaning that Brakna's people feel part of the decision-making process more than people in any other region (Table A1 of Annex II).

AST plays a relevant role for Assaba and Tagant. Indeed, households located in these regions have a high monetary house value and high TLU per capita (Table A1 of Annex II). Differences exist between Tagant and Assaga with respect to AC; in the former region, this pillar is more relevant than in the latter. Actually, Tagant's households are more **educated** and participate in **more income-generating activities**.

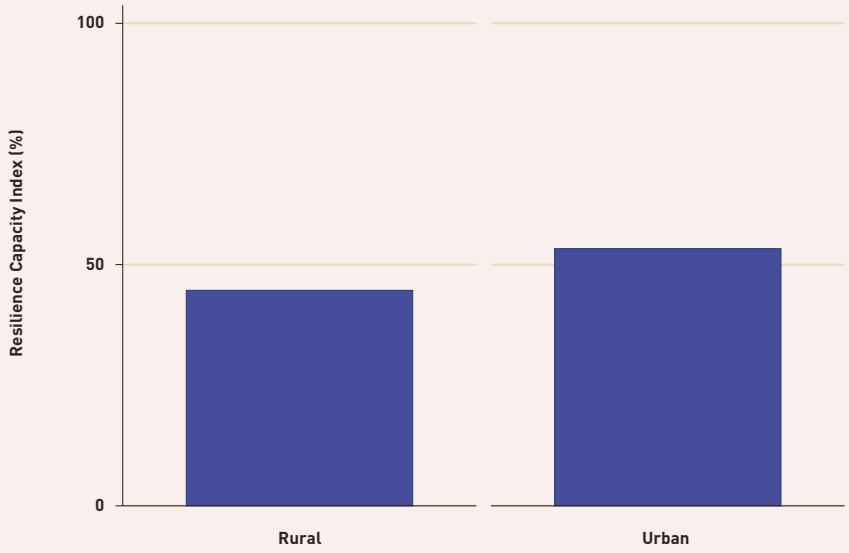
Guidimagha is the least resilient region of the Triangle of Hope because it performs generally worse than all the other regions. Its households show the worst access to basic services (**highest distances to hospitals**, **markets and safe water**). They have a very limited association between SSN and the RCI (supported by the **lowest volume of cash and in-kind transfers and a limited participation in associations**); limited access to **livestock and land**.

Looking at AC, Guidimagha presents the lowest level of formal education and an inverse dependency ratio (active members versus non-active members) compared to the other regions of the Triangle of Hope. On the other hand, households located in these regions have a perception of the decision-making process of their community that suggests they are able to participate (Table A1 of Annex II).

4.3 ANALYSIS BY URBAN STATUS

The majority of the households located in the Triangle of Hope is in rural areas, while only 24 percent of the sample is located in urban areas. **Urban households are more resilient than rural ones**, as shown in Figure 7 representing the average level of RCI by urban and rural households. This result is in line with the level of poverty by urban status in Mauritania; the rate of poverty for rural households is 44.4 percent, while for urban households it is 16.7 percent (ONS, 2015). This positive effect of the urban localization of households can be called the "urban effect", and is consistently demonstrated in almost every resilience analysis performed using the RIMA methodology.

Figure 7. **RCI over urban status in the Triangle of Hope (2015)**



Source: Author's own calculation

The **urban effect is persistent within each region of the Triangle of Hope, with the exception of Tagant**. However, Tagant is almost totally rural. As supported by Table 3,[16] the difference between the mean value of RCI of rural (45.0 percent) and urban (53.6 percent) households is statistically significant both in the macro area of the Triangle of Hope and within each of the four regions, with the exception of Tagant.[17]

The major difference between urban and rural households is reported in **ABS** and **AST**, as shown in Figure 8 (which shows the correlation between pillars and RCI by urban status); ABS is more important for urban than for rural households, while AST is more important for rural.

The **disparities in terms of access to services by urban status is huge** in the surveyed households. While only 2 percent of rural household have access to electricity, the proportion of urban households with electricity access is 38 percent. The same pattern is revealed for access to sanitation: 50 percent in rural areas, and 85 percent in urban ones. Furthermore, households in rural areas report greater distances (in minutes) to all the most important basic services: schools, markets and hospitals (Table A2 of Annex II).

[16] The significance of the difference of the RCI mean by urban status is confirmed by the t-test.

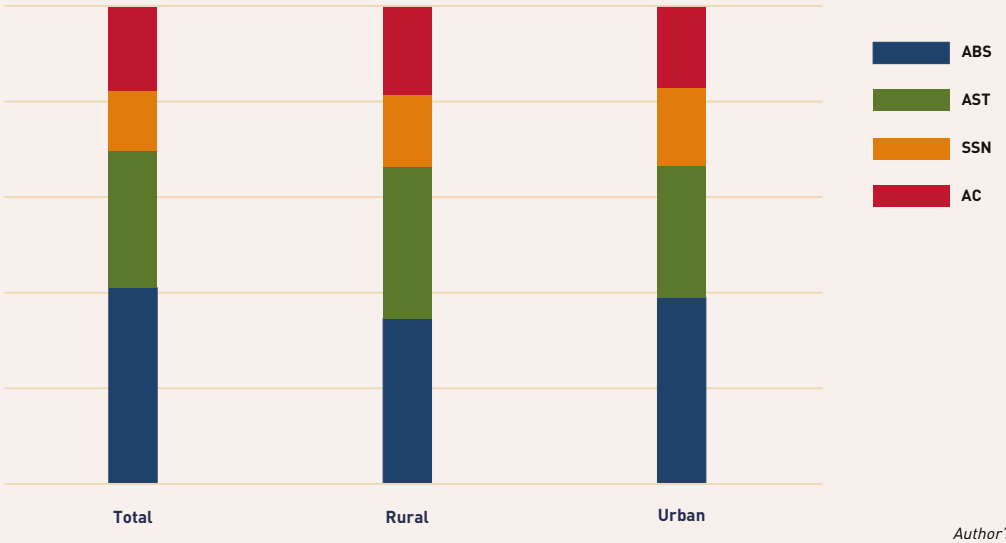
[17] In this case, however, the observations for urban households are not enough to draw statistically valid conclusions.

Table 3. **Resilience capacity over urban status by region**

	Rural		Urban		Difference RCI rural-urban
	# Obs	RCI mean	# Obs	RCI mean	
Macro level	1 152	45.01	363	53.62	-8.61***
Assaba	362	46.63	134	53.41	-6.78***
Brakna	364	54.73	114	61.37	-6.64***
Tagant	117	46.26	20	51.28	-5.01
Guidimagha	309	31.20	95	45.12	-13.91***

*** P-value of t-test < 0.01

Figure 8. **RSM - Correlation pillars – RCI by urban status in the Triangle of Hope (2015)**



Source: Author's own calculation

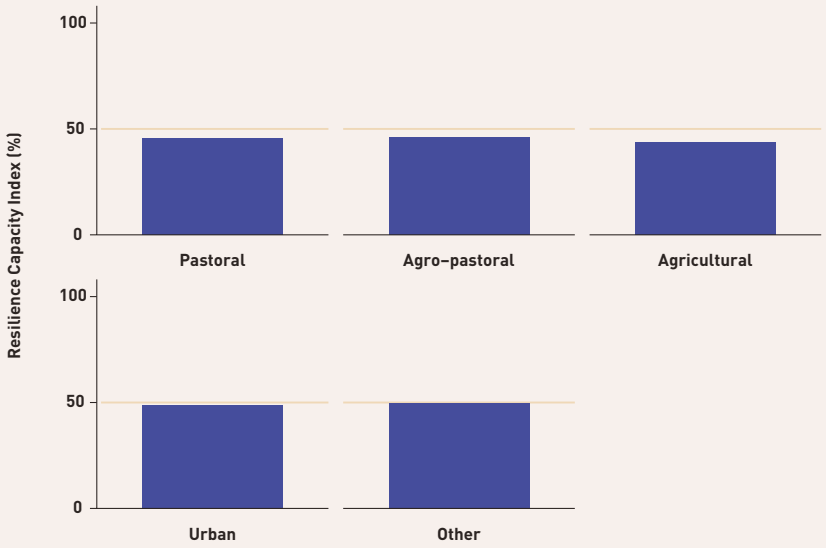
Despite rural households having a greater AST, the asset composition between urban and rural households is, as expected, diversified. Indeed, while rural households have a greater value of owned land, agricultural inputs and TLU, urban households have more non-productive assets, such as house and wealth index (Table A2 of Annex II).

4.4 ANALYSIS BY LIVELIHOOD

A description of the resilience capacity by **livelihoods** and of the livelihoods' distribution by urban localization can help to better understand the differences in resilience capacity between urban and rural households. In the Triangle of Hope there are pastoral, agro-pastoral, farmers, urban and other livelihoods. These classifications are derived from a self-reported answer made by the

HH.[18] As shown in Figure 9, **the most resilient households are those classified as urban** (RCI of 49.2 percent) **and 'other'** (50.1 percent) **while the least resilient are the farmers** (43.9 percent) **households**.[19] While **the latter are mainly** (87 percent) **localized in rural areas**, the households classified as urban or other mainly live in the urban areas of the Triangle of Hope.

Figure 9. **RCI over livelihoods in the Triangle of Hope (2015)**



Source:
Author's own calculation

Households self-classified as other and urban seem to have similar characteristics. They have a greater association between ABS and RCI. Indeed, they report lowest distances (in minutes) to **water sources**, **hospitals** and **markets**, and a high share of households have **access to sanitation** (Table A3 in Annex II).

Differences also emerge in terms of AC, where other and urban households perform better than the remaining livelihoods. They have a high level of formal **education**, and mainly receive **income from wages** of household members (Table A3 in Annex II). In term of AST, they have a high **value of the household** where they live (Table A3 in Annex II).

The high resilience of households classified as other is additionally driven by both the gender of household[20] and the regional effect. Accordingly, they are mainly concentrated in Brakna, the most resilient region, and 33 percent of them have a female head (Table A3 in Annex II).

On the contrary, farmers have low AC, while pastoral households have the second least resilient livelihood. Their average level of education is low, as well as a low share of active members in the household. Furthermore, looking at SSN, farmers receive the lowest amount of both cash and in-kind transfers of all the livelihood categories. Finally, their income is the lowest among those of the different livelihoods (Table A3 in Annex II).

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[18] The question used was the following: "Do you consider your household to be mainly: pastoralist, agro-pastoralist, farming, riverine, fishing, urban or other?". The list of represented livelihoods was agreed upon with enumerators and ONS to ensure specificity to the context of the analysis, during the enumerator training phase of the data collection in November 2015.

[19] The analysis of livelihood is not disaggregated by urban status in order to avoid issues of sampling representativeness.

[20] In the next section of this report, female-headed households are shown to be the more resilient ones.

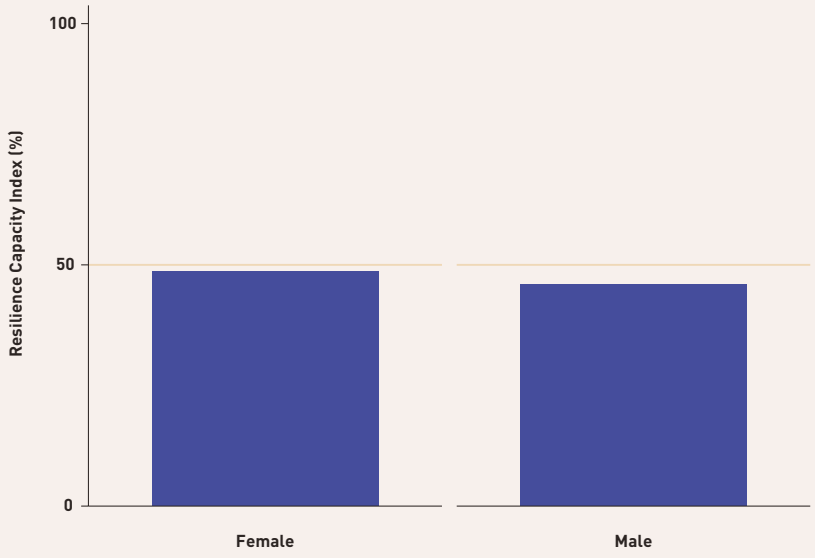
The Government of Mauritania is investing significantly in policies for developing a competitive agricultural sector at the national level. The SDSR - Horizon 2025 demonstrates this, along with the PNDA 2015-2025. The latter targets selected supply chains (such as rice, wheat, traditional cereals and dates) and is aimed, among the different strategic orientations, at the integration of the agricultural sector with national and international markets, the creation of employment opportunities, and the application of technological innovation for the diversification of agricultural production.

According to these results, it seems that households located in rural areas of the Triangle of Hope that depend on agriculture as a unique source of income should be targeted for interventions. These agricultural households rely on rain-fed and oasis agriculture, with limited access to water sources and a deficit of hydraulic infrastructure, such as dams. Projects for developing infrastructure, and increasing education and income for agricultural households are encouraged.

4.5 ANALYSIS BY GENDER OF HOUSEHOLD HEAD

The sample of households in the analysis is mainly composed of households with male heads. The households with female heads represent only 28 percent of the total surveyed households in the Triangle of Hope. **Households with female heads are slightly more resilient than households with male heads**, as shown in Figure 10. The result is in line with the poverty rate at the national level in 2014. Indeed the percentage of poor households with female heads is 27.4 percent, while for male-headed households it is 32.3 percent (ONS, 2015).

Figure 10. **RCI over HH gender in the Triangle of Hope (2015)**



Source: Author's own calculation

However, a further analysis reveals interesting insights. The (very minor) difference between the mean value of the RCI of male and female HHs is statistically significant when comparing the entire sample.[21] However, it is not significant for urban households while it does for rural households and for those who live in Tagant

[21] A *t*-test assesses that the mean RCI difference between female- and male-headed households is statistically significant at the macro level (difference 2.6, p-value 0.012) and for rural households (difference 2.8, p-value 0.016) while it is not for the urban sample (difference 0.1, p-value 0.965).

Table 4. **Resilience capacity over HH gender by region**

	Female		Male		Difference RCI female-male
	# Obs	RCI mean	# Obs	RCI mean	
Macro level	423	48.91	1 083	46.34	2.56**
Assaba	167	47.63	329	48.88	-1.25
Brakna	132	57.58	346	55.83	1.75
Tagant	49	51.13	88	44.69	6.44**
Guidimagha	84	36.52	320	33.94	2.58

** P-value of t-test < 0.05

Given this heterogeneity it seems like the most relevant finding regards the location: most likely, the regional heterogeneity plays a confounding role in explaining differences in resilience capacity.

The presence of a similar level of resilience between female- and male-headed households can be linked to the efficiency of policies implemented by the Government of Mauritania in the Triangle of Hope that target women. As an example, the PASK I 2003-2009 supported income-generating micro-projects, benefiting mainly women and young people. Due to the relevant differences in income level between female- and male-headed households and the dependence of the former on transfers as income source, these policies should be further encouraged.

5 CAUSAL RESILIENCE ANALYSIS

This section provides the results of the causal analysis of resilience. It first explores the effects of shocks on resilience capacity, taking into consideration both self-reported and covariate shocks, harnessing the geographic coordinates of the households' location and additional data sources. Then, it presents the most important factors that correlate with food security.

In this report, the causal part of the RIMA-II methodology focuses on (i) the role of shocks in explaining resilience capacity and (ii) the association between the resilience's contributing factors and food security indicators, used for estimating the RCI in the descriptive resilience analysis. A proper analysis of the determinants of resilience capacity cannot be performed with cross-sectional data, but this type of analysis will be possible in future once panel or pseudo-panel data is collected in the Triangle of Hope.

5.1 THE EFFECTS OF SHOCKS ON RESILIENCE CAPACITY

Households' food security in the Triangle of Hope depends not only on their resilience capacity but also on their exposure to shocks. The latter may affect their resilience capacity and contribute to its reduction, especially in areas prone to geo-climatic shocks.

Furthermore, the subjective well-being may play a role on household food security and resilience capacity. Both subjective and objective measures have their weaknesses and strengths. Only a few studies have compared subjective and objectives measures (Ravallion and Lokshin, 2002; Carletto and Zezza, 2006; Wagle, 2008). A thorough discussion of subjective measures of resilience goes beyond the scope of this analysis; this study only explores the role played by subjective well-being for food security and resilience capacity in the Triangle of Hope.

In further detail, this section aims at testing the association between the RCI estimated through through FA and the MIMIC model as described above (and re-scaled between 0 and 100), on one hand, and shocks and subjective well-being, on the other. To this end, the following empirical model is employed:

$$RCI_i = \alpha + \boldsymbol{\beta S}_i + \gamma W_i + \boldsymbol{\vartheta X}_i + \varepsilon_i \qquad (1)$$

where S_i is a vector of shocks including both idiosyncratic shocks:

- Self-reported shocks experienced by the household during the last year by typology of shocks, namely a vector of dummies reporting whether or not a shock occurred in the household;

and covariate shocks:

- Deviation of the 2015 rainfall from the long-term average (1981-2010) by district.
- Conflict intensity index estimated as in Bozzoli *et al.* (2011).

Additionally, W_i is an index of subjective well-being[22] estimated by employing the perception module of the survey. A greater value of this indicator is associated with a higher level of subjective well-being.

X_i is a vector of household control characteristics, as the urban status or gender of the HH.

The summary statistics of all variables used are in Table A4 of Annex II, while Table 5 shows the results of the effects of shocks on the RCI.[23]

Table 5. **The effects of shocks on resilience capacity**

Shocks	RCI
Rainfall deviation	0.059*** (0.007)
Flood	3.174** (1.426)
Drought	-3.961*** (1.338)
Livestock death	3.890*** (1.220)
Crop failure	-4.901** (2.023)
Clashes	-32.55** (15.00)
Inability to pay loan	-2.635* (1.422)
Fire	18.21*** (6.759)

[22] The index is created through FA. A list of variables that assumes value from 0 (meaning at no time) to 4 (meaning all of the time) is used, depending on whether or not the HH during the last week has felt (1) cheerful and in good spirit; (2) calm and relaxed; (3) active and vigorous; (4) fresh and rested; (5) that his/her life has been filled with interesting things. The possible answers have a slightly different formulation with respect to those employed for the calculation of the World Health Organization (WHO)-5 well-being index. Furthermore, the well-being index used in this a report is calculated through FA instead of summing the results of the five questions, as per the WHO-5 index.

[23] Table 5 is a truncated output. The entire list of regressors employed is reported in table A5 in Annex II

Table 5. **The effects of shocks on resilience capacity (cont.)**

Shocks	RCI
Subjective well-being	
Subjective well-being index	2.289*** (0.412)
HH control characteristics	
Rural	-9.926*** (0.942)
Guidimagha	-18.360*** (1.363)
Constant	59.980*** (1.652)
Observations	1 515
R-squared	0.345

The reference category of the regional dummies is Brakna.
Standard errors in parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.1

Among the covariate shocks, the deviation from the average rainfall is positively associated with the resilience capacity of the households located in the Triangle of Hope. This suggests the presence of a positive influence of favourable climatic conditions on resilience capacity. Indeed in 2015 a positive mean deviation from the long-term average was registered (Table A4 of Annex II). Nevertheless, the rainfall indicator does not take into account intra-year variability, which could be of interest in the context of the analysis. There is another important consideration here – the coefficient of variation from the mean of the rainfall is not necessarily a negative shock indicator; it may well be that higher rainfall might turn to be a positive effect for agriculture.

The coefficient for the conflict intensity index, described in the data section, is not statistically significant. This could be explained by the nature of violent events which took place in Mauritania in 2015, registered in the ACLED dataset. In fact, among the 49 episodes reported by the ACLED in 2015, 73 percent happened in the capital Nouakchott and almost all these event involved riots and protest (85 percent) with one fatality in total. Households located far from the capital have supposedly not been dramatically affected by those events.

Looking at the self-reported shocks, those presenting a negative and statistically significant association with resilience capacity are drought, crop failure, clashes (i.e. an episode of violence) and inability to pay a loan.

The most substantial reduction in resilience capacity is due to the presence of clashes in the area: those who reported clashes in the last 12 months saw their resilience capacity reduced by one third. Two aspects of this finding in particular are worth mentioning. First, this is perfectly in line with the current literature on the relationship between food security and conflicts and between food security and local clashes (FAO, 2000; Fearon and Laitin, 2003; Blattman and Miguel, 2010). Second, given the extent of this reduction in resilience capacity, these findings call for an adequate intervention when further clashes arise that could compromise the stability of an area.

For those households that reported droughts in the last 12 months, the RCI decreases by almost 4 percent. For those that reported crop failure, it reduces by 5 percent. It is worth noticing that,

especially in dryland regions, an intensification of aridity or any other issue involving crops can severely affect coping capacity. People living in Triangle of Hope have being suffering shocks in recent years; this has translated into a reduction of the capacity for resistance, which continues to deteriorate in the case of further negative events. Ultimately, the above-mentioned clearly indicates that in the event of a worsening climatic situation, those households that mainly rely on agriculture and are located in arid areas should be immediately supported.

The inability to pay a loan also reduces resilience capacity. This is adopted as an indicator for the difficulty of access to credit and for the pre-existence of past debt, which tend to create a burden on people's budget availability and management choices. The positive effect of livestock death and flood are counterintuitive. However, they involve only a negligible number of households in the sample and this may bias the estimation.

The literature suggests the existence of a positive association between subjective well-being indicators and objective benefits in terms of health and longevity, income, productivity and organizational behavior, and individual and social behavior (De Neve *et al.*, 2013). Interestingly, the indicator of subjective well-being has a positive and significant association with the resilience capacity. While some degree of reciprocity may affect and bias this estimation, it is still a valid indicator of how a positive approach can have positive effects on resilience.

As expected, the coefficients of the control characteristics are in line with the profiles of the descriptive part of the analysis. All the regions are less resilient than Brakna, the reference category excluded in the specification, and in particular Guidimagha is the least resilient one. Rural households are less resilient, while the gender of the HH does not play a relevant role when urban and regional effects are taken into account. The HH size effect has not been detected. The variables used for the RCI estimation are expressed in per capita terms. Therefore the size effect is taken into account in the estimation of the resilience capacity.

5.2 FOOD SECURITY ANALYSIS

Any resilience analysis has to be indexed to a specific well-being indicator. RIMA-II specifically focuses on food security indicators. The purpose of this section is to explore a static analysis of the food security indicators employed in the descriptive part for estimating the RCI. On the contrary, a proper analysis of the determinants of resilience capacity, based on the inter-temporal evolution of food security indicators, cannot be performed with cross-sectional data.

The following reference specification is adopted for each of the three food security indicators employed in the descriptive part of the analysis:

$$\boldsymbol{FS}_i = \alpha + \boldsymbol{\beta R}_i + \boldsymbol{\delta S}_i + \gamma W_i + \boldsymbol{\vartheta X}_i + \varepsilon_i \qquad (2)$$

$\boldsymbol{FS}_i$ represents alternatively, in three empirical models, (1) food consumption, (2) Simpson DDI,[24] and (3) FCS; $\boldsymbol{R}_i$ is the vector of all observed variables employed for the estimation of the pillars. The shocks, subjective well-being indicators and control characteristics are the same as those in model (1).

As shown in Table 6, the contributing factors most (positively) associated with the different aspects of households' food security are: access to sanitation, distance to markets and hospitals, TLU,

[24] Results in Table 6 are "truncated output" of regression analysis; complete outcomes – which include Simpson DDI – can be found in Table A6 in Annex II.

wealth index, average education, and perception of the decision-making process.

Among them, those jointly relevant for the RSM in the Triangle of Hope – as shown in the descriptive part of the measure – are: **access to sanitation, distances to market, wealth index, and perception on the decisional process. The variables contributing to SSN are confirmed as playing a less relevant role for food security and resilience capacity**.

Table 6. **The correlates of food security**

	(1) Food consumption per capita	(3) FCS
ABS		
Sanitation	-0.021 (0.037)	4.223*** (1.424)
Distance to market	0.184*** (0.047)	3.711** (1.806)
AST		
TLU	0.087*** (0.012)	1.125** (0.475)
Wealth index	0.329*** (0.098)	22.050*** (3.758)
SSN		
Cash transfers	0.022 (0.017)	1.117* (0.605)
AC		
Perception on decisional process	0.052*** (0.012)	1.343*** (0.444)
Shocks		
Drought	-0.041 (0.0544)	-7.133*** (2.085)
Livestock death	0.120** (0.049)	6.175*** (1.896)
Crop failure	-0.326*** (0.083)	-9.604*** (3.184)
Severe illness	-0.134** (0.063)	-1.055 (02.406)
Inability to pay loan	-0.157*** (0.058)	-2.639 (2.217)
Displacement	0.280 (0.306)	-26.470** (11.730)
Fishing failure	0.764* (0.429)	5.338 (16.460)

Table 6. **The correlates of food security (cont.)**

	(1) Food consumption per capita	(3) FCS
Subjective well-being		
Subjective well-being index	0.012 (0.018)	3.009*** (0.675)
HH control characteristics		
Guidimagha	-0.280*** (0.058)	-24.650*** (2.226)
Rural	0.174*** (0.046)	-7.736*** (1.745)
Household size	-0.103*** (0.008)	0.360 (0.325)
Constant	3.545*** (0.171)	43.400*** (6.544)
Observations	1 515	1 515
R-squared	0.331	0.429

The reference category of the regional dummies is Brakna.
The distances in minutes to different services are rescaled to be bound between 0 and 1,
where 0 means no access and 1 the minimum distance to the service.
The monetary values are expressed in logarithm and per capita.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The coefficients of self-reported and covariate shocks are coherent with those of resilience capacity in Table 5, with the exception of Simpson DDI. Interestingly, livestock death and fishing failure increase food expenditure; households that cannot confirm their normal livelihood because of failure or death, can be forced to buy food and, therefore, increase expenses. Severe illness, displacement and inability to pay loan reduce food expenditure because they reduce the capacity of buying food. Similarly, living in large-size households, in rural areas and mostly in Guidimagha is associated with lowest level of food security.

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6 MAIN CONCLUSIONS FROM THE ANALYSIS AND POLICY IMPLICATIONS

This section summarizes the main findings of the resilience analysis implemented using the RIMA-II methodology. It also provides final assessments and delivers relevant implications for policy design and implementation, in comparison with policies currently programmed or implemented by the Government of Mauritania.

This study employs the RIMA-II methodology in order to measure the resilience capacity of households located in the Triangle of Hope. The dataset used in this analysis comes from an ad hoc data collection implemented by FAO and ONS in December 2015. After describing the RSM, the report presents the results of resilience capacity by region, urban status, and gender of HH.

- The most relevant pillar associated with resilience capacity in the Triangle of Hope is ABS, followed by AST. On the other hand, AC and SSN have a marginal relevance. For ABS, having access to electricity and sanitation, as well as the distance to market, play the most important role. In terms of AST, productive assets for agriculture, specifically land and the use of agricultural inputs, and wealth index are the most important contributing variables. Both the descriptive and causal analyses of resilience underline the importance of access to sanitation, distances to market, and wealth index for resilience to food insecurity in the Triangle of Hope. Additionally, the perception of the decision-making process in the community plays a relevant role, even though the role of AC is minor.
- Despite the fact that the four regions of the Triangle of Hope make up a cluster of the poorest regions of Mauritania (ONS, 2015), some heterogeneity in resilience capacity has been found among these regions: Brakna is shown to be the most resilient region, Guidimagha the least resilient, while Assaba and Tagant score a middle-range RCI.
- Urban households are more resilient than rural ones, both in the macro area analysed and within regions.
- Households with female heads are slightly more resilient than households with male heads, but the gender differences in relation to resilience capacity are not present for urban households. Additionally, a regional differentiation between male- and female-headed households may contribute to the resilience differences. In other words, the spatial localization of female-headed households may explain the gender effect.

The results of the resilience analysis show an association between higher resilience capacity of urban households living in the Triangle of Hope and better access to basic services. **Investments in infrastructure for basic services and productive services are encouraged to prioritize rural households**.

The development of the rural sector is considered a key objective of Mauritania's government. Indeed the SDSR 2015-2025 aims to promote the development of the livestock sector and agriculture, local development, management of natural resources, and institutional and legal improvement at the national level. In more detail, the PASK I involves projects for rebuilding roads (83 kilometres of the M'Bout-Soufa stretch of road); rehabilitation and installation of community infrastructure, such as the construction of wells and boreholes; rehabilitation of existing boreholes and reinforcement of the M'Bout dam. Furthermore, the four regions of the Triangle of Hope have been recognized as a specific target in the Politique Nationale de Santé et d'Action Sociale 2005-2015, owing to differences with respect to the national average in terms of mortality, malnutrition and the fertility rate.

In terms of regional differences, the resilience analysis demonstrates that Guidimagha, the least resilient region within the Triangle of Hope, is in a disadvantaged position in terms of access to basic services, formal education and dependence on active household members. Additionally the analysis suggests that in Guidimagha the difference in the RCI between rural and urban households – the RCI being higher in urban areas – is greatest in that region out of all the four regions. Together, these factors indicate that the **rural areas of Guidimagha are a potential target for investments in formal education and income diversification activities**.

One of the main objectives of the ZEP implemented by the Mauritanian Ministry of Education is to reduce differences in both the scholarization rate and quality of education (which is linked to access to other basic services, such as drinking water) between Triangle of Hope regions and the rest of the country. In line with this national plan, the Government of Mauritania is implementing the PASK II 2009-2017, following the PASK I 2003-2009, and involving some rural districts of Guidimagha and Assaba. The main objectives and intervention areas of PASK are reducing rural poverty, proving universal access to basic social services, and supporting institutional development at the local level. Furthermore, this programme covers the rehabilitation and construction of schools. In terms of income, improving and diversifying incomes translates to: support for cooperatives in the form of training, granting of limited quantities of inputs and agricultural implements, and identification and support for income-generating micro-projects.

The resilience analysis over livelihood suggests that **farmer and pastoral households – which are the least resilient livelihoods – should be targeted for projects aimed at developing the agriculture and livestock sectors, with specific attention to geo-climatic variability**.

PNDA 2015-2025 targets selected supply chains (such as rice, wheat, traditional cereals and dates) and is aimed at the integration of the agricultural sector with national and international markets, creation of employment opportunities, and the application of technological innovation for the diversification of agricultural production. Within this national framework, PRAPS 2016-2021 specifically targets the pastoralist and agro-pastoralist households located in all four regions canvassed in the survey. The main objectives of the project are to improve (i) the access to market and production services for pastoralists, and (ii) pastoralists' capacity to cope with crisis involving the pastoral sector. It involves different measures with multiple objectives to:

- improve livestock health: increase the coverage of vaccines against PPR and PPCB, implement a national system for the epidemiological controls, modernize infrastructure for veterinary services;
- improve management of natural resources: diffuse laws and regulations, ameliorate infrastructure and access to water (to improve both the mobility of transhumant livestock

to the frontiers and the condition of the durable pastures) such as through the construction or rehabilitation of hydraulic infrastructures for livestock including drilling, ponds and wells;

- improve access to market for pastoralists: construct or rehabilitate livestock markets close to the borders with Mali and Senegal; plan equipped areas along the principal roads of commercialization; construct centres for milk collection and small-scale dairies; reinforce pastoral professional organizations; and
- manage the pastoral crisis and intervene in emergencies: diversify income sources; offer professional training with the specific target of young pastoralists.

The report underlines that female-headed households are slightly more resilient than male-headed households, yet despite this **income-generating and diversification activities are encouraged for female-headed households**.

This indication goes in line with the PASK II, which pays specific attention to younger and female people living in Guidimagha and Assaba mainly for training and micro-credit projects. In accordance with the results of the analysis, which demonstrates the crucial role of female heads in ensuring a diversified diet, the Mauritanian Ministry of Health – among the measures of the Protocole National de Prise en Charge de la Malnutrition Aiguë – underlines the relevant role of females in education projects for child malnutrition coping practices.

In terms of resilience programming perspective, the situation in the Triangle of Hope requires an integrated livelihoods approach that can address the multisectoral issues being faced by the population in the four districts.

From this analysis, the main programming priorities to strengthen the resilience of livelihoods would be the following:

- food security monitoring information system component to collect, analyse and disseminate food security related information (market and prices monitoring, rainfall information, etc.) to farmers, pastoralists and other stakeholders taking advantage of the strong telecommunication and radio network in the country, as reflected in the analysis. This will be linked to the ongoing work on Cadre Harmonisé / IPC (food security analysis), coordinated by government technical services. If the market monitoring information is timely and reliable, this has a potential to improve access to markets for smallholders;
- provision of productive inputs (e.g., oxen and ploughs, seeds of staple, walking tractors-for sharing among households, high value crops for income generation) and services (extension, training on agronomic practices, agribusiness), to increase agricultural productivity and increase on the asset base of the population;
- increase of rural-urban connectivity with both information provision and infrastructure such as markets and roads, in particular for poor rural farmers and pastoralists to access urban markets, where the purchasing power is higher than in rural areas;
- interventions to improve the sustainable and fair management of renewable natural resources (such as land, pasture, water, trees, etc.) has the potential to decrease the risk of inter- and intra-community clashes and conflicts. Investment in pastoral infrastructure, such as boreholes and wells and rehabilitation of pasture areas, is key to reduce the tensions between farmers and pastoralists. Work on land tenure is also crucial to facilitate equitable access to land for all members of community, as the analysis shows that productive assets (land and livestock in particular) are lower in the less resilient districts;

- a value chain approach can be used for some selected crop and livestock enterprises to create employment and generate incomes and value addition through investment including in processing and transformation. This will contribute towards reducing the poverty level in the districts. Increased incomes will allow the most vulnerable to invest in productive assets and also improve their access to non-productive assets such as housing, telephone, television, radio, etc.;
- provision of multipurpose tree seedlings to individual households and local administrations to establish community forests. This will have a long-term effect positive effect on the environment and the micro-climate of the districts, providing additional copying options in the face of climate variability and the impacts of climate change;
- investments in basic services such as water and sanitation. Health and education should be increased particularly in the less resilient districts, as access to basic services is one of the most relevant factors contributing to the resilience index; and
- interventions to support the diversification of livelihoods and income sources, with both on-farm and off-farm productive activities and services. Projects of this kind are crucial to reduce the effect of seasonality on the higly volatile incomes of the less resilient households. Interventions should aim to reduce the livelihoods risk profile of households (i.e. the combined risk exposure of the different livelihoods sources) and mitigate the negative effects associated with alternative livelihoods strategies such as migration, labour and education.

Finally, the report highlights the relevance of clashes as a destabilizing factor for resilience, as well as the relevance of natural shocks (especially drought and crop failure) in the most arid areas and agriculture-dependent households.

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(All links were checked on May 24th, 2016)

ANNEX I

THE ESTIMATION OF THE RCI

In the first step, FA is used to identify the pillars that contribute to household resilience, starting from observed variables. This variable reduction mechanism relies on finding cross-correlations between the observed variables, identifying number of (unobservable) factors reflected in correlations, and predicting the latent outcome (pillar) as a linear combination of underlying factors. The factors considered for each attribute are those capable of explaining at least 95 percent of the variable variance. In further detail, three factors are retained for all pillars with the exception of SSN, for which two factors capture enough variables' variance.

In the second step, a MIMIC model is estimated. This model, belonging to the class of Structural Equation Model (SEM), is characterized by one underlying latent variable that has multiple indicators as well as multiple causes. In more detail, a system of equations is constructed, specifying the relationships between an unobservable latent variable (RCI), a set of outcome indicators (food security indicators), and a set of attributes (pillars). The MIMIC model is made up of two components, namely the measurement equation (i), reflecting that the observed indicators of food security are imperfect indicators of resilience capacity, and the structural equation (ii), which correlates the estimated attributes to resilience capacity.

$$\begin{bmatrix} Food\ consumption \\ Simpson\ DDI \\ FCS \end{bmatrix} = [\Lambda_1, \Lambda_2, \Lambda_3] \times [RCI] + [\varepsilon_2, \varepsilon_3, \varepsilon_4] \tag{3}$$

$$[RCI] = [\beta_1, \beta_2, \beta_3] \times \begin{bmatrix} ABS \\ AST \\ SSN \\ AC \end{bmatrix} + [\varepsilon_1] \tag{4}$$

In the formative model, the hypothesis is that resilience (RCI) is influenced by the pillars. Formative indicators are assumed to be correlated and to be measured. In the reflective part, the model's reflective indicator errors (ε) are correlated and assumed to contain measurement errors. The MIMIC model permits simultaneous estimation of the measurement model and the incorporation of causal variables in the structural model for the latent variable RCI, which is linearly determined (apart from random errors, ε_1) by formative indicators or pillars, and RCI determines the observed reflective indicators (apart from random errors, ε_2 ε_3 ε_4) (Lester, 2008).

Since the latent variable (RCI) is inherently unobserved, there is no natural scale or unit of measurement. However, in order to represent it, a reference unit must be defined.[25] Therefore, the coefficient (Λ1 loading) of food consumption is not estimated, but it is restricted to unity, meaning that one standard deviation increase in RCI results in a single unit increase in the standard deviations of food consumption. This defines the unit of measure for the other lambda (Λ2, Λ3) and for the variance of food consumption, Simpson DDI and FCS. Given the model above:

$$Food\ consumption = \Lambda_1 RCI + \varepsilon_2 \quad (5)$$

$$Simpson\ DDI = \Lambda_2 RCI + \varepsilon_3 \quad (6)$$

$$FCS = \Lambda_3 RCI + \varepsilon_4 \quad (7)$$

After estimating the RCI, a Min-Max rescaling is employed. Accordingly, the index value range between 0 and 100. The adopted transformation is the following:

$$RCI_h^* = \frac{(RCI_h - RCI_{min})}{(RCI_{max}\ \ RCI_{min})} * 100 \quad (8)$$

where RCI_h is the estimated index for household h.

[25] Automatically, from the statistical software employed (Stata).

ANNEX II

Table A1. **Observed variables – Descriptive statistics for the macro area and by region in the Triangle of Hope (2015)**

	Macro area	Assaba	Brakna	Tagant	Guidimagha
ABS					
Electricity	0.115	0.141	0.121	0.088	0.084
Distance to water source (min.)	17.252	12.840	15.662	9.964	27.022
Distance to school (min.)	11.756	12.749	12.445	8.940	10.847
Distance to hospital (min.)	72.411	66.044	51.331	39.873	93.778
Distance to market (min.)	36.714	38.078	21.027	24.649	55.826
Sanitation	0.587	0.522	0.722	0.504	0.535
AST					
TLU per capita	0.623	0.819	0.632	0.860	0.291
Cultivated land value per capita	34.030	33.419	38.439	45.755	25.586
Wealth index	0.490	0.437	0.576	0.533	0.440
House value per capita	453.303	590.231	400.713	540.390	317.546
Agricultural inputs	0.098	0.067	0.192	0.102	0.025
SSN					
Received cash transfers per capita	6.311	11.320	5.485	4.134	1.876
Received in kind transfers per capita	0.293	0.170	0.269	1.594	0.031
Participation in association	0.139	0.111	0.195	0.139	0.109
AC					
Income participation index	0.301	0.231	0.412	0.362	0.237
Average (formal) education	3.284	3.486	3.659	4.620	2.138
Dependecy ratio inverse (actives/ not-actives)	1.727	1.833	1.855	1.602	1.488
Perception of decisional process	1.721	1.538	1.787	1.321	2.005
Food security indicators					
Food consumption per capita	46.333	45.427	52.606	61.980	34.716
Simpson DDI	0.576	0.585	0.598	0.549	0.548
FCS	75.677	78.198	90.568	73.281	55.777
Additional variables					
Subjective well-being	0.000	0.329	-0.189	0.210	-0.251
Total year income USD	1 086.412	1 200.513	1 373.153	1 037.929	622.359

Table A1. **Observed variables – Descriptive statistics for the macro area and by region in the Triangle of Hope (2015) (cont.)**

	Macro area	Assaba	Brakna	Tagant	Guidimagha
Income sources					
Income - agriculture	0.283	0.173	0.345	0.285	0.342
Income - wage	0.478	0.464	0.584	0.518	0.357
Income - fish	0.003	0.000	0.008	0.000	0.000
Income - livestock product	0.020	0.016	0.008	0.044	0.032
Income - livestock sale	0.191	0.198	0.270	0.226	0.077
Income - enterprise	0.118	0.157	0.105	0.022	0.119
Income - other income	0.038	0.026	0.021	0.029	0.077
Income - transfers	0.289	0.266	0.418	0.350	0.144
Male HH head	0.715	0.663	0.724	0.642	0.792
Household size	7.362	6.204	7.245	6.197	9.317
Rural	0.760	0.730	0.762	0.854	0.765
Observations	1 515	496	478	137	404

Note: all monetary values are expressed in US dollars and per capita terms. Food consumption, the value of transfers and income are expressed in monthly values. Income is the sum of all wages of household members; sales of crop, livestock, and their products; other income sources (such as rent); earnings from enterprises; discounted by the value of bought inputs and paid labour force.

The land value is reported only for households involved in farming activity that are 292.

Table A2. **Observed variables – Descriptive statistics by urban status and by gender of HH in the Triangle of Hope (2015)**

	Macro area	Rural	Urban	Male	Female
ABS					
Electricity	0.115	0.029	0.388	0.105	0.139
Distance to water source (min.)	17.252	19.074	11.470	18.136	15.037
Distance to school (min.)	11.756	11.371	12.920	11.916	11.362
Distance to hospital (min.)	72.411	84.153	47.939	73.058	70.691
Distance to market (min.)	36.714	40.994	26.936	37.311	35.270
Sanitation	0.587	0.502	0.857	0.575	0.616
AST					
TLU per capita	0.623	0.719	0.318	0.664	0.519
Cultivated land value per capita	34.030	41.162	11.394	33.657	34.964
Wealth index	0.490	0.485	0.506	0.497	0.472
House value per capita	453.303	369.117	720.237	413.879	552.045
Agricultural inputs	0.098	0.120	0.030	0.104	0.083
SSN					
Received cash transfers per capita	6.311	6.023	7.223	5.296	8.856
Received in kind transfers per capita	0.293	0.368	0.056	0.064	0.867
Participation in associations	0.139	0.154	0.094	0.135	0.150
AC					
Income participation index	0.301	0.349	0.149	0.301	0.302
Average (formal) education	3.284	3.086	3.912	3.092	3.764
Dependency ratio inverse (actives/ non-actives)	1.727	1.669	1.910	1.685	1.833
Perception of decisional process	1.721	1.777	1.545	1.823	1.468
Food security indicators					
Food consumption per capita	46.333	48.490	39.486	46.184	46.705
Simpson DDI	0.576	0.575	0.579	0.576	0.576
FCS	75.677	72.484	85.811	74.491	78.652
Additional variables					
Subjective well-being	0.000	0.015	-0.047	-0.002	0.005
Total year income USD	1 086.412	1 008.651	1 332.979	1 243.159	693.820
Income sources					
Income - agriculture	0.283	0.341	0.099	0.313	0.206
Income - wage	0.478	0.457	0.545	0.521	0.370
Income - fish	0.003	0.003	0.000	0.004	0.000
Income - livestock product	0.020	0.025	0.006	0.022	0.016
Income - livestocksale	0.191	0.215	0.113	0.207	0.150
Income - enterprise	0.118	0.096	0.190	0.116	0.123
Income - other income	0.038	0.034	0.052	0.041	0.032
Income - transfers	0.289	0.311	0.220	0.246	0.398
Income - enterprise	0.118	0.096	0.190	0.116	0.123
Income - other income	0.038	0.034	0.052	0.041	0.032
Income - transfers	0.289	0.311	0.220	0.246	0.398

Table A2. **Observed variables – Descriptive statistics by urban status and by gender of HH in the Triangle of Hope (2015) (cont.)**

	Macro area	Rural	Urban	Male	Female
Income sources					
Male HH head	0.715	0.729	0.669		
Household size	7.362	7.328	7.468	7.810	6.238
Rural	0.760			0.776	0.722
Assaba	0.327	0.314	0.369	0.304	0.387
Brakna	0.316	0.316	0.314	0.319	0.306
Tagant	0.090	0.102	0.055	0.081	0.113
Guidimagha	0.267	0.268	0.262	0.295	0.194
Observations	1 515	1 152	363	1 083	432

Note: all monetary values are expressed in US dollars and per capita terms. Food consumption, the value of transfers and income are expressed in monthly values. Income is the sum of all wages of household members; sales of crop, livestock, and their products; other income sources (such as rent); earnings from enterprises; discounted by the value of bought inputs and paid labour force.

Table A3. **Observed variables – Descriptive statistics by livelihood in the Triangle of Hope (2015)**

	Macro area	Pastoral	Agro-pastoral	Farmers	Urban	Other
ABS						
Electricity	0.115	0.046	0.036	0.040	0.285	0.093
Distance to water source (min.)	17.252	16.913	19.730	23.305	12.228	17.220
Distance to school (min.)	11.756	13.642	11.450	11.957	11.950	7.814
Distance to hospital (min.)	72.411	82.438	76.845	88.705	62.623	42.317
Distance to market (min.)	36.714	47.048	37.964	46.252	32.664	13.939
Sanitation	0.587	0.643	0.470	0.542	0.697	0.602
AST						
TLU per capita	0.623	1.103	0.766	0.435	0.205	0.7043
Cultivated land value per capita	34.030	6.751	62.029	54.231	7.549	49.5030
Wealth index	0.490	0.460	0.502	0.505	0.483	0.5167
House value per capita	453.303	399.235	251.877	368.526	725.658	545.2647
Agricultural inputs	0.098	0.018	0.183	0.119	0.021	0.1949
SSN						
Received cash transfers per capita	6.311	6.727	6.437	1.467	7.347	8.189
Received in kind transfers per capita	0.293	0.267	0.284	0.044	0.463	0.134
Participation in associations	0.139	0.088	0.213	0.147	0.103	0.076
AC						
Income participation index	0.301	0.209	0.457	0.456	0.103	0.373
Average (formal) education	3.284	3.158	2.929	2.590	3.892	3.858
Dependency ratio inverse (actives/non-actives)	1.727	1.719	1.760	1.602	1.768	1.641
Perception of decisional process	1.721	1.558	1.600	1.949	1.551	2.915
Food security indicators						
Food consumption per capita	46.333	47.212	51.849	46.137	38.908	48.856
Simpson DDI	0.576	0.605	0.592	0.536	0.574	0.506
FCS	75.677	73.740	73.934	71.065	79.294	81.144
Additional variables						
Subjective well-being	0.000	0.012	0.031	0.001	-0.003	-0.153
Total year income USD	1 086.412	1 035.789	1 259.021	811.033	1 070.211	954.159
Income sources						
Income - agriculture	0.283	0.060	0.499	0.599	0.055	0.280
Income - wage	0.478	0.389	0.507	0.418	0.510	0.542
Income - fish	0.003	0.000	0.008	0.000	0.000	0.000
Income - livestock product	0.020	0.049	0.024	0.011	0.002	0.017
Income - livestock sale	0.191	0.247	0.276	0.158	0.062	0.229
Income - enterprise	0.118	0.117	0.072	0.096	0.207	0.017
Income - other income	0.038	0.071	0.020	0.056	0.036	0.017
Income - transfers	0.289	0.272	0.340	0.316	0.205	0.390

Table A3. **Observed variables – Descriptive statistics by livelihood in the Triangle of Hope (2015) (cont.)**

	Macro area	Pastoral	Agro-pastoral	Farmers	Urban	Other
Income sources						
Male HH head	0.715	0.693	0.751	0.746	0.688	0.669
Household size	7.362	6.576	7.781	8.763	6.977	6.805
Rural	0.760	0.859	0.954	0.819	0.431	0.847
Assaba	0.327	0.399	0.291	0.175	0.403	0.254
Brakna	0.316	0.357	0.345	0.384	0.175	0.508
Tagant	0.090	0.067	0.122	0.023	0.066	0.203
Guidimagha	0.267	0.177	0.241	0.418	0.355	0.034
Observations	1 515	283	498	177	439	118

Note: all monetary values are expressed in US dollars and per capita terms. Food consumption, the value of transfers and income are expressed in monthly values. Income is the sum of all wages of household members; sales of crop, livestock, and their products; other income sources (such as rent); earnings from enterprises; discounted by the value of bought inputs and paid labour force.

Table A4 **Descriptive statistics of covariate and idiosyncratic shocks in the Triangle of Hope (2015)**

Variable	Mean	Std. Dev.	Min	Max
RCI	46.739	18.142	0	100
Food security indicators				
Food consumption per capita	3.612	0.711	1.203	5.399
Simpson DDI	0.576	0.123	0	1
FCS	75.677	29.540	0	163
Subjective well-being	0.000	1.043	-2.770	1.283
Covariate shocks				
Rainfall variability	41.901	73.903	-42.2	191
Conflict intensity index	0.142	0.895	0	33.666
Idiosyncratic shocks				
Flood	0.110	0.313	0	1
Drought	0.288	0.453	0	1
Crop disease	0.017	0.130	0	1
Livestock death	0.316	0.465	0	1
Business failure	0.013	0.111	0	1
High food prices	0.135	0.341	0	1
High input prices	0.026	0.158	0	1
Severe water shortage	0.068	0.252	0	1
Crop failure	0.053	0.224	0	1
Loss of land	0.002	0.044	0	1
Accident	0.004	0.063	0	1
Severe illness	0.081	0.272	0	1
Clashes	0.001	0.026	0	1
Death of main earners	0.012	0.108	0	1
Inability to pay loan	0.135	0.341	0	1
Displacement	0.003	0.051	0	1
Storm	0.001	0.036	0	1
Crop damage after storage	0.002	0.044	0	1
Job loss / no salary	0.007	0.081	0	1
Fire	0.003	0.057	0	1
Fishing failure	0.001	0.036	0	1
Household control characteristics				
Assaba	0.327	0.469	0	1
Brakna	0.316	0.465	0	1
Tagant	0.090	0.287	0	1
Guidimagha	0.267	0.442	0	1
Rural	0.760	0.427	0	1
Male HH	0.715	0.452	0	1
Household size	7.362	4.362	1	51
Squared household size	73.207	144.561	1	2601
Observations	1 515			

Note: all monetary values are expressed in US dollars and per capita terms. Food consumption, the value of transfers and income are expressed in monthly values. Income is the sum of all wages of household members; sales of crop, livestock, and their products; other income sources (such as rent); earnings from enterprises; discounted by the value of bought inputs and paid labour force.

Table A5. **The effects of shocks on resilience capacity**

Shocks	RCI
Rainfall deviation	0.059*** (0.007)
Conflict intensity index	-0.388 (0.435)
Flood	3.174** (1.426)
Drought	-3.961*** (1.338)
Crop disease	-4.177 (3.238)
Livestock death	3.890*** (1.220)
Business failure	2.734 (3.479)
High food prices	0.659 (1.512)
High input prices	-2.221 (2.804)
Severe water shortage	-2.670 (1.777)
Crop failure	-4.901** (2.023)
Loss of land	12.790 (9.030)
Accident	2.792 (6.267)
Severe illness	0.841 (1.548)
Clashes	-32.55** (15.00)
Death of main earners	-0.426 (3.649)
Inability to pay loan	-2.635* (1.422)
Displacement	-3.794 (7.611)
Storm	0.064 (10.520)
Crop damage after storage	-6.294 (8.839)
Job loss / no salary	-4.299 (4.789)

Table A5. **The effects of shocks on resilience capacity (cont.)**

Shocks	RCI
Fire	18.21*** (6.759)
Fishing failure	6.611 (10.71)
Subjective well-being	
Subjective well-being index	2.289*** (0.412)
HH control characteristics	
Rural	-9.926*** (0.942)
Male HH	-0.422 (0.888)
Household size	0.059 (0.199)
Squared household size	0.005 (0.006)
Assaba	-9.320*** (1.149)
Tagant	-4.253** (1.762)
Guidimagha	-18.360*** (1.363)
Constant	59.980*** (1.652)
Observations	1 515
R-squared	0.345

The reference category of the regional dummies is Brakna.
Standard errors in parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.1

Table A6. **The correlates of food security**

	(1) Food consumption per capita	(2) Simpson DDI	(3) FCS
ABS			
Electricity	0.067 (0.058)	0.019* (0.012)	2.999 (2.215)
Sanitation	-0.021 (0.037)	0.028*** (0.007)	4.223*** (1.424)
Distance to water source	0.275* (0.147)	0.016 (0.029)	8.195 (5.651)
Distance to school	-0.138** (0.064)	-0.008 (0.013)	2.572 (2.438)
Distance to hospital	0.006 (0.041)	-0.001 (0.008)	7.562*** (01.579)
Distance to market	0.184*** (0.047)	0.004 (0.009)	3.711** (1.806)
AST			
TLU	0.087*** (0.012)	0.008*** (0.002)	1.125** (0.475)
Cultivated land value	0.016 (0.011)	0.0008 (0.002)	0.032 (0.428)
Wealth index	0.329*** (0.098)	0.017 (0.020)	22.050*** (3.758)
House value	0.007 (0.013)	-0.004* (0.003)	1.313*** (0.494)
Agricultural inputs	-0.179*** (0.064)	-0.018 (0.013)	1.316 (2.445)
SSN			
Cash transfers	0.022 (0.017)	0.006* (0.003)	1.117* (0.605)
In-kind transfers	0.062 (0.048)	0.017* (0.009)	1.601 (1.828)
Participation in associations	0.004 (0.049)	0.013 (0.010)	-2.075 (1.895)
AC			
Income diversification	0.118 (0.074)	-0.029** (0.015)	0.412 (2.853)
Average education	-0.0005 (0.0066)	0.0008 (0.0013)	1.156*** (0.254)
Dependency ratio	0.008 (0.009)	0.001 (0.002)	-0.258 (0.350)
Perception on decisional process	0.052*** (0.012)	-0.005** (0.002)	1.343*** (0.444)

Table A6. **The correlates of food security (cont.)**

	(1) Food consumption per capita	(2) Simpson DDI	(3) FCS
Shocks			
Rainfall variation	-0.0001 (0.0003)	0.00001 (0.00006)	0.086*** (0.012)
Conflict intensity index	0.038** (0.018)	0.006* (0.003)	-0.873 (0.673)
Flood	0.005 (0.059)	0.009 (0.012)	6.105*** (2.264)
Drought	-0.041 (0.0544)	-0.00009 (0.0108)	-7.133*** (2.085)
Crop disease	0.219* (0.131)	0.017 (0.026)	1.421 (5.012)
Livestock death	0.120** (0.049)	-0.00794 (0.010)	6.175*** (1.896)
Business failure	0.166 (0.141)	0.024 (0.028)	-7.291 (5.409)
High food prices	0.086 (0.062)	0.0174 (0.012)	5.403** (2.384)
High input prices	-0.004 (0.114)	0.011 (0.023)	-4.050 (4.353)
Severe water shortage	-0.097 (0.072)	-0.002 -0.014	-4.863* (2.753)
Crop failure	-0.326*** (0.083)	0.002 (0.017)	-9.604*** (3.184)
Loss of land	0.052 (0.364)	-0.054 (0.072)	7.226 (13.950)
Accident	-0.280 (0.252)	-0.027 (0.050)	3.385 (09.668)
Severe illness	-0.134** (0.063)	-0.022* (0.013)	-1.055 (02.406)
Clashes	0.094 (0.603)	-0.188 (0.120)	-34.170 (23.110)
Death of main earners	0.131 (0.146)	0.023 (0.029)	0.201 (5.615)
Inability to pay loan	-0.157*** (0.058)	-0.022* (0.012)	-2.639 (2.217)
Displacement	0.280 (0.306)	0.057 (0.061)	-26.470** (11.730)

Table A6. **The correlates of food security (cont.)**

	(1) Food consumption per capita	(2) Simpson DDI	(3) FCS
Storm	0.176 (0.422)	-0.161* (0.084)	18.390 (16.190)
Crop damage after storage	0.237 (0.355)	0.038 (0.071)	-7.036 (13.600)
Job loss / no salary	0.053 (0.193)	0.019 (0.038)	-2.876 (7.391)
Fire	0.378 (0.270)	0.005 (0.054)	27.20*** (10.360)
Fishing failure	0.764* (0.429)	0.066 (0.086)	5.338 (16.460)
Subjective well-being			
Subjective well-being index	0.012 (0.018)	-0.017*** (0.004)	3.009*** (0.675)
HH control characteristics			
Assaba	-0.238*** (0.050)	-0.006 (0.010)	-11.270*** (1.904)
Tagant	-0.026 (0.074)	-0.044*** (0.015)	-10.080*** (2.832)
Guidimagha	-0.280*** (0.058)	-0.037*** (0.012)	-24.650*** (2.226)
Rural	0.174*** (0.046)	0.019** (0.009)	-7.736*** (1.745)
Male HH	0.083** (0.037)	0.010 (0.007)	-0.737 (1.404)
Household size	-0.103*** (0.008)	-0.003* (0.002)	0.360 (0.325)
Squared household size	0.002*** (0.0002)	0.0001 (0.00005)	-0.0002 (0.009)
Constant	3.545*** (0.171)	0.576*** (0.034)	43.400*** (6.544)
Observations	1 515	1 515	1 515
R-squared	0.331	0.105	0.429

The reference category of the regional dummies is Brakna.
The distances in minutes to different services are rescaled to be bound between 0 and 1, where 0 means no access and 1 the minimum distance to the service.
The monetary values are expressed in logarithm and per capita.
Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

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This report is part of a series of country level analyses prepared by the FAO Resilience Analysis and Policies (RAP) team. The series aims at providing programming and policy guidance to policy makers, practitioners, UN agencies, NGO and other stakeholders by identifying the key factors that contribute to the resilience of households in food insecure countries and regions. The analysis is largely based on the use of the FAO Resilience Index Measurement and Analysis (RIMA) tool. Latent variable models and regression analysis have been adopted. Findings are integrated with geo-spatial variables.

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