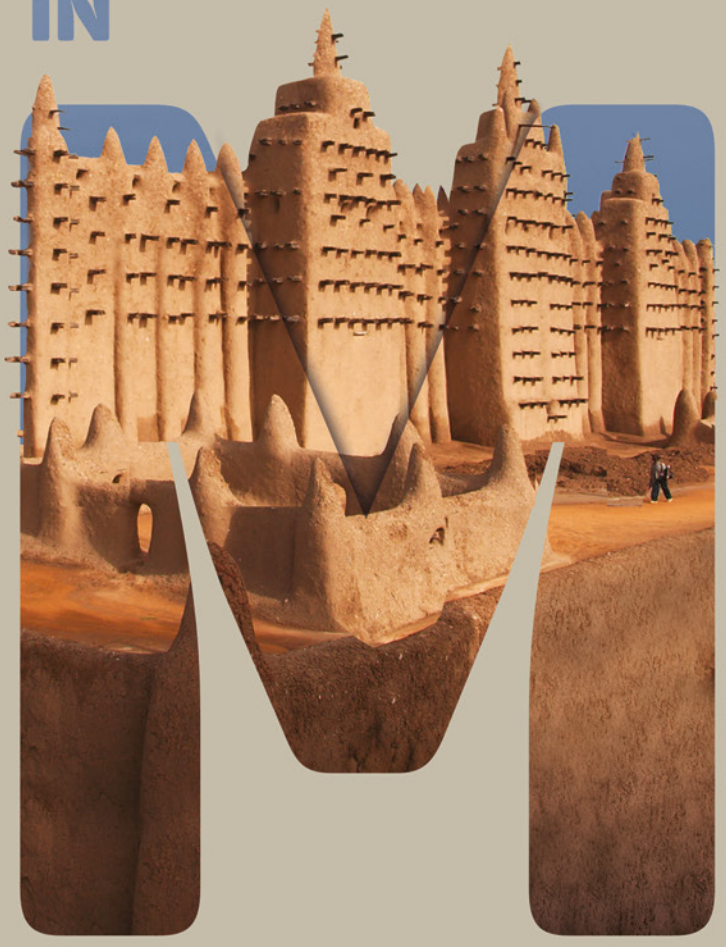
Food and Agriculture Organization of the United Nations

ANALYSING RESILIENCE FOR BETTER TARGETING AND ACTION

FAO RESILIENCE ANALYSIS No. 4

RESILIENCE ANALYSIS IN MALI



2009/2010

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RESILIENCE ANALYSIS IN MALI 2009/2010

Food and Agriculture Organization of the United Nations
Rome, 2015

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ACRONYMS

ABS	Access to Basic Services
AC	Adaptive Capacity
AGIR	Global Alliance for Resilience
AST	Assets
ELIM	*Enquête Légère Intégrée auprès des Ménages*
ESIP	Education Sector and Investment Program
EU	European Union
FA	Factor analysis
FAO	Food and Agricultural Organization of the United Nations
FHH	Female-headed household
GPRSP	Growth and Poverty Reduction Strategy Paper
HH	Household
HHH	Household head
IFA	Income and Food Access
IMF	International Monetary Fund
INSTAT	National Institute of Statistics (Mali)
MHH	Male-headed household
MICS	Multiple Indicator Cluster Survey
NRP	National Resilience Priorities
PCDA	Agricultural Competitiveness and Diversification Project
RAP	Resilience Analysis and Policies team
RIMA	Resilience Index Measurement and Analysis
S	Sensitivity
SEM	Structural equation model
SSN	Social Safety Nets
TLU	Tropical livestock units
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
WB	World Bank
WHO	World Health Organization

EXECUTIVE SUMMARY

Mali is the largest landlocked country in the Sahel region of West Africa. Although between 2000 and 2010 Mali has enjoyed sustained economic growth and significant decline in poverty rate[1] (World Bank, 2013), since 2010 Mali has been hit by a mix of external and internal shocks. Among the external ones, the crisis in Libya, the rise of food and oil prices on international markets and the economic and political crisis in Côte d'Ivoire increased the vulnerability of the population of Mali. Internally, the invasion of north Mali by insurgent groups and a coup against the President Touré caused a major socio-political crisis and security deterioration in the country in March 2012.

Against this background, it is important to ensure a greater capacity of households to deal with recurrent and often complex shocks. In order to enable better thought-out interventions, the present analysis aims at examining the resilience of people for a better understanding of the root causes of vulnerability of affected populations.

This report identifies the key pillars of resilience and related contributing factors at household level in Mali using the FAO Resilience Index Measurement and Analysis (RIMA) model. The study estimates the Resilience Index for Mali using the FAO RIMA methodology. This model allows the identification of different dimensions of household resilience. In the case of Mali, the dimensions are limited to Access to Basic Services (ABS), Assets (AST), Sensitivity (S) and Adaptive Capacity (AC), due to data constraint. The data employed for the analysis are from the Multiple Indicator Cluster Survey (MICS) and the *Enquête Légère Intégrée auprès des Ménages* (ELIM), 2009/10, which are, despite their limitations, the latest available for Mali.

RIMA methodology can be used for resilience oriented policy recommendations as well as to assess the relevance and contribution to resilience of policies adopted in response to crises. This report examines the resilience structure and the differences in the resilience capacity of specific groups: between rural and urban households, between regions and between female-and male-headed households. The aim of this analysis is to detect heterogeneity in resilience capacity among households with different profiles. Consequently it sheds a light on the drivers of resilience on which to target specific policies.

- The resilience analysis in Mali can be used as baseline to: critically review the different policies and resilience-building initiatives being endorsed, promoted and implemented by the Government of Mali with the support of major stakeholders.
- Assess the evolution of resilience capacity over the years.

[1] Decline in poverty rate from 55.6 percent in 2001 to 43.6 percent in 2009/10 (World Bank, 2013).

KEY HIGHLIGHTS

1. The pillars which appear to be most closely associated with Resilience Index are **ABS** and **AST**, followed by **AC**. S represents the least correlated pillar with the index.
2. **A sizable difference in resilience capacity is noted between urban and rural households**. Urban regions, the most resilient, appear to score significantly better in terms of all relevant pillars, ABS, AST and AC. Indeed, rural households not only have major constraints in access to basic services, in particular water, electricity and toilet facility, but they also mainly depend on agriculture. Furthermore, they register much lower educational attainment and health status which undermine their AC and S.
3. The analysis also presents evidence on the disparities in resilience capacity between regions. **The country can be divided along a north-south axis: the southern regions are the most resilient**. Among them, the capital district Bamako shows the highest resilience capacity. On the contrary, the northern areas, extended into the Sahara and Sahel, are the less resilient regions of the country. The resilience capacity of the population living in the north of the country has been additionally stressed out by the invasion of the insurgent groups in 2012.
4. **Female-headed households (FHH) are only slightly more resilient than male-headed households (MHH)**. MHH tend to be richer in terms of AST. However, the difference in resilience structure is mainly driven by S with FHH being less exposed to shocks. Moreover, households with female heads ensures to their members greater ABS, mainly water, electricity and toilet facility. In terms of AC, FHH ensure greater level of education to their members.
5. **Summing up, the analysis shows that geographical differences (north and south, rural and urban settings), are associated with differences in resilience capacity and structure of households**. The disparities between north and south have been exacerbated by the deterioration of the security situation and the major socio-political crisis after 2012. Among others, lack of adequate infrastructure and basic services remains a chronic problem affecting the population, mainly in rural areas.

POLICY IMPLICATIONS

The main findings from the resilience analysis are analysed in relation to the policy initiatives recently adopted by the Government of Mali. Before the institutional and security crisis of 2012, the country has adopted the **Growth and Poverty Reduction Strategy Paper (GPRSP) III (IMF, 2013)** for the period 2012-2017 with the aim of reducing poverty and fostering country's economic growth. Government's plans are ambitious and cover social sector, employment, vocational training, rural development, transports, income generating activities and transparency in the management of public finance (IMF, 2013). Among these priorities, strong commitment to enhance access to basic social services and the development of the rural/agricultural sector is clearly within the Government agenda. The need to focus on these sectors is strongly suggested by the findings of the RIMA analysis. However, the deterioration of the security situation after 2012 has affected the country's capacity to implement its agenda immediately after the adoption of the GPRSP III in 2011. Recent post-crisis data sets should provide the empirical evidence demonstrating progresses.

Significant alignment is noted between the measures planned under the framework of the Global Alliance for Resilience (AGIR) initiative and the main findings of the analysis. Consistently with the plan of action of the **National Resilience Priorities** (NRP-2015-19), the results of resilience analysis show the need to focus on the social and the agricultural sectors. Evidence suggests that considerable efforts should be placed to the development of rural areas specifically to improve rural households' access to quality facilities such as potable water. In addition emphasis should be placed on expanding coverage of the health care and schooling systems in those disadvantaged areas.

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1 PURPOSE OF THE ANALYSIS

Mali is the largest landlocked country in the Sahel region of West Africa. With a GDP of 10.9 billion of dollars and a population of 15.3 million (World Bank, 2015a), it is one of the poorest countries in the world. However, between 2000 and 2010, Mali enjoyed sustained economic growth, accompanied with a significant decline in poverty rate (World Bank, 2013). On the other hand, since end 2010, the country has been hit by a mix of external and internal shocks which have had particular negative effects on food insecurity of its population. The crisis in Libya, the rising of food and oil prices on international markets, the crisis in Côte d'Ivoire and a coup against the President Touré with the invasion of north Mali in March 2012 by insurgent groups have increased the vulnerability of the population to shocks in the recent years.

The primary sector is dominant in the Malian economy, employing a substantial portion of the country's workforce; particularly gold mining has gained in importance in the past decade. Main subsistence crops grown are rain fed millet and sorghum, while commercial agriculture is devoted to cotton and rice (World Bank, 2013). Despite heavy reliance on agriculture, only a small portion (14 percent) of the country's land area is considered suitable for agriculture, making sustainable land management a major concern (World Bank, 2015b). Finally livestock production is of key economic importance to Mali, accounting for approximately 30 percent of agricultural GDP (USAID, 2012).

This report aims at identifying the key pillars of resilience and related contributing factors at household level in Mali using FAO Resilience Index Measurement and Analysis (RIMA) model.

The resilience analysis is based on the Multiple Indicator Cluster Survey (MICS) and the *Enquête Légère Intégrée auprès des Ménages* (ELIM), implemented by the National Institute for Statistics and the Ministry for Health, Social Development and Promotion of Family in Mali in 2009/10. The analysis identifies the importance of different dimensions and related contributing factors to resilience at the time of the survey and compares the findings with some of the key policies put in place by the Government of Mali after 2010. It can therefore be used to critically review, with respect to resilience, implemented or programmed policies.

The report is structured as follows: section 2 presents the methodology adapted to data limitations; section 3 gives details on the data employed; section 4 shows the analysis of resilience structure at national level and of resilience capacity at regional level, by urban/rural localization and household head (HHH) gender. Finally, section 5 concludes with some policy recommendations.

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2 RESILIENCE MEASUREMENT

This section introduces to the FAO resilience measurement framework. It briefly describes the econometric framework underlying Resilience Index Measurement and Analysis (RIMA) estimation approach and provides substantive detail on construction of particular resilience components and variables used in the analysis.

Resilience is defined according to the definition of the Resilience Measurement Technical Working Group (RMTWG)[2] specifically: "Resilience as the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences" (RMTWG, 2014).

The FAO RIMA model estimates the Resilience Index as a latent variable depending of pre-determined dimensions, so called pillars. In the case of Mali, the model employs only a limited[3] number of pillars: Access to Basic Services (ABS), Assets (AST), Sensitivity (S) and Adaptive Capacity (AC). This limitation is due to data constraints (see next section).

The Resilience Index is estimated in a two-step procedure. First, the **pillars** are estimated through factor analysis (FA) from observed variables (see Table 1). Therefore, the pillars can be seen as a weighted combination of observed variables. Indeed each variable has a specific weight, **variable weight** ,[4] in determining the related pillar. Second, a structural equation model (SEM)[5] is employed to predict the **Resilience Index** as a latent outcome which identifies the relation between the pillars. Thus each pillar has an exact weight **pillar weight**[6] in determining the Resilience Index. Further details on the procedure can be found in Alinovi et al. (2010) and FAO (2013).

This methodology allows at conducing two analyses. **The analysis of resilience structure** uses:

1. the pillar weights to assess which pillars are the most relevant in determining resilience;
2. the variable weights to assess which observed variables are the most relevant in determining the related pillars.

---

[2] The RMTWG has been established under the Food Security Information Network (FSIN).

[3] The standard FAO RIMA model employs the following six pillars:IFA, ABS, AST, SSN S and AC.

[4] The variable weights are the factor loadings estimated through factor analysis (FA) to explain 95 percent of variables' variance. If the latter is explained by more than one factor, the variable weights are a weighted sum of the loadings of all used factors, where the weights are the explained variances.

[5] The main advantage of using the SEM approach in the second step of the estimation instead of FA is that it controls for the correlation between the residual errors.

[6] The pillar weights are the beta coefficients obtained through SEM estimation.

Table 1. **Resilience pillars**

	Pillars of resilience	Definition	Variables	Factors
Physical pillars	**Access to Basic Services (ABS)**	Access to basic services shows the ability of a household to meet needs, such as accessing toilets, water and electricity.	Electricity; Improved water facility; Improved toilet facility; Distance to water.	1 factor
Physical pillars	**Assets (AST)**	Assets are the key elements of a livelihood. Productive assets (mainly land and livestock) enable households to produce consumable or tradable goods. Non-productive assets (house, appliances) are important determinant of household wellbeing.	Wealth index; Land; Tropical livestock units (TLU); House condition index.	2 factors
Capacity pillars	**Sensitivity (S)**	S measures the degree to which a household has been affected by a shock in the recent past.	Number of children with malaria; Number of children with diarrhea; Number of infibulated women.	1 factor
Capacity pillars	**Adaptive Capacity (AC)**	AC is the ability of a household to adapt to a new situation and develop new sources of livelihood. Having active and educated members, for example, may decrease the negative effects of a shock on a household.	Education; Dependency ratio; HHH wage earner; HHH farmer; HHH employer; HHH independent worker; HHH no job.	5 factors

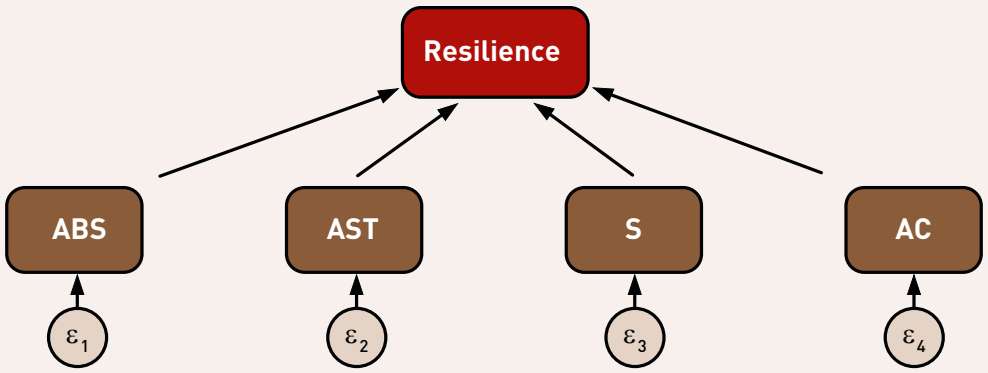
The analysis of resilience capacity uses the Resilience Index to:

- compare the values of the index of different profiles of households (namely male-headed vs. female-headed; urban vs. rural) to attribute each profile the higher or lower capacity of coping with shocks;

Finally, the average pillars scores, namely the values of estimated pillars and the mean values of underlying variables by profiles of households are used to assess why different profiles of households have the higher or lower resilience capacity.

The analysis of resilience capacity is useful to assess **which** profiles of households are the most resilient. By focusing on the most relevant pillars and variables, according to the analysis of resilience structure, both the average pillar scores and the mean values of observed variables assess **why** specific profiles of households are the most resilient. Therefore, the two combined analyses shed a light on the drivers (pillars and related variables) ensuring higher resilience capacity. Therefore, policy recommendations can be formulated, particularly with regard targeting.

Figure 1. **Resilience Index and pillars**



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3 DATA

This section describes the data used in the analysis, the survey and why they have been found suitable for this study; data limitations are introduced as well.

The analysis uses two surveys: the Multiple Indicator Cluster Survey (MICS) and the *Enquête Légère Intégrée auprès des Ménages* (ELIM), implemented by the National Institute for Statistics and the Ministry for Health, Social Development and Promotion of Family in Mali in 2009/10.[7] The common sample of household consists of 9 235 observations and is representative at the national, regional, and urban/rural level.[8]

The definition of household adopted by the analysis is the following: "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".

According to the above definition, household members are only present residents. Therefore, the analysis excludes absent residents, visitors and members with missing information on residence situation. Furthermore the analysis does not consider as household members the employees of the household.[9] The restricted sample used is composed of 8 660 households.

The main data limitation is that the survey only contains a restricted number of variables suitable for applying the FAO RIMA model. The main reason is that the survey is mainly aimed at investigating children and women conditions. More in detail, the data particularly lacks sections on income generating activities, social networks, asset shocks and coping strategies. This results in a restricted number of pillars determining the Resilience Index.

---

[7] Technical and financial support has been provided by UNICEF, *La Coopération Suédoise*, the European Union, the World Bank and USAID.

[8] The household sample was drawn in two stages, with stratification in the first stage. According to the stratification, 17 strata are defined: two (rural, urban) for each of the 8 regions and one for the capital Bamako.

[9] Looking at their characteristics, the household's employees are mainly female, with low level of education and are concentrated mainly in the Bamako region or other urban places. They cannot be considered as members since they do not share income with the household members.

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4 RESILIENCE ANALYSIS

This section provides the resilience analysis results.
First describes the analysis of resilience structure of Mali at national level, spelling out relevance of each pillar in explaining Resilience Index.
Then, it presents the results disaggregated by location of household, region and gender of household head, identifying and explaining existing differences in resilience capacity between different profiles of households.

This section presents the results of the resilience analysis in Mali (2009/10). First, it analyses the pillar and variable contribution in determining, respectively, the Resilience Index and the pillars, at national level. Then, it presents the analysis of resilience capacity disaggregated by urban status, regional location and gender of household head to detect and explain potential differences in resilience between different profiles of households (by looking at the average pillars scores and the mean values of observed variables). 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. Knowing 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.

4.1 ANALYSIS AT NATIONAL LEVEL

Figure 2 reveals the resilience structure by showing the pillars' relevance in determining the Resilience Index. In Mali, ABS and **AST explain most of the Resilience Index, followed by AC**. On the other hand, **S plays only a marginal role** in determining resilience.

Figure 3 goes behind the pillars and shows the variable weights in determining each pillar. In terms of AST, non-agricultural variables, as wealth index and house condition index, are the most relevant. Looking at ABS, having access to electricity and improved toilet facility plays the major role. The average years of education and having HHH wage earner or farmer contribute most to determine AC. Finally shocks affecting children health are the most relevant determinant of S.

Figure 2. **Resilience structure – Pillar weights in Mali (2009/10)**

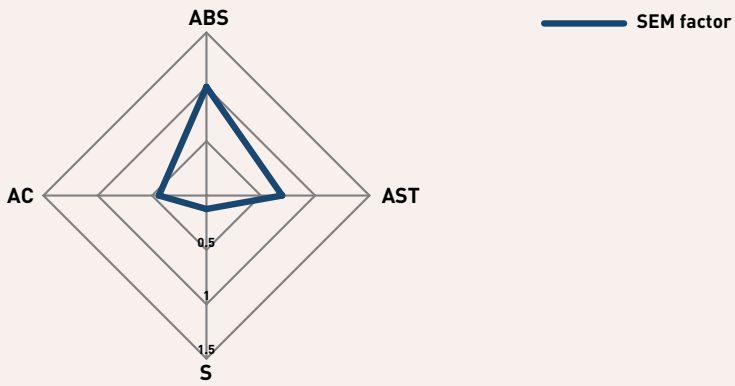
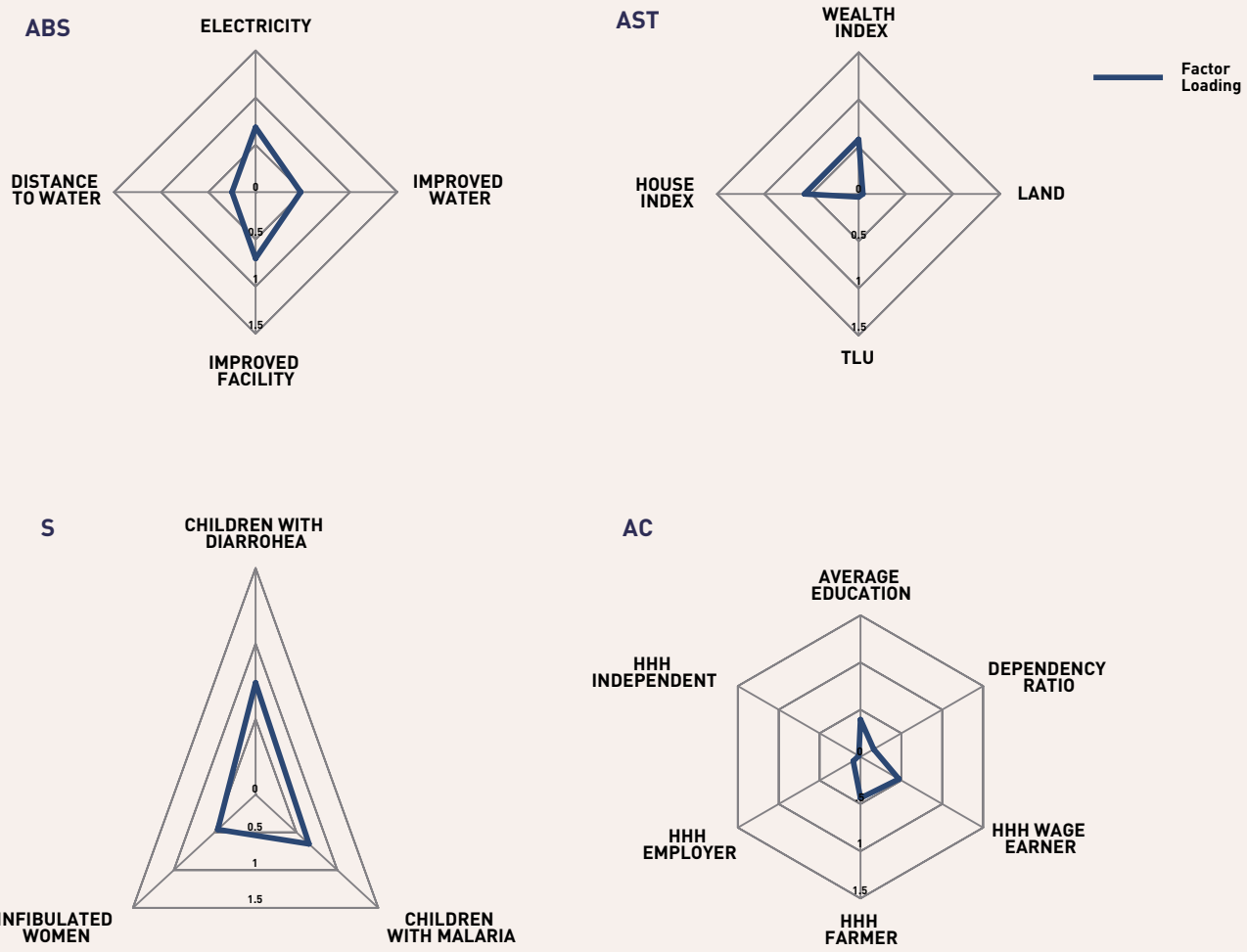


Figure 3. **Resilience structure – Variable weights by pillar in Mali (2009/10)**

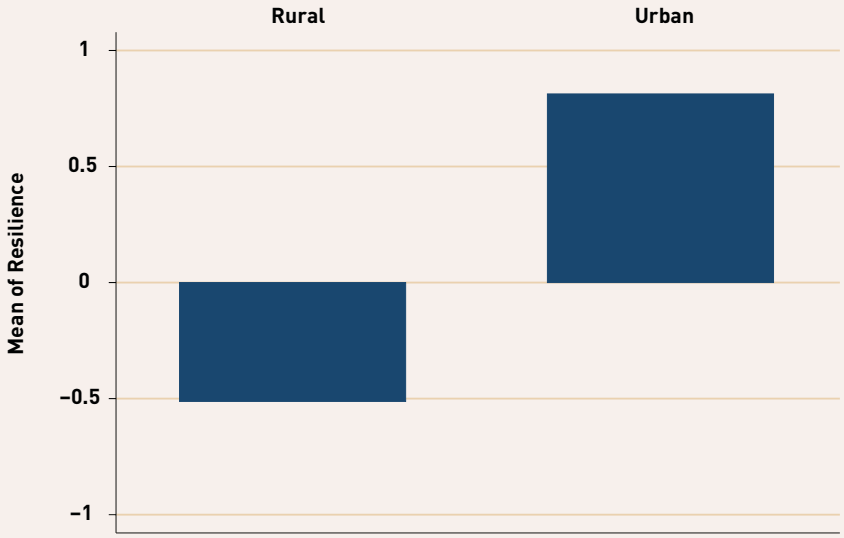


4.2 ANALYSIS OF GEOGRAPHICAL LOCATION: URBAN STATUS

Household localization in rural or urban areas strongly explains household differences in resilience.

Urban households are, on average, much more resilient than rural. Figure 4 illustrates the mean resilience by household localization. It shows that households living in rural areas (61.35 percent of the sample) have lower resilience capacity than urban households.

Figure 4. **Resilience capacity by urban status in Mali (2009/10)**



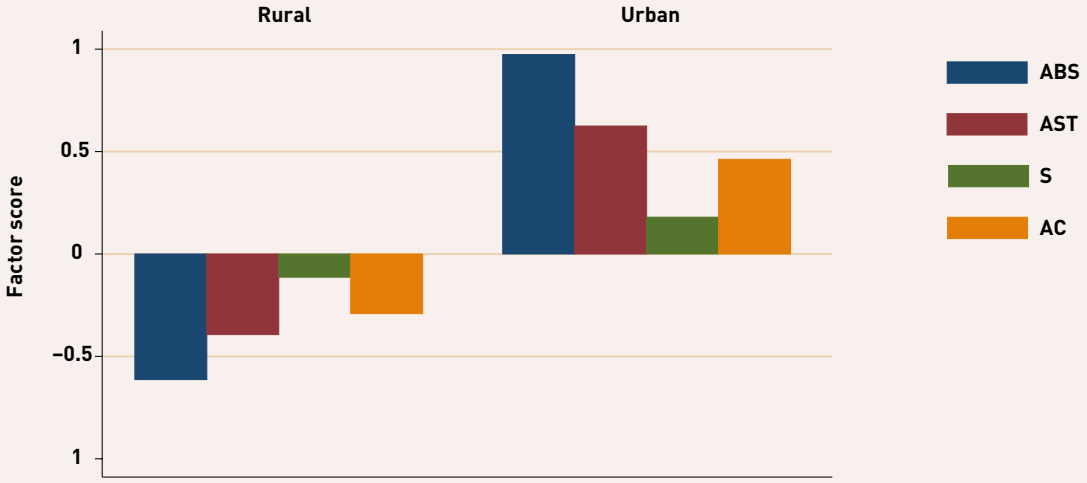
The main reason is that rural households are in a disadvantaged position with respect to all the resilience pillars, as shown in Figure 5 representing the average pillars scores[10] by household localization. Specifically, **urban households have a huge advantage in terms of ABS and AST**, the most relevant pillars for resilience in Mali (See Figure 2).

ABS, the most relevant pillar for resilience in Mali, is the pillar where urban households have a huge advantage with respect to rural. This is confirmed by a greater access to services of urban households. As example, the 70 percent of the urban household of the sample have access to toilet facility (the most relevant variable for ABS as shown by Figure 3) while only the 19 percent of rural household access to it (Table A1).

Urban households rely on AC much more than rural households. In urban areas in fact households have more educated members and fewer dependent members. Furthermore an important difference emerges when looking at the income generating activities of the household head. While household heads living in urban areas are mainly wage earner and independent workers those in rural are mostly (75 percent) farmers (Table A1).

[10] Pillars scores are the representation of the place where the subject locates on average into the distribution of the variable. For example, the distribution of observations for ABS can be subdivided by household localization; average values for these two subgroups, will locate rural and urban households in one point on the curve; higher value means greater performance in ABS.

Figure 5. **Average pillar score by urban status in Mali (2009/10)**



In terms of AST, urban households have more non-agricultural assets, the more relevant determinants of AST (Figure 3), than rural households (Table A1).

Finally, the difference in S (higher average score for urban communities) should be interpreted as another reason behind the higher resilience capacity for urban households (higher sensitivity is associated with higher resilience). This finding can be explained by the fact that S score is built upon the negative (multiplied by -1) number of shocks affecting children and women (i.e.: lower shocks are associated with higher sensitivity and, consequently, higher resilience), which is clearly higher in urban areas than in rural areas. This shows that households in urban areas suffer less shock than rural household; especially shocks related to children health.[11]

4.3 ANALYSIS OF GEOGRAPHICAL LOCATION: REGIONS

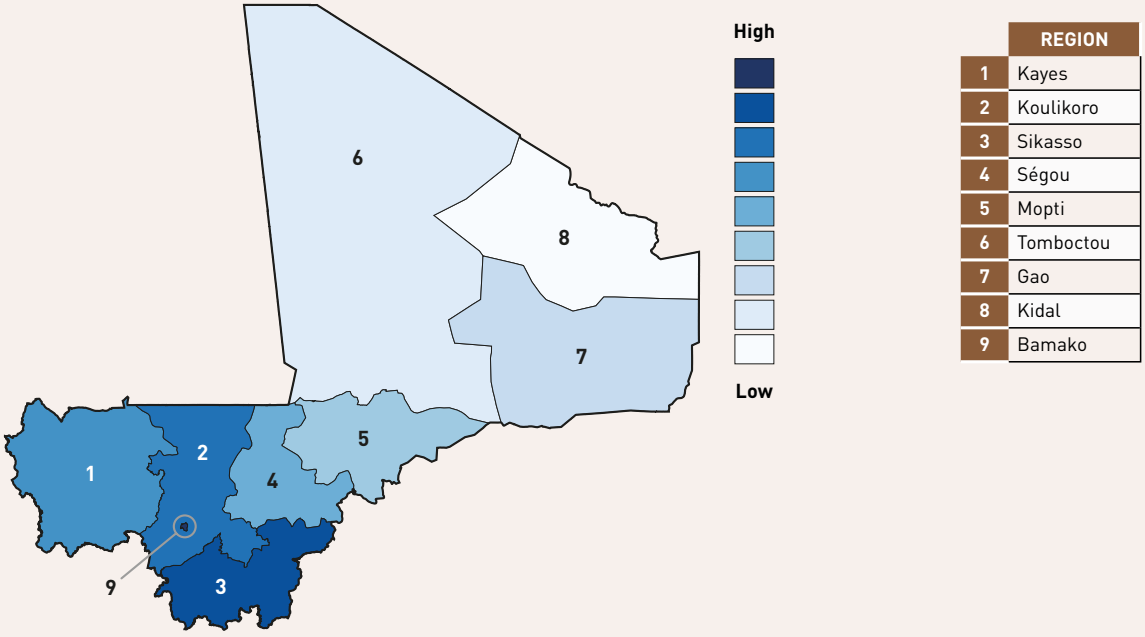
The country can be divided along a north-south axis: the southern regions are the most resilient. This clearly emerges from Figure 6 which represents the average Resilience Index for each region: darker the blue is, the more resilient the region is. Indeed the northern areas, extended into the Sahara and Sahel, are the least resilient, while the southern regions host most of the country's economic activities and are the most resilient. Unsurprisingly, the capital Bamako (the darkest spot in the bottom left side of the map) is the most resilient area of the country.

Figure 7 shows the map of the total annual precipitation (mm/yr.) in Mali averaged over 1950-2009.[12] The map clearly corresponds to the resilience map: the southern regions which receive more rainfall are the most resilient. The climatic conditions seem to be associated with regional differences in resilience capacity.

[11] In the Senegal report (FAO, 2015), lower average score for S sensitivity is a concomitant of higher resilience. This difference is due to the different variables used for building the S. In the Senegal case, the S score is built upon the perception of sensitivity to food consumption, revenue, health and poverty in the community which is lower in urban areas than in rural areas. In this report, the S score is built upon the negative (multiplied by -1) number of shocks affecting children and women, which is higher in urban areas than in rural areas.

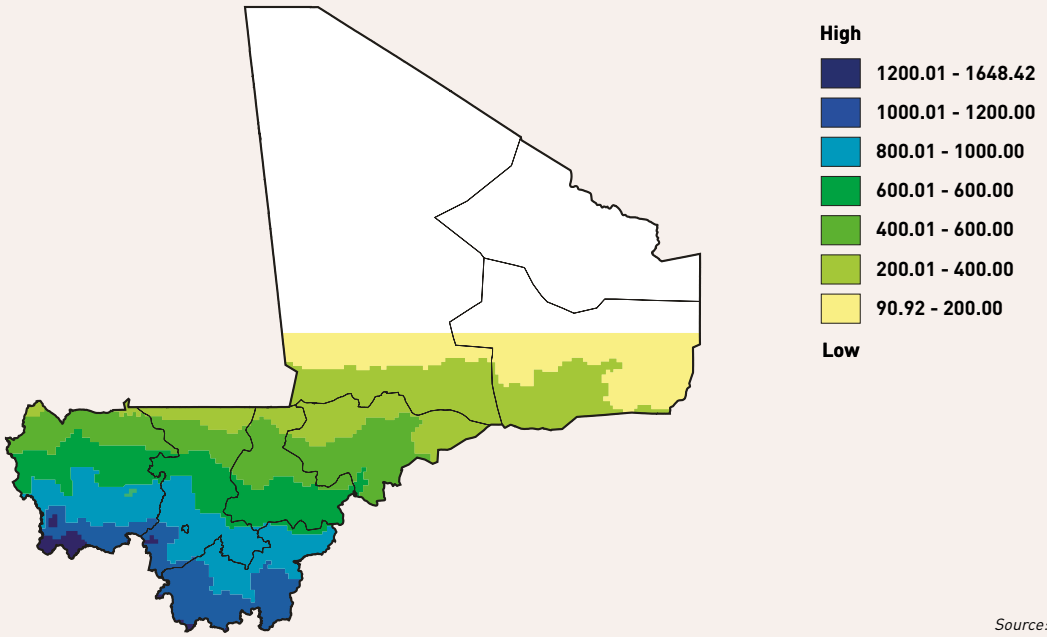
[12] Data are not reported for all areas north of 17.2° N latitude. For more details, see USAID, 2014. Additional data on precipitation in Mali can be found in World Bank, 2015b.

Figure 6. **Resilience capacity map – Average Resilience Index by region in Mali (2009/10)**



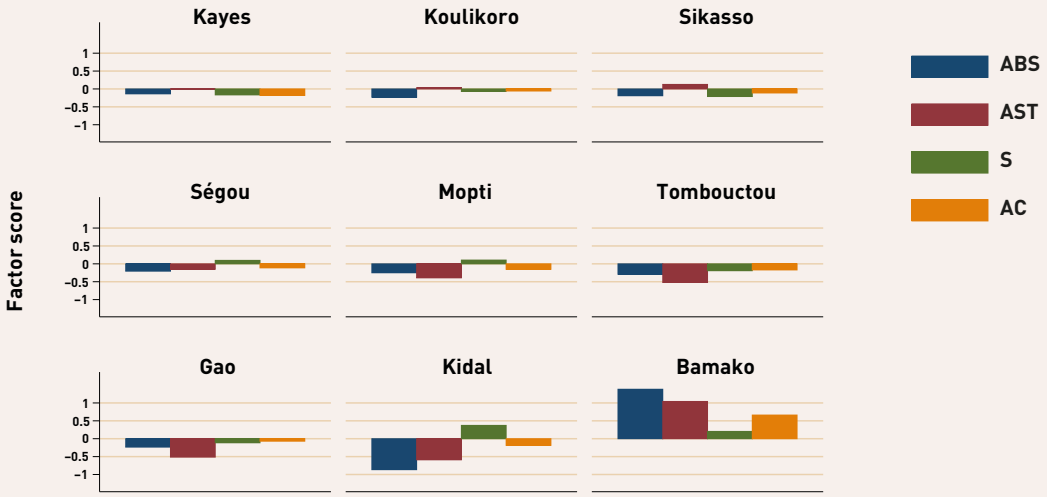
	REGION
1	Kayes
2	Koulikoro
3	Sikasso
4	Ségou
5	Mopti
6	Tomboctou
7	Gao
8	Kidal
9	Bamako

Figure 7. **Precipitation map in Mali**



Source: USAID, 2014

Figure 8. **Average pillar scores by region in Mali (2009/10)**



The highest resilience capacity for Bamako can be attributed to the highest scores for ABS, AST and AC, as shown by Figure 8 which represents the average pillar scores by region. Relatively high resilience scores for Sikasso and Koulikoro are reflected in modestly high AST. **On the contrary, the lowest resilience for the northern regions, Kidal (the least resilient), Tomboctou and Gao, is associated with very low scores for ABS, AST and AC**.

The highest score of resilience for Bamako is mainly driven by very good access to house facilities and low distance to services underlying ABS (Refer to Table A2 for more details on regional variables), the most relevant pillar of resilience in Mali (Figure 2). On the contrary, the least resilient regions, and particularly Kidal, are disadvantaged in terms of house facilities and distance to water source.

In terms of AC, the most relevant variables for resilience are education and having HHH wage earner (as shown by Figure 3). First, there is a huge disparity in the education attainment between households living in the capital and households in the northern regions. Households in Bamako have the highest level of education while those in Kidal the lowest one. Furthermore, while the household heads in Bamako are mainly wage earner or independent workers, the HHH in the three northern regions are mostly occupied in farming. Also, Bamako presents the lowest mean of dependency ratio while Kidal the highest.

Looking at AST, household in the capital have the highest score of house and wealth indexes, the most relevant variables for AST (as shown by Figure 3), while the northern regions the lowest.

In terms of S, higher levels of child health shocks variables are observed in Tomboctou and Gao whereas the situation is slightly better in Segou, Mopti, and Kidal. Bamako has the lowest levels compared to all other regions.

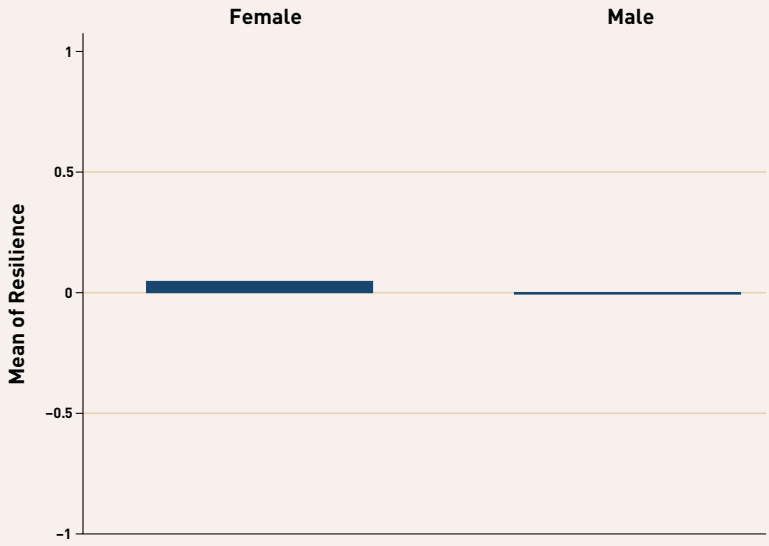
Overall, Kidal, Tomboctou and Gao, the least resilient regions of the country, present high prevalence of rural households (respectively 86 percent, 77 percent and 67 percent) suggesting that a relevant role or urban localization in explaining resilience capacity.

4.4 ANALYSIS BY HOUSEHOLD HEAD GENDER

Female-headed households (FHH) are of particular interest. The resilience report for Senegal (FAO, 2015), for example, reveals that FHH have a greater resilience capacity. This can be associated with both their localization (e.g. if they are mainly localized in urban areas, a condition which usually ensures a greater resilience capacity) and their household characteristics and choices. In the case of Mali, FHH are localized both in rural (53.45 percent) and urban areas (46.55 percent) of the country.

There are not relevant differences in resilience capacity between female- and male-headed households;[13] **FHH are only slightly more resilient than male-headed households (MHH)**, as shown in Figure 9. The average pillars scores by gender of household head (Figure 10) allow identifying the weaknesses in each group's resilience capacity. Since the Resilience Index is multidimensional, it allows taking into account different dimensions, despite assets, in which FHH perform better than households with male heads.

Figure 9. **Resilience capacity by gender of household head in Mali (2009/10)**



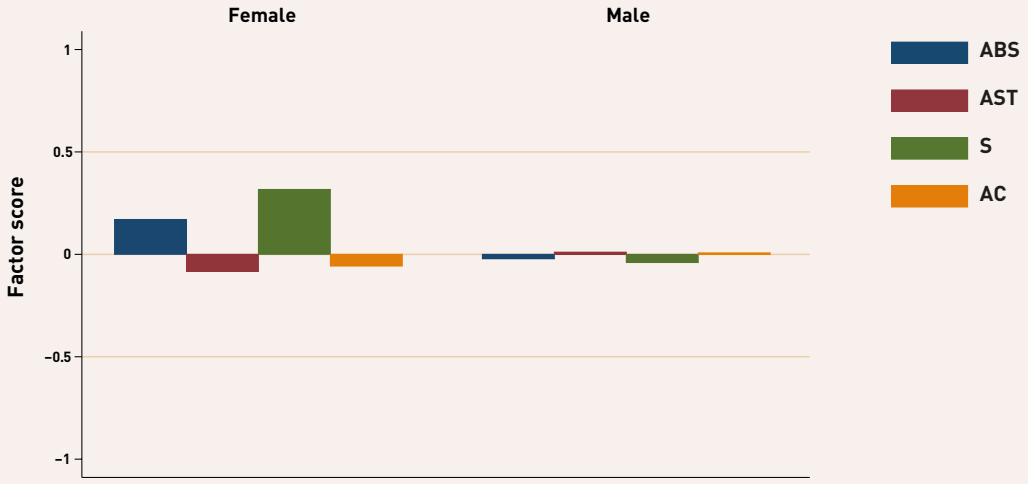
As shown in Figure 10, the main difference between MHH and FHH is due to S which is more relevant for female-headed households as well as ABS, the most relevant pillar for resilience. Digging into the analysis it is possible to profile FHH and MHH.

FHH experience significantly fewer shocks (associated with higher sensitivity and, consequently, higher resilience) than male-headed households. Looking at ABS, FHH perform much better than MHH in terms of access to all services: water, toilet facility and electricity (see Table A1).

Differences emerge also in terms of AST. As reported by other sources (World Bank, 2013), FHH living in Mali tend to be poorer. Indeed they have a lower amount of assets than MHH (see Table A1), which perform better in terms of AST.

[13] The absolute mean resilience difference between male- and female-headed households is not statistically significant as confirmed by a t-test for the equality of the resilience mean (p-value 0.2546).

Figure 10. **Average pillar score by gender of household head in Mali (2009/10)**



Finally, AC contributes to resilience less for female- than for male-headed households. Table A1 underlines a complementary income generating pattern between FHH and MHH. While the latter are mostly farmers and wage earners, the former are mostly independent workers or unoccupied.[14] Moreover the dependency ratio is smaller for MHH, meaning a bigger number of members in working age inside the household. On the other hand, FHH ensure greater level of education to their members.[15]

[14] The presence of transfers should be investigated but the analysis is constrained by the lack of data.

[15] This evidence is confirmed by analyses in other countries. Ogundari and Addulai (2014) for instance demonstrate that in Nigeria households with female heads spend more than MHH on education of household's members and healthcare services. The same positive association between children education and female HHH is confirmed by Khan (2013) in the Pakistan case.

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5 MAIN CONCLUSIONS FROM THE ANALYSIS AND POLICY IMPLICATIONS

This section summarizes the main findings of the resilience analysis, provides final assessments and delivers relevant implications for policy design and implementation.

This study employs the FAO RIMA methodology in order to measure the resilience of Malian households in 2009/10. Resilience Index has been estimated only with a limited number of pillars due to data constraints. After presenting the analysis of resilience structure, the results of resilience capacity are presented by region, gender of household head and household localization in rural or urban areas.

- The components which are most associated with resilience are ABS and AST, followed by AC, while S plays only a marginal role.
- There is a relevant divide in resilience capacity of households between urban and rural areas. Urban households are more resilient and perform better in terms of all resilience's pillars.
- The capital Bamako as well as the southern regions is the most resilient; while the northern areas, extended into the Sahara and Sahel, score the least in terms of resilience capacity.
- FHH are only slightly more resilient than MHH. Major differences can be attributed to a different ABS and S, dimensions where FHH perform better than male-headed ones.

Since the years 2000s, the Government of Mali has been developing an agenda for reducing poverty and fostering country's economic growth. With this aim, the country adopted the **Growth and Poverty Reduction Strategy Paper (GPRSP) III** for the period **2012-17**, following the GRPSP I (2001-2006) and II (2007-11). The most relevant areas covered by the Government's plans are social sector, employment, vocational training, rural development, transports, income generating activities and transparency in the management of public finance (IMF, 2013). Moreover, Mali is in the process of implementing the **National Resilience Priorities** (NRP) as part of the **Global Alliance for Resilience (AGIR)**. The NRP plan of action (2015-2019) focuses on activities to enhance the resilience of most vulnerable communities particularly in line with the evidence provided by the RIMA analysis.

ABS is the most correlated dimension to the Resilience Index. Therefore, improving access to basic services should have a major impact on households' resilience. This dimension includes variables such as use of water and toilet facilities as well as electricity and distance to water sources. Even if the access to services has improved over the last decade in Mali, it is still below Sub-Saharan averages (World Bank, 2013).

- A particular focus on improving access to improved facilities (e.g. water) is shown in the AGIR – NRP Strategic Objective 1: "*Restaurer, renforcer et sécuriser les moyens d'existence et améliorer la protection sociale des communautés et ménages vulnérables*" and Strategic Objective 2: "*Renforcer la nutrition des ménages vulnérables*" where activities are designed to increase access to potable water particularly in the most vulnerable areas. As suggested by the analysis, priority should be given to rural areas where households face major constraints in accessing potable water also due to longer distances to water sources compared to households in urban settings.
- An urban water sector reform was initiated in 2010 to increase access and improve operational performance of the sector through the realization of modern water points in urban and semi-urban centers (Council of Ministers of Mali, 2014). Also a focus is on regions such as Kati, Koutilala, Sikasso, Kayes and the district of Bamako. It is important to note that, in terms of regional diversities, the analysis shows that Kidal region has the lower values in terms of both distances from water sources and access to improved water facilities.
- The main constraints of the **electricity sector** remain high cost and difficulty of expanding the supply in a low density and landlocked country. The analysis shows that all regions excluding Bamako report low scores for access to electricity.
- All in all, evidence supports the need to improve **living conditions** and households facilities particularly in **rural areas** by providing better-quality water services, sanitation, and electricity.

AST comprise another important dimension in the resilience structure. However, it should be noted that the major difference in assets owned are between rural and urban areas. The interesting factor in this dimension is that although rural households have on average much higher levels of agricultural assets, they score much lower resilience levels. This pinpoints to a **low productivity of agricultural assets thus showing the need to increase investments and support to the agricultural sector**. Also, it should be noted that female-headed households are dramatically disadvantaged compared to male-headed households in terms of access to agricultural assets.

- Support to the agricultural sector is particularly envisaged by the AGIR-NRP Strategic Objective 3: "*Renforcer durablement la productivité agricole et alimentaire, les revenus des plus vulnérables et leur accès aux aliments*". Consistently with the results of the resilience analysis, increased attention is devoted to rural and peri-urban areas as well as female, youth, and most vulnerable households.

AC is also a relatively important dimension in explaining the resilience capacity of households. This dimension provides, among others, information on educational attainment and employment opportunities.

- The analysis shows a vast gap between rural and urban households on **education** with the former scoring levels of education dramatically below the national average. Therefore, evidence clearly supports the implementation of activities to enhance education pursued through AGIR-NRP Pillar 1 with a focus on children living in more deprived areas.
- The GPRSP-III emphases **education** with the Education Sector and Investment Program

(ESIP) III (2012-2017). The objective of the Program builds on the Program II (2006-2010) (World Bank, 2015c), namely the increase of the proportion of Malian children completing the quality basic education.

In terms **employment opportunities for the households' heads**, evidence suggests that policy priorities should increase diversification of job in rural areas where households are mostly employed in the farming sector. On the other hand, higher unemployment rates of households head are registered in urban areas, suggesting the need to invest in income generating activities and employment schemes.

- Consistently with these goals, the National Labour Policy (2013-15) presents very ambitious objectives as the realization of decent work and the promotion of the safety and security of work (Council of Ministers of Mali, 2013).

For what concerns **health** and particularly support to child health, the **S**[16] dimension of resilience structure highlights that children in rural households face much more health shocks compared to children in urban households.

- Consistently with the findings of the resilience analysis, the AGIR-NRP Strategic Objective 1 and Strategic Objective 2 focus both on increasing the coverage of social protection measures (e.g. quality health system) and improving access and quality of health facilities in particular for children under 5 years of age.
- An initiative was launched in 2013 to provide better health insurance to rural and poor population through health cooperatives. The prevention of children diseases is a relevant target in order to reduce the source of potential household shocks.

According to the International Monetary Fund (IMF), Mali's economic outlook for the 2014-2016 periods appears favorable with the gradual restoration of security (IMF, 2014). Recent post-crisis datasets should be used to compare pre and post-crisis situation and evaluate progresses made by interventions.

[16] This dimension is calculated based on shocks to child health status (e.g. diarrhea and malaria).

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ANNEX

Tables below show averages for observed elemental variables. Variables are presented at national level and disaggregated by gender of household head, location (rural or urban) and regions.

Table A1. **Mean values of variables by gender of household head and location in Mali (2009/10)**

			GENDER		LOCATION	
		National	Male	Female	Rural	Urban
ABS	Electricity	0.25	0.24***	0.29***	0.05***	0.55***
	Improved water facility	0.72	0.71***	0.76***	0.58***	0.93***
	Improved toilet facility	0.38	0.38***	0.44***	0.19***	0.70***
	Distance to water	11.76	11.92*	10.56*	14.80***	6.94***
AST	Wealth index	0.29	0.30***	0.25***	0.17***	0.49***
	Land	3.06	3.30***	1.14***	4.33***	1.04***
	Tropical livestock units (TLU)	3.03	3.23***	1.43***	4.28***	1.04***
	House condition index	0.35	0.35***	0.39***	0.16***	0.67***
S	Children with malaria	0.26	0.28***	0.16***	0.31***	0.18***
	Children with diarrhea	0.30	0.32***	0.17***	0.37***	0.20***
	Infibulated women	1.87	1.94***	1.38***	1.86	1.89
AC	Education	3.23	3.16***	3.81***	1.83***	5.46***
	Dependency ratio	1.22	1.22**	1.29**	1.39***	0.97***
	HH head - wage earner	0.15	0.17***	0.07***	0.06***	0.31***
	HH head - farmer	0.51	0.56***	0.16***	0.75***	0.14***
	HH head - employer	0.01	0.02***	0.01***	0.01***	0.03***
	HH head - independent or other	0.24	0.22***	0.39***	0.14***	0.41***
	HH head - no job	0.08	0.04***	0.38***	0.05***	0.12***
Observations		8 660	7 689	971	5 313	3 347

T-test is used for assessing whether the mean differences are statistically different for male and female-headed households; rural and urban households.

*** indicates statistical significant mean differences at 1%, ** at 5% and * at 10%.

Table A2. **Mean values of variables by region in Mali (2009/10)**

		REGION								
		Kayes	Koulikoro	Sikasso	Segou	Mopti	Tomboctou	Gao	Kidal	Bamako
ABS	Electricity	0.15	0.16	0.19	0.15	0.16	0.15	0.12	0.15	0.71
	Improved water facility	0.75	0.66	0.70	0.66	0.66	0.71	0.69	0.36	0.98
	Improved toilet facility	0.31	0.30	0.28	0.35	0.33	0.24	0.33	0.16	0.84
	Distance to water	7.95	10.02	9.54	11.28	14.97	12.51	10.89	31.34	7.43
AST	Wealth index	0.24	0.29	0.29	0.25	0.21	0.20	0.20	0.14	0.57
	Land	3.16	4.57	6.25	4.91	3.23	1.85	1.78	0.05	0.35
	Tropical livestock units (TLU)	5.72	3.25	3.53	3.57	3.24	2.79	2.23	3.58	0.26
	House condition index	0.38	0.36	0.41	0.25	0.13	0.07	0.08	0.11	0.92
S	Children with malaria	0.27	0.24	0.38	0.19	0.21	0.44	0.38	0.19	0.14
	Children with diarrhea	0.40	0.30	0.33	0.25	0.28	0.45	0.39	0.21	0.19
	Infibulated women	2.18	2.36	2.43	1.97	1.64	1.26	1.42	0.64	2.01
AC	Education	2.29	3.48	3.11	2.72	2.23	1.98	3.32	1.49	6.31
	Dependency ratio	1.31	1.30	1.26	1.27	1.32	1.27	1.34	1.41	0.81
	HH head - wage earner	0.09	0.14	0.12	0.11	0.11	0.09	0.14	0.12	0.36
	HH head - farmer	0.62	0.60	0.63	0.66	0.61	0.57	0.61	0.52	0.02
	HH head - employer	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04
	HH head - independent or other	0.21	0.19	0.19	0.16	0.21	0.28	0.16	0.23	0.44
	HH head - no job	0.08	0.06	0.05	0.06	0.06	0.06	0.09	0.12	0.13
	Observations	1 010	1 035	1 160	991	1 028	785	655	588	1 408

Table A3. **Variables description**

		DEFINITION
ABS	**Electricity**	The variable is a dummy equal to one is the household has access to electricity and zero otherwise.
	Improved water facility	The variable is a dummy equal to one is the household uses improved water source (household connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection) and zero otherwise (unprotected well, unprotected spring, rivers or ponds, vendor-provided water, bottle water, tanker truck water).
	Improved toilet facility	The variable is a dummy equal to one is the household uses improved facility (connection to a public sewer, connection to a specific system, pour-flush latrine, simple pit latrine, ventilated improved pit latrine) and zero otherwise (public or shared latrine, open pit latrine, bucket latrine).
	Distance to water	The variable express how many minutes the household spends to go to the nearest water source, get water and come back. It is equal to zero if the household has a water source in its dwelling or yard/plot. The variable is multiplied by -1 for the estimation of SEM.
AST	**Wealth index**	The index is estimated using three dummies for having TV, watch, fan, mobile, motorcycle, and fridge.
	Land	The variable measures the hectares of agricultural land (used for agriculture) owned by the household.
	Tropical lLivestock uUnits (TLU)	TLU standardizes different types of livestock into a single unit of measurement. The conversion factor adopted is: 1 camel; 0.5 cattle; 0.6 horses/ donkeys/mules; 0.1 sheep/goats; 0.01 chickens; 0.2 pigs.
	House condition index	The index is estimated using three dummies for having: (1) finished floor, equal to one if the dwelling of the household has a safe (namely finished: parquet, vinyl or asphalt strips, ceramic tiles, cement, carpet) floor and zero if the material of the dwelling floor is natural (earth/sand; dung) or rudimentary (wood planks; palm/bamboo) or other; (2) finished roof, equal to one if the dwelling of the household has a safe (finished: metal; wood; calamine/ cement fiber; ceramic tiles; cement; roofing shingles) floor and zero if the material of the dwelling roof is natural (no roof; thatch/ palm leaf; grass; sod), rudimentary (mat; palm/bamboo; wood planks; cardboard) or other; (3) finished walls, equal to one if the dwelling of the household has safe (finished: cement; stone with lime/cement; bricks; cement blocks; covered adobe; wood planks/ shingles) walls and zero if the material of the dwelling walls is natural (no walls; cane/palm/trunks; sod), rudimentary (bamboo with mud; stone with mud; uncovered adobe; plywood; cardboard; reused wood) or other.
S	**CNumber of children with malaria**	Number of household children with malaria in the past two weeks. The variable is multiplied by -1 for the estimation of SEM.
	CNumber of children with diarrhea	Number of household children with diarrhea in the past two weeks. The variable is multiplied by -1 for the estimation of SEM.
	INumber of infibulated women	Number of infibulated women in the household. The variable is multiplied by -1 for the estimation of SEM.
AC	**Education**	The years of education are calculated by using two answers: one about the LEVEL of school attended and another about the GRADE completed for each level. The grade completed for each level attended is used to compute the numbers of years of education for each individual. Then, the average years of education within the household is calculated.
	Dependency ratio	The variable is the share of dependent (younger than 15 and older than 64 years old) members of the household over the active (of age between 15 and 64 years) members. The dependency ratio is inverted for the estimation of SEM.
	HHH - wage earner	Dummy for weather the household head is a wager earner.
	HHH - farmer	Dummy for weather the household head is a farmer.
	HHH - employer	Dummy for weather the household head is an employer.
	HHH- independent or other	Dummy for weather the household head is an independent worker.
	HHH - no job	Dummy for weather the household head has no job.

Graphic designer: Tomaso Lezzi

This report is part of a series of country level analysis 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. Structural Equation Models are applied to estimate resilience capacity and structure. Findings are integrated with other more traditional measures of poverty and food insecurity.

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