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Issue Brief

Resilience Measurement

Practical Applications of COSA's Resilience Measurement Approach

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In this third issue brief, we present insights gathered by testing COSA's resilience measurement approach that highlights its usefulness and adaptability with varying projects with different aims and scales, from impact to hot spots and performance monitoring assessments.

The Issue

Given the intrinsic complexity, a key challenge to understanding and building resilience is establishing practical ways to measure its components.

COSA's resilience toolkit offers a practical method to help organizations identify and measure the specific elements that build resilience at the all-important household level. From there – a collective understanding of households – comes a path toward facilitating community-level resilience.

The COSA resilience approach can be tailored for three different levels of rigor, depending on researchers' or practitioners' needs. In particular, the tool can be used to:

1. Rapidly assess the main risks and shocks with resilience's **11 basic key performance indicators** (KPI) at a very low cost.

This approach is ideal for projects with a limited budget or that do not target building resilience as a central goal but still wish to measure key aspects of the resilience KPIs.

2. Identify critical "hot spots" by quantitatively assessing levels of household resilience in a target area at a given point in time. The tool is optimal for determining critical factors affecting resilience and helping to design appropriate interventions.

This approach makes use of a simplified **core set of 27 KPIs** (or more), depending on project needs and budget, and can be used for monitoring resilience and determining changes in resilience over time.

3. Identify the relative impact of resilience on household well-being or the impact of a resilience-specific intervention to enhance household resilience.

This more rigorous objective uses the **full set of 73 resilience indicators** as part of an impact assessment (IA). In this case, our tool not only assesses changes in resilience, but also identifies cause-and-effect attribution while establishing how resilience affects household well-being (e.g., food security, poverty, etc.).

In this issue brief we describe some of the key resilience indicators and how they can be aggregated, and provide the results obtained from each of the three different objectives (i.e., rapid assessment, hot spot identification and

impact assessment). This issue brief will be particularly useful for development practitioners who want to better understand the different types of available resilience analysis and their relative costs.

GOAL 1: To rapidly assess resilience

To rapidly assess resilience, COSA suggests focusing on a basic set of 11 indicators[1] that have been identified by the literature and the COSA Resilience Working Group as foundational resilience indicators.[2]

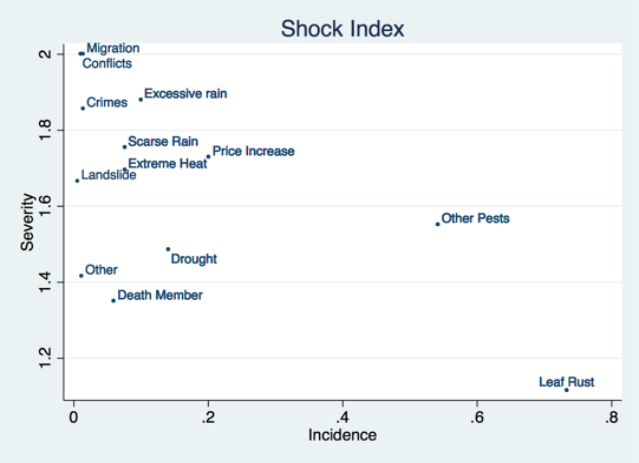
To demonstrate some of the practical uses of the information COSA collects, we will analyze two of these indicators: Occurrence and Severity of Shock, and Coping Strategies.

Occurrence and Severity of Shock Index

COSA uses a simple index to combine the severity and intensity of each shock or stressor, following the Risk Mapping Approach (Smith et al., 2000; Quinn et al. 2003; Inskip et al. 2013; Barid et al. 2009).

Table 1 captures the shocks (actually occurring unfavourable events for coffee farmers in Peru in 2017) and their severity. Through this mapping technique, farmers first identified shocks and then ranked them by order of severity, information that was then combined to generate a shock index.

Table 1: Shock Index



Source: Peru case study (2017). Note: In Peru, the main source of shock was a specific type of coffee pest well known in Central and South America as *"roya"* or leaf rust. The x axis represents the incidence (0-1) and the y-axis represents the severity (1-2), with 2 representing minimum and 1 maximum severity.

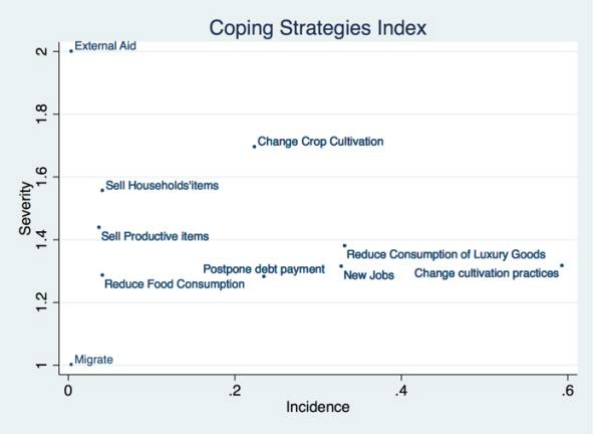
Coping Strategies Index

This second COSA index relates severity and incidence of coping strategies and relies on assessing coping strategies that are not equal in severity. In other words, different strategies are ranked differently, depending on how severe they are considered to be by the people who rely on them. This method resolves one of the main limitations related to the coping strategies indicator that otherwise would have been simply represented by counting the number of coping strategies used by the household.

[1] The 11 indicators are: occurrence and severity of shocks; coping strategies (type and perceived severity); access to safety nets; days without sufficient food; access to credit; diversification of livelihood; soil and water conservation measures; fertilizer use; access to information; access to medical services; access to safe water.

[2] COSA Resilience Working Group members include Lutheran World Relief, International Centre for Tropical Agriculture, Conservation International, Sustainable Food Lab, Catholic Relief Services, and Root Capital.

Table 2: Coping Strategies Index



Source: Nicaragua case study (2017). Note: the coping strategies that rate highest on this particular index are changes of cultivation practices and reduced consumption of luxury goods such as meat.

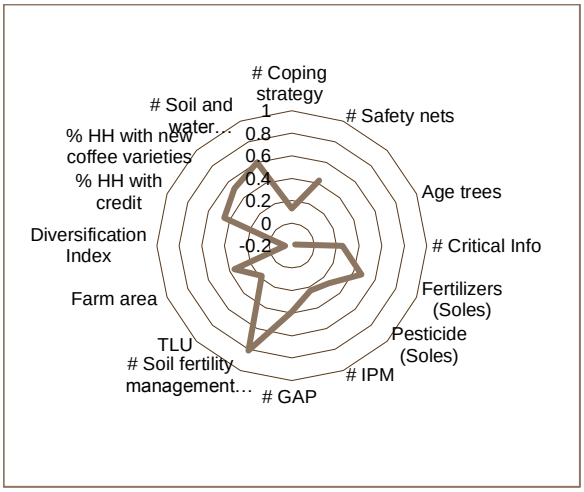
These two aggregation methods, from the basic list of 11 resilience KPIs, are simple examples of the type of analysis that comes from a rapid resilience assessment. Other data collected through this assessment will help farmers and managers understand safety nets, access to credit and other basic services.

This analysis was designed for practitioners who need to acquire a quick sense of resilience conditions in a specific area, to then decide whether to implement a deeper resilience diagnostic analysis or an *ad hoc* resilience intervention.

GOAL 2: To identify critical resilience "hot spots"

COSA suggests using a broader set of indicators, such as the 27 core resilience indicators or an extended version of them, to produce a more accurate analysis of resilience capacities.[3] The greater the budget, the more sophisticated the analysis can be. With a larger set of indicators, more data can build the three capacities indices (absorptive, adaptive and transformative) and fro that the relative resilience index.[4] A spider diagram from a resilience analysis in Peru (see Table 2) illustrates the most important contributors to the first of these capacities (absorptive):

Table 3: Absorptive Capacity



Source: Peru case study (2017). Note: The analysis shows that the index of absorptive capacity is mostly defined by the number of soil fertility management practices in use (factor loading of 0.80), the soil and water conservation practices (factor loading of 0.60), and the adoption of new seeds varieties (factor loading 0.52). These variables are the factors that contribute most to the household's capacity to effectively respond to the shock in the short term (absorptive capacity), highlighting the importance of preparedness over mitigation. In other words, being prepared to face shocks contributes more to the absorptive capacity than all the activities developed and the aid received to stem shocks' devastating effects.

The same methodology determines the transformative and the adaptive capacities, to then build the resilience index and relative score. In Peru, this analysis highlights the contribution of the three capacities to the average resilience score, with a predominance of the transformative capacity (factor loading 0.77) over the absorptive and the adaptive capacities (factor loading of 0.74 and 0.56 respectively). Moreover, the analysis finds that the overall resilience score in the area of study is at a medium-high level (0.60), on a scale between 0 (low resilience) and 1 (high resilience).

This "hot spot" analysis enables development practitioners to identify barriers preventing farmers and communities from improving their livelihoods. The results also serve as a

[3] COSA's website lists indicators and their classification in each capacity [https://thecosa.org/working-with-us/measuring-resilience/]

[4] Please refer to the II COSA 's resilience issue brief [https://thecosa.org/resilience-measurement-differences-similarities-sustainability/] to understand the formation of the resilience index and its three capacities (absorptive, adaptive and transformative).

baseline to evaluate future interventions and enhance future program design.

GOAL 3: To determine the impact of resilience on well-being

In order to evaluate the effect of a resilience intervention on household well-being (e.g., food security, poverty, income, etc.), COSA suggests using the full set of 73 resilience indicators to build a resilience index and evaluate the effects of resilience on livelihood for a given shock and further changes over time. It is imperative to adopt an analytic technique taking into account that resilience is at the same time a cause and consequence of the specific outcome of interest (e.g., endogeneity issues).

For this particular analysis, we suggest using FAO's RIMA II (FAO, 2016) framework, based on the Multiple Indicators Multiple Causes approach (MIMIC). This technique proposes an indirect measure of resilience that adopts regression analysis and consequently allows causal inference. In this approach, the resilience latent variable is jointly estimated by its causes and effects.

COSA's Guatemala case study[5] provides a useful application of this approach by examining the effects of resilience on income losses generated by a leaf rust shock. Using micro-data from two rounds of a survey administered to coffee farmers affected by leaf rust, we captured farmers' resilience capacities and determined the influence of each capacity on their lost income. The analysis found that more resilient farmers experience less loss.

Conclusion

Since agricultural managers often have questions about the type of data and analysis needed to assess resilience, we have attempted to clarify here some of the most common options for measuring resilience. This Issue Brief, the third in a series, provides practical applications of COSA's Resilience Measurement approach that emphasize its adaptability to projects with different goals and wide-ranging needs, where three levels of analysis helps assess different facets of resilience.

For more information about COSA and its resilience measurement system, please email info@thecosa.org or es@thecosa.org.

[5] COSA (2018) Coffee in crisis offers a lesson on resilience. (Forthcoming paper)

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