Premise

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Right-fit monitoring and evaluation (M&E) systems embody the principles of Credible, Actionable, Responsible, and Transportable, or CART. In the Goldilocks case study series, we examine the M&E systems of several innovative organizations and explore how the CART Principles can work in practice.

Premise: Monitoring Food Prices in Post-Disaster Environments

In most countries, government agencies collect data on the prices of consumer goods throughout the year, using periodic market and household level surveys run by National Statistics Offices (NSOs). The data are reported in aggregate (in the form of a monthly consumer price index, for example) and are used for central planning and macroeconomic policy as well as private sector decision-making.

In tandem, the World Food Programme (WFP) monitors prices for a small set of staple goods, particularly in areas of the world prone to food insecurity, where emergencies are frequent and resources to collect high quality data are scarce. WFP is a United Nations (UN) humanitarian agency that fights hunger worldwide through food aid, emergency assistance, and disaster prevention activities. A key function of the agency is to track food security globally, through a program of Vulnerability Analysis and Mapping (VAM). The VAM is a collection of continuous and periodic monitoring systems that track changes in community access to food, forecast food scarcity, and alert the humanitarian sector to potential emergencies. During the recent Ebola epidemic in West Africa, which reached its peak in 2014-15, WFP played a key role in capturing price data across Liberia, Sierra Leone and other affected countries.

Yet throughout the epidemic, WFP faced challenges in collecting high quality data. Reaching remote regions and recruiting survey workers is particularly hard. Because rural markets and small retailers are expensive to survey, they are often excluded from the sampling frames of large national surveys. The low frequency of data collection is exacerbated by delays in manual data aggregation, cleaning and analysis. For this reason, economic shocks may not be detected or reported for several weeks. The delays make it difficult to update interventions and respond to emergencies in a timely manner while the limited information-infrastructure captures only a relatively restricted list of food staple items.

Technology Solution

As part of the Goldilocks Project, WFP piloted a new technology for capturing market prices in Liberia; this pilot tackled some of the data collection challenges that humanitarian agencies face. The technology was developed by Premise, a venture-backed startup headquartered in San Francisco that supports a global network of data contributors. Premise has created a smartphone application that allocates tasks to individuals in its network, and then provides tips to guide them through the data capture process. The contributors live in close proximity to target markets and can readily visit shops, clinics, and other outlets on a regular basis to perform price checks. They are compensated with a small cash incentive for each instance of data capture. Submissions can include text (e.g. prices, inventory) and images (for verification of text data). The data are georeferenced and logged with a time-stamp, then sent to Premise over the mobile network.

On the back end, the company has developed a software platform that automates several processes— including the allocation of tasks across the network of contributors, the optimization of contributor incentives, and the classification and analysis of data. Premise also implements multiple layers of validation to minimize fraud and improve data quality, including both human and computer control checkpoints[3].

A schematic of the Premise technology is provided in Figure 1, which describes how a customer (in this case, WFP) is able to design and monitor a campaign of data collection using the company's global network of contributors.

The Goldilocks pilot was based on a successful proof-of-concept deployment in rural Indonesia, operated by Premise in cooperation with the WFP, FAO and Pulse Lab Jakarta. In this project, Premise monitored a basket of core consumer food staples in traditional markets in West Nusa Tenggara, one of Indonesia's most rural provinces (with 4.7 million inhabitants across 19,700 square kilometers). Data were collected using a network of more than 200 local residents who were recruited virtually and guided by an app downloaded to their smartphones. In 10 weeks, the Premise platform analyzed price trends across 65,000 data points throughout the province for twenty products ranging from tofu to mackerel. The results demonstrated that the Premise platform can be an effective, rapid method to monitor a basket of core consumer food staples in traditional markets in rural and difficult to reach locations (UN Global Pulse Feasibility Study 2015).

FIGURE 1. PREMISE TECHNOLOGY PLATFORM
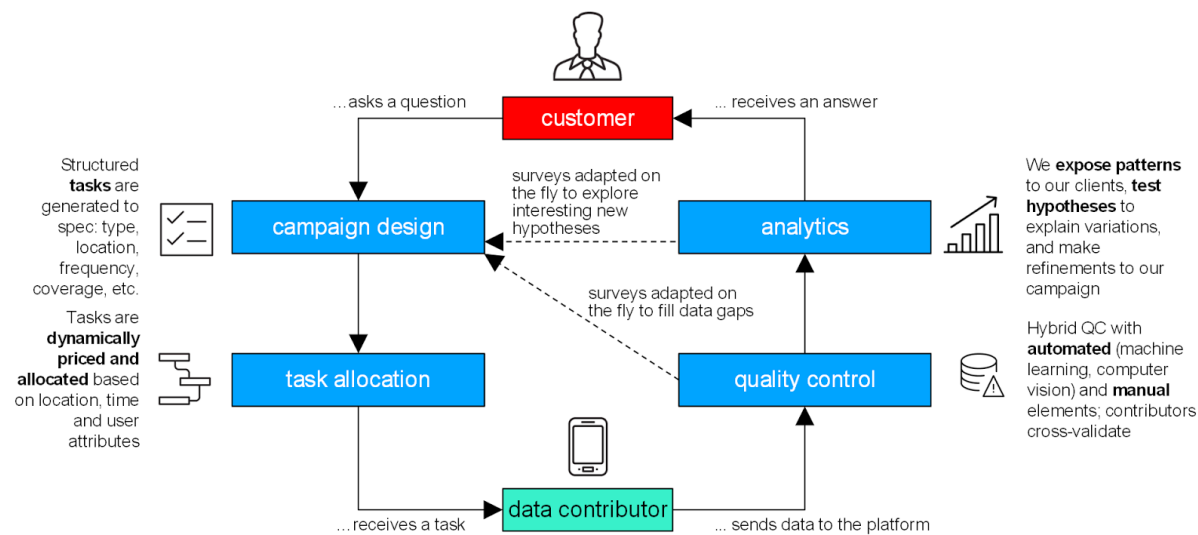
Technology Application

The Goldilocks pilot focused on tracking food prices and access to food in Liberia in the aftermath of the Ebola epidemic. Premise worked with the agency to identify target markets as well as consumer goods to be tracked in Liberia. WFP was interested in collecting prices for food staples as well as a handful of other consumer staples such as fuel. Premise recruited local citizens in each city/town to track consumer goods pricing. During weekly market visits, Premise contributors collected the following data:

1. Market Monitoring: Price surveys for basket of commodities defined by WFP

2. Demand-side Monitoring: Tracking the daily wage for unskilled labor (distinguishing between agriculture and non-agricultural labor and disaggregated by gender) to supplement VAM information on food consumption and coping.

3. Aid Monitoring: Tracking the presence of food aid in markets in those countries where food aid is provided.

The questionnaires used by Premise contributors were designed with substantial WFP input, and could be revised on a situational basis, enabling the capture of "quick response" data for operational decision-making. Data submitted on a daily basis to Premise were cleaned, analyzed, and modeled into a daily Food Staples Price Index (FSPI), designed in part by referencing a USAID-sponsored household consumption survey[1]. The FSPI for Liberia is a weighted sum of prices for 12 different groups of goods, including items like meat, grains and flours, vegetables, oils and fats, roots/tubers, and milk products.

In addition to capturing and processing these data, Premise has built a cloud-based platform for automating the analysis and visualization of results, including the issuing of alerts that direct attention towards emerging situations on the ground. In order to populate the platform, the system is updated in near real-time with fine-grained data that reflect the set of geographies and commodities selected by WFP.

Results

As part of this Goldilocks pilot, CEGA researchers Josh Blumenstock and Niall Keleher (both at the University of Washington) evaluated the FSPI generated by Premise. The index was compared with two sets of existing data: a nationally representative, monthly consumer price survey overseen by the Central Bank of Liberia, and a weekly price survey of a small number of consumer goods collected by WFP[2]. Premise data were shown to correlate with central bank data, although there were problems with interpretation (largely because the Premise data were collected daily from the capital city of Monrovia, while the central bank's data were collected on a monthly basis, nationwide). The correlation of individual food item prices between the WFP and Premise was weaker.
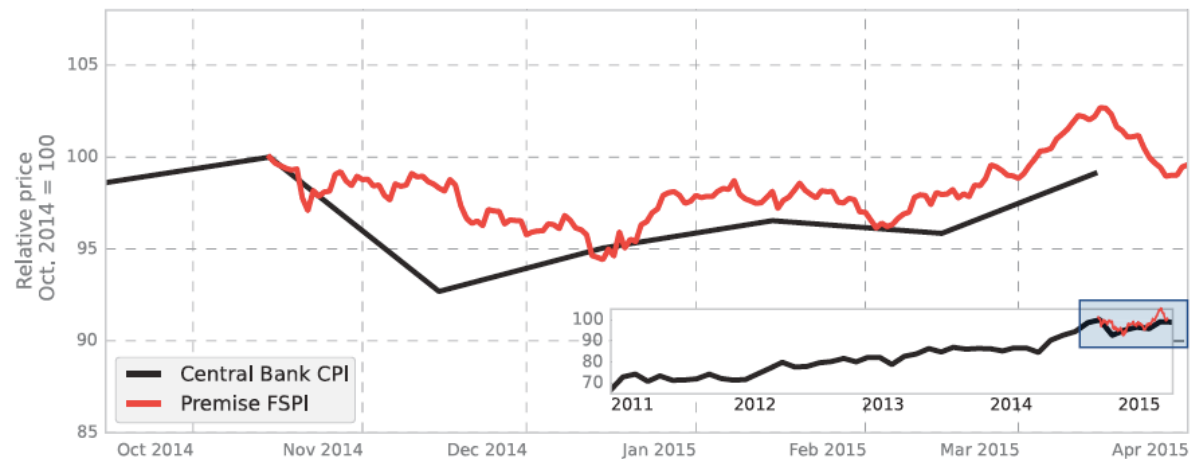
Main figure shows the CPI calculated by the Central Bank of Liberia and the FSPI based on Premise data. Inset figure displays the Food and Non-Alcoholic Beverages relative price from May 2011 to April 2015.

FIGURE 3. COMPARISON OF PREMISE AND WFP ITEM PRICES
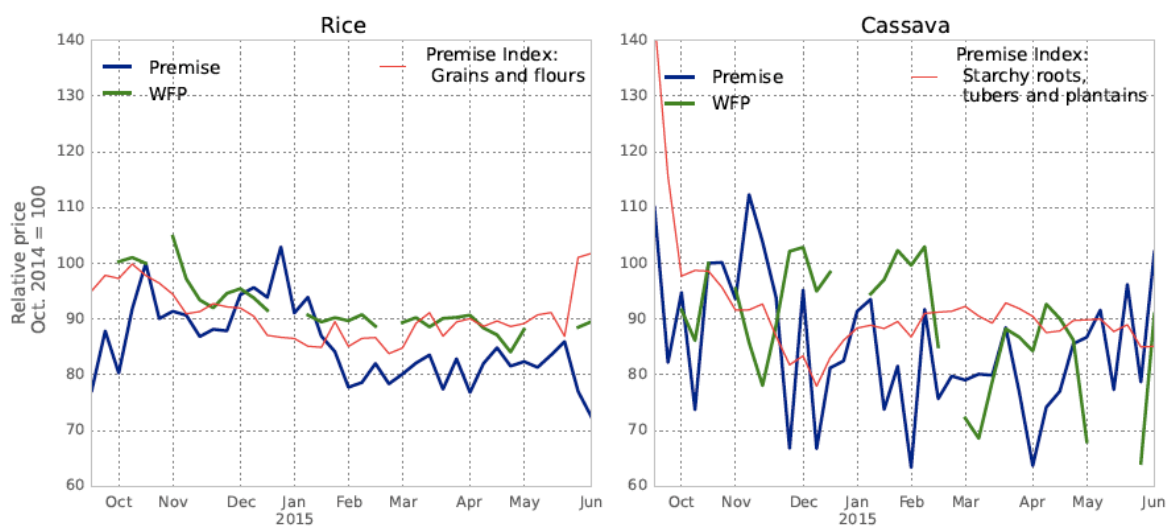
Average price data for two food items in Liberia. The blue lines represent the average weekly price data collected for rice (left) and cassava (right). The green lines indicate the corresponding price data for the same item, collected by the WFP. The red line indicates the composite sub-index from Premise data, constructed from all goods in the grains (left) and starchy roots (right) product categories. Each series is normalized to a value of 100 on the week of October 15, 2015.

TABLE 1. MODEL PERFORMANCE

The correlation coefficients for Premise data compared with the central bank and the WFP indices are shown in Table 1. While central bank data were more readily replicated than WFP price surveys, the analysis suggests that the Premise technology can produce a credible economic indicator.

	Corr	RMSE	RMSE (% of mean)
A. Central Bank Food Price Index			
FSPI (Monthly Average)	0.64	2.97	3.58%
FSPI (Daily vs. Central Bank linear interpolation)	0.73	2.39	2.88%
B. Food Items (WFP, relative prices)			
Rice	0.54	8.94	9.77%
Cassava	0.03	16.27	18.71%
Charcoal	0.35	6.29	6.64%

Measures of model accuracy and error, comparing Premise data to data collected by the Central Bank of Liberia and the World Food Programme.

Goldilocks Principles

Overall, this pilot by WFP and Premise suggests that decentralized, crowd-sourced data collection can adhere to the CART principles.

Credible: Collect high quality data and accurately analyze the data.

By ground-truthing data from Premise against Liberian national data sources, the CEGA team determined that indices produced by the Premise platform can be both valid and reliable. Furthermore, Premise has implemented multiple layers of validation for each data point—with human and computer controls—which reduces the bias associated with typical market survey methods. From a broader perspective, the fact that Premise is able to tightly control the sampling of markets is a great advantage of its platform[2]. Premise data are also highly granular, and can be sourced continuously in time and space, increasing the ability to track prices in real-time, in sub-regions of the country.

Actionable: Commit to act on the data you collect.

The Premise platform collects actionable data daily. It can be revised rapidly, enabling the capture of "quick response" data for operational decision-making. The fact that data can be analyzed in real time allows for rapid changes in sampling or survey design mid-way through a study. Also, the platform includes the ability to issue alerts that direct attention towards emerging locations. As information is continuously updated, in the future there is the potential to utilize the analysis to distribute aid more rapidly, where it is most needed.

Responsible: Ensure the benefits of data collection outweigh the costs.

The WFP already invests in monitoring the prices of foods, essential services, and goods in countries such as Liberia; they consider this a sound use of funds and an important resource for

organizations devoted to providing aid. An attractive feature of Premise's technology is its cost, which is competitive with surveys administered by trained enumerators. With relatively little cost or delay, the sample can be enriched in a particular class of goods, or data collection can be focused in a region of special interest.

Transportable: Collect data that will generate knowledge for other programs.

Premise's platform is accessed through a web portal that is designed to provide tactical decision support to clients like WFP and the wider humanitarian community. Depending on the client's preferences, analytic indicators can be made publicly available, thus creating a public good for use by governments, donors, enterprises and the general public. Also, the platform's flexibility makes it portable to new contexts, making the design of the FSPI transportable to new settings.

Going Forward

The CEGA research team has proposed to develop more refined techniques for identifying and removing erroneous entries in the Premise data set, which may constitute as much as 10-20% of the total data captured on the platform. In particular, they are exploring a supervised learning approach to define a parameter that screens outliers by specific product type. This will allow for some products with greater expected variation over time to exhibit more intertemporal variability. Also, through a longer time series of indices, it will be possible to test for a more robust lagged structure to the relationship between the central bank indicators and Premise indicators, and between the specific food item prices.

Several lessons can be drawn from this case study. First, it is important to look for independent validation of data quality and reliability for information provided by private sector firms. Companies that are transparent about their data generating process (i.e. the steps used to capture and index information) are more likely to be evaluated by outside researchers. Second, new classes of data may be more reliable than "gold standard" data sets maintained by governments and multilaterals. In this case, it is still too early to know if Premise is out-performing other sources-- but it is very possible that as technology develops, more "tried and true" methods may become obsolete. It is important to continue cross-validating data using multiple sources. There are risks to relying exclusively on private sector firms for data collection, just as there are risks to relying on data from NSOs or multilaterals. However, these data sources can collectively be used to test and refine data collection methods.

Finally, the main objective of this research was to characterize the operational feasibility of using the Premise platform and data to understand the conditions on the ground as WFP introduces aid within a region. The goal was also to expose WFP to Premise's real time data stream. With growing interest in mobile-based data collection, WFP ultimately recommended the implementation of additional analyses using Premise data. At this time, Premise and WFP are also collaborating on additional pilots, to keep testing the operational framework of the Premise platform in several countries in Southern Africa.

Endnotes

1. Premise. (2014) Premise Data Corporation: Food Staples Indexes, Nov. 2014.

2. Blumenstock, Joshua E., and Niall Keleher. (2015) "The Price is Right?: Statistical evaluation of a crowd-sourced market information system in Liberia." *Proceedings of the 2015 Annual Symposium on Computing for Development*. ACM, 2015.

3. Dubey, Sangita, and Pietro Gennari. (2014) "Now-casting Food Consumer Price Indexes with Big Data: Public-Private Complementarities." IAOS 2014 Conference on Official Statistics