

# HARNESSING BIG DATA FOR EARLY WARNING AND FOOD SECURITY MONITORING

## LESSONS FROM AFRICA

**Early-warning and situation-monitoring systems** are crucial for averting food crises, responding to humanitarian emergencies and reducing disaster-risk. They provide decision support by helping to identify risks to food security at an early stage of development, forecast crises, and monitor developing situations and the at-risk population. Thereby, they can trigger, inform and shape early interventions and the humanitarian emergency response. To do so, they require timely, reliable, high-quality and spatially-disaggregated data. Yet, across many developing countries, the availability of such data is still insufficient. Big data analytics may provide a means to overcome data gaps and contribute to early warning and the timely detection of food crises.

### Closing data gaps? The potential of Big Data for early warning in Africa

**The need for better information on emerging food security issues has long been recognized.** The past 50 years saw the development of various major monitoring and early warning systems for food security risks, such as USAID's Famine Early Warning System Network and FAO's Global Information Early Warning System.

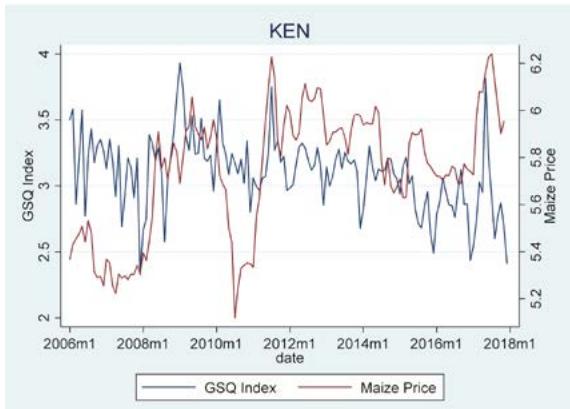
In the last decade, advances in technology, particularly the wide availability of satellite data have enabled the timely integration of weather and vegetation data and agro-climatic models, with a high spatial detail and global coverage.

However, existing monitoring systems are still prone to e.g. irregularity of reports, delayed situation updates and time consuming and costly food security classification processes.

**With the emergence of the Internet, new online data sources have become available in the form of digital traces left by Internet users.** Such online metadata can be obtained from a much larger number of people than usually covered by standard surveys.

In particular, **search engine metadata**, i.e. data representing what people at a specific location currently

- search for as they navigate the Internet, has gained considerable interest. Tapping into this kind of information holds the potential to **extract a near real-time online signal** about the current interest of people at different locations.
- Internet meta data has found wide applicability and has been used, for example, to predict the spread of the flu, trends in private consumption and unemployment rates.
- **Across many African countries, Internet-adoption rates have started to increase significantly** and more than doubled in many countries over the past decade. A large digital divide, i.e. differences in usage of and access to information and communication technologies (ICTs) and the Internet, between and across countries is still present. Yet the gap is closing: average Internet-user rates in Africa currently range at around 24% of the population and are expected to increase at a rapid pace in the coming years.
- **The resulting growth in Internet meta data could provide valuable input into situation monitoring and early warning.** Particularly in the context of developing countries, extracting a near real-time online signal about the contemporaneous interest of a society could help identify upcoming crises and improve current forecasting models and decision making processes.
- **Case study: Google search query data and now-casting of food prices**
- A recent case study by researchers at ZEF explores the link between food price developments (in this case the crop prices for maize), as a proxy indicator for food security, and online-signals in the form of Google search query (GSQ) data in nine African countries: Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia and Zimbabwe.
- The objective was to understand, whether GSQ data has the potential to improve simple maize price nowcasts. These forecasts intent to predict the next time period and are usually based exclusively on past price realizations. **The results indicate that an increase in**



**Figure 1:** Google search volume of the search term maize and maize prices in Kenya and Uganda

**maize prices is associated with an increase in the use of the search term *maize* in all nine countries.**

**The GSQ data further improved the accuracy of maize price forecasts in most of the nine countries** (except Zimbabwe). By including the GSQ data, the now-casting error of maize prices could be reduced by between 3% and 23%. The largest improvements of more than 14% were achieved for Malawi, Kenya, Zambia and Tanzania

## Lessons Learned



**Figure 2:** Google search volume of the search term maize and maize prices in Kenya and Uganda

Internet, remain unexplored. The case study shows that signals from the Internet have the potential to assist in food security monitoring.

Internet meta data can be harnessed at virtually no cost or in a very cost-effective way. In particular GSQ data is passively produced in any case and reliably and readily available free of charge. Hence, using Internet meta data as a complimentary data source could potentially contribute to overcoming some of challenges currently experienced by early warning systems.

## Policy recommendations

- Prioritize investigating the potential of Internet meta data in the context of developing countries
- Invest in technology that automatizes the harnessing of Internet meta-data
- Integrate Internet meta data into early warning systems and situation monitoring
- Explore the option of technical and analytical capacity building required to harness and handle online data to avoid analytical barriers

### IMPRINT:

This policy brief is based on:  
Weber, Regine (2020), Food Security Monitoring for Developing Countries in the Age of Big Data, Doctoral Dissertation, Agricultural Faculty, University of Bonn.  
Weber, Regine; Kornher, Lukas (2019), Can One Improve Now-Casts of Crop Prices in Africa? Google Can, ZEF Discussion Paper 271, available at [www.zef.de](http://www.zef.de).  
Prepared by Regine Weber.

This research was part of the „Analysis and Implementation of Measures to Reduce Price Volatility in National and International Markets for Improved Food Security in Developing Countries“ project which is funded by the Federal Ministry of Development and Economic Cooperation (BMZ).

Center for Development Research (ZEF)  
Genscherallee 3 | 53113 Bonn | Germany  
E-Mail: [presse.zef@uni-bonn.de](mailto:presse.zef@uni-bonn.de)  
Phone: +49-(0)228 - 73 18 46  
Layout: Yesim Pacal

March 2020



[www.zef.de](http://www.zef.de)