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Data analysis and packaging

This is one of a series of information sheets for people designing and implementing agricultural market information systems in Africa.

A market information system gathers large amounts of data and then adds value to it. It does this in several ways:

- It **combines data** from various sources to reveal insights into the market. For example, it might produce a map of agro-dealers that locates dealer profiles (gathered by the market information system itself) on a map (provided by Google maps, Bing or other providers).
- It **analyses and interprets the data** to draw conclusions. For example, it may take data on weather and production to predict a grain shortage in a particular area. Users can then use the information to decide whether to buy, sell or transport their grain.
- It converts data useful for **short-term commercial decisions** into information of use for **long-term planning**. Price information basically has two functions for farmers and others:
 - It can help them decide whether to sell, when and where.
 - Expressed as a time series, it can help them decide what to plant and when.
- It converts the data into a form that is **easy to understand**. Examples: it summarizes price observations from several traders into an average price for a particular market; it converts time-series data into user-friendly graphs and charts.
- It makes the information **available to users** by disseminating it through various channels.

This sheet covers the first four of these activities. See the separate sheets on *Collecting data* and *Choosing the right technology* for ideas on how to gather information, and *Disseminating information to your clients* for how to make information available.

Data verification and cleaning

Data verification starts when the data are being collected. Train the enumerators to notice data points that may be inaccurate. For example, a wholesale price of maize that is higher than the retail price may indicate an error. The enumerator might not spot such discrepancies in the field, so the entry software can be programmed to alert the user before the data are uploaded.

The data go into a spreadsheet or database so they can be verified and cleaned. Things to look for include unrealistic prices, big differences between markets, sudden jumps compared to the previous period, missing data, obvious typos, and patterns that may indicate the enumerator has confused the units of measure or is making the numbers up. You can programme the spreadsheet or database to alert you to suspicious data points or sequences, and use a spellchecker to reduce the number of mistyped words.

The analyst checks suspect data by calling the enumerator or a trader directly to verify the numbers. Random spot-checks of non-suspicious data are also advisable to monitor data quality and the performance of enumerators. Correct or eliminate outliers or figures that cannot be verified.

Data analysis

Analysis is what converts a set of numbers into useful information. It involves calculating descriptive statistics, combining and comparing datasets, extrapolating and predicting, discerning trends and seeking relationships. The aim is to reveal a picture that clients will find useful in making decisions about their operations.

There is no point in doing sophisticated number-crunching and producing fancy graphics if a single number ("50 kg of maize in Busia today cost X shillings") or a simple graph will do. Remember: less is sometimes more. For most clients, it is



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Figure 1. SMS alert with prices

probably better to err on the side of simplicity rather than sophistication.

We can divide analysis into four broad types: description, comparison, interpretation, prediction and recommendation. We discuss these below.

Description

You can calculate simple descriptive statistics to summarize the price of a single commodity. They often consist of only one or two numbers, so are easy to receive and understand on a small mobile phone screen.

Mean price. This is the mean of several prices gathered from different traders in a particular market.

Figure 1 shows the mean prices of wholesale (WHS) and retail (RTL) pineapples at several markets in Ghana.

You can also calculate mean prices for a particular market for a whole month or year, or across several markets.

The mean price is the single most important piece of information for most clients. Farmers, traders and processors all want to know today's price so they can decide whether to buy or sell their produce, or to wait for a few more days or weeks in the hope that it will go up or down.

Price range

These are the maximum and minimum prices measured throughout the day (or month or year).

Comparison

This is where you compare two or more datasets: prices in different markets, for different commodities, or for a commodity over time. These data can be presented either as a graph or as a table. Some market information services give users a choice between the two.

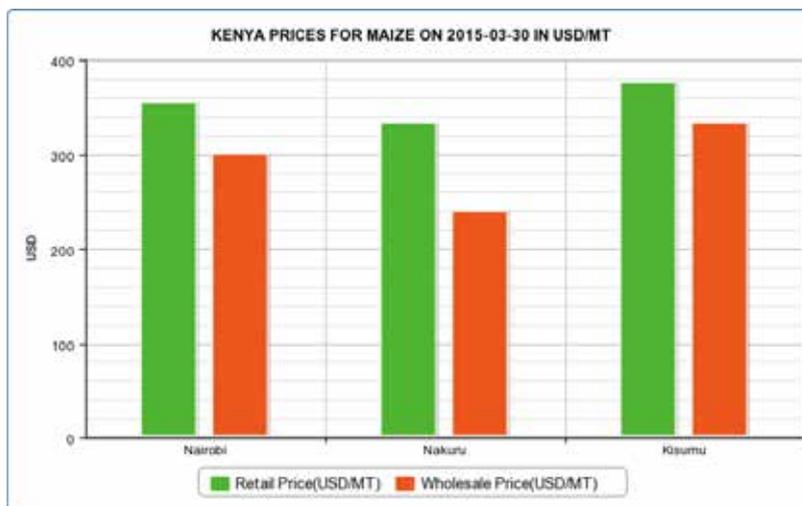
Comparing similar markets

You can present the mean prices and trends for the same commodity in two or more markets. This enables clients to see the markets where they might want to buy or sell (Figure 2). This is of special interest for traders, who may have more flexibility than farmers. But they will always want to follow up with phone calls to the market to check that the price differences still apply.

Comparing commodities

You can also present the mean prices for two or more commodities in the same market (Figure 3).

The prices of two products may influence each other. If the price of maize goes up, for example, buyers may switch to other crops (sorghum or potatoes). Higher demand may push up the prices of those products too.



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Figure 2. Comparing commodities in different markets

Traders want immediate price information so they can decide what to buy, store or sell. Farmers, on the other hand, may be interested in comparing commodity prices over time so they can decide what to plant next season.

Time series for a commodity

Once you have built up some historical data, you can present how prices of commodities have changed over a year or more (Figure 4). This will reveal seasonal patterns in the data (prices hit a peak just before harvest and fall to a minimum after harvest when produce is plentiful). They can also reveal differences from year to year caused by the weather or changes in government policy.

Terms of trade analysis

Clients may be interested in comparing the prices of two apparently unrelated commodities. For example, both development agencies and feedlots are often interested in comparing the prices of live-stock and grain. Development agencies may want to know how many bags of grain a herder can get in exchange for a goat or a cow: the herders often sell or barter animals to acquire cereals and other types of food. Feedlots want to know whether it is profitable to buy feed to fatten their animals.

Governments and relief agencies may want to compare the price of a staple commodity (such as maize or rice) with the purchasing power of a given population. That will give them early warning of impending food shortages. If the price of animals is going down, it may show that people are selling their animals to buy grain, or that they have no feed for the animals.

Comparing prices at different stages in the chain

Traders and processors may be interested in knowing the prices of a commodity at different locations or stages in the value chain – for example at the farm gate, local market, wholesale market or retailer. This will help transporters calculate whether they can make money by moving grain around the country (which helps to even out the availability of grain and avoid food shortages). It also enables processors to decide where and when to source their supplies.

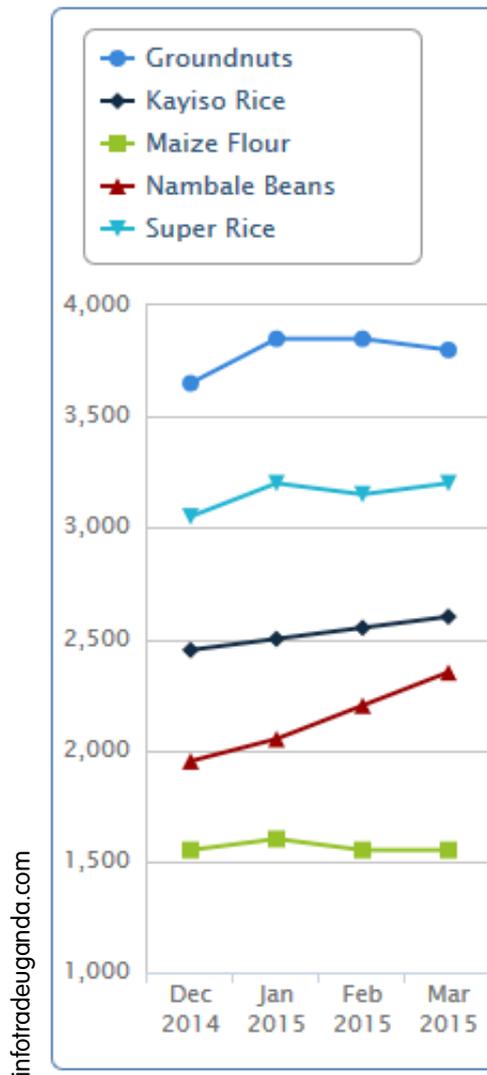


Figure 3. Comparing commodities over time

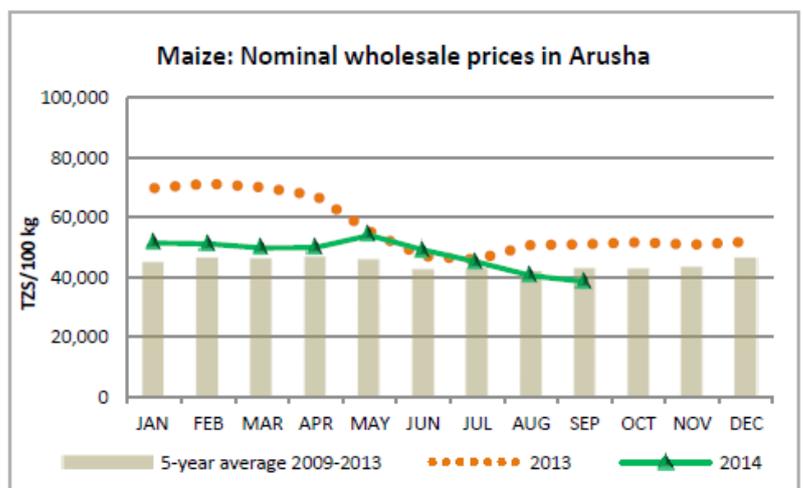


Figure 4. Time series for prices of a commodity with a 5-year average

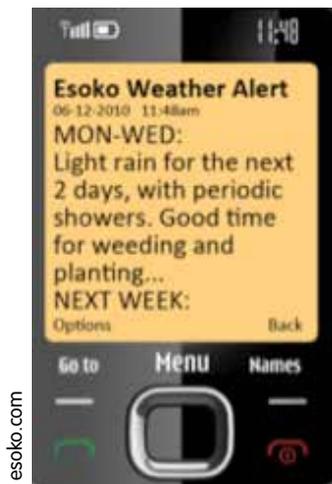


Figure 5. Weather alert and production advice

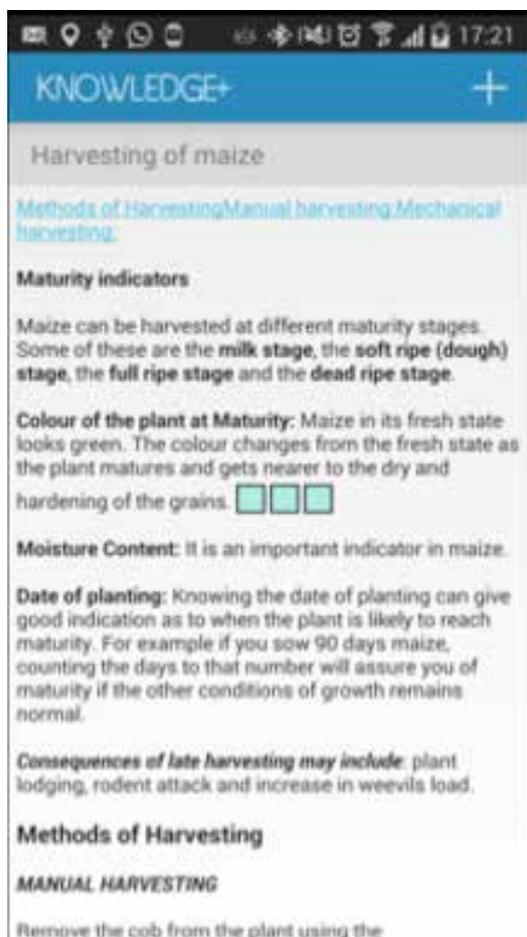


Figure 6. Crop production advice

Table 4: Summary of wheat, sorghum and millet prices in Rwanda.

Weekly Average prices for Sorghum in USD/MT					
Market	Week 1	Week 2	Week 3	Week 4	Week 5
Kicukiro	473	473	472	481	473
Ruhengeri	553	587	589	594	547
Kimironko	478	478	480	491	481
Kigali	308	308	310	297	310

Figure 7. A table of commodity prices

Interpretation

Interpretation involves understanding the reasons for particular trends in the data. It combines statistical techniques such as correlation, regression analysis and cross-tabulation with expertise in and understanding of the markets. While both description and comparison can be done automatically, interpretation (still) needs a human. It involves understanding the agricultural production system and how the market works, then spotting patterns, seeking causes – and explaining them clearly and succinctly.

Prediction

Prediction means forecasting changes on the basis of past and current trends. **Weather forecasts** (derived from a weather service) can be combined with production advice (as in Figure 5).

Early warning systems try to forecast drought, food shortages or gluts in supply. Like interpretation, they rely on a combination of statistical techniques and human expertise.

Trying to predict **prices** is risky. Most market information services avoid doing so: they provide information about current prices to their clients, and let them make up their own minds on which way the price will move. Others indicate that they expect the price to rise or fall, but avoid giving specific numbers.

Recommendations

Some market information services offer recommendations on **production** based on expertise from researchers or crop specialists (Figure 6).

Most services avoid making recommendations about whether to **buy, hold or sell** a commodity. But some do try to predict price trends and advise farmers what to do. This can be risky: if you tell farmers to sell because the price is high, they will be annoyed if they do so and then find the price continues to rise. If you tell them not to sell, the government may accuse you of encouraging hoarding. And a widely used market information service may itself move the market: if many farmers follow its advice to sell because the price is high, they may flood the market, causing prices to drop.

If you do decide to offer such advice, be cautious and make it clear that the client is responsible for his or her own decisions.

Information packaging

You can package the information in various ways. Some of these can be done automatically by software that extracts information from your database and converts it to a user-friendly format. Other types of packaging require human intervention – for example to write text, generate customized

graphics, or to combine text and graphics in a meaningful way.

Text and numbers

This is a brief message with a minimum of text and the relevant numbers – such as the name of the commodity and market location, plus the price per kilogram of the commodity. It is useful for SMS messages, which are restricted to 160 characters (Figure 1).

Tables

Tables can be hard to read, but they give detail and precision (Figure 7). This is likely to be the sort of presentation required by traders rather than farmers.

Graphs

Graphs are easier to read and understand quickly than tables. But they lack precision: it can be hard to read from a graph exactly what the price was on a particular day. Some market information services allow users to see the data in both tabular and graphic formats, or let the user hover the pointer over an on-screen graph to reveal the underlying data (Figure 8).

Text

Longer text (and numbers) is useful to provide explanation and interpretation (Figure 9).

Maps

Maps are useful for displaying locations, areas, boundaries and routes. On screen, you can allow users to choose what to display, and can let them click to reveal pop-up boxes with more information (Figure 10).

Photos

If you offer production advice, photos are useful to show things like disease symptoms, pest characteristics and application methods. They need to be accompanied by captions and perhaps labels to explain what to look at.

Voice

Some types of information (such as market prices and production tips) can be converted to voice messages. It is not practical to transmit lots of numbers or detail in this way.

Voice text may be user friendly for illiterate farmers, but it is more expensive to transmit than SMS text. You will need people to translate the messages into different languages, sufficient storage for voice files, and an internet connection that is fast enough.

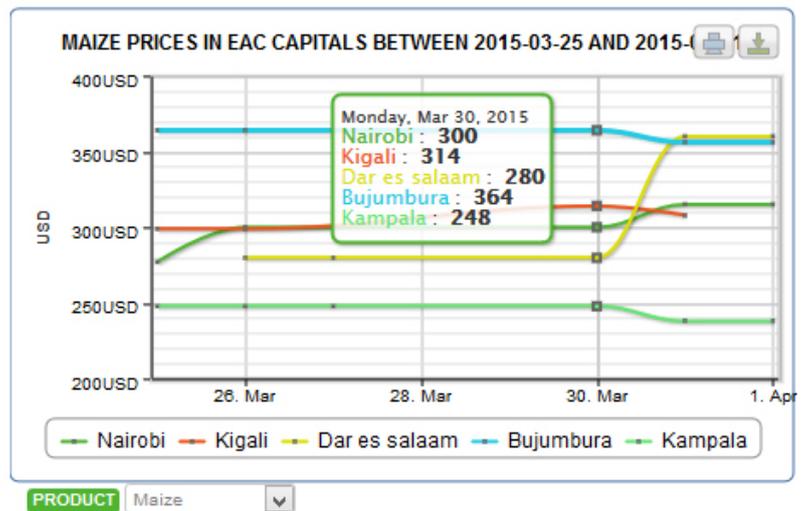


Figure 8. Graph of commodity prices over time

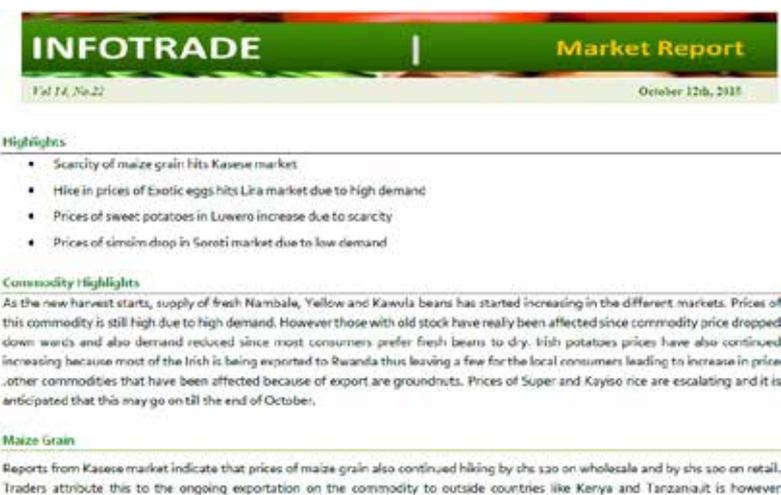


Figure 9. Excerpt from a market report

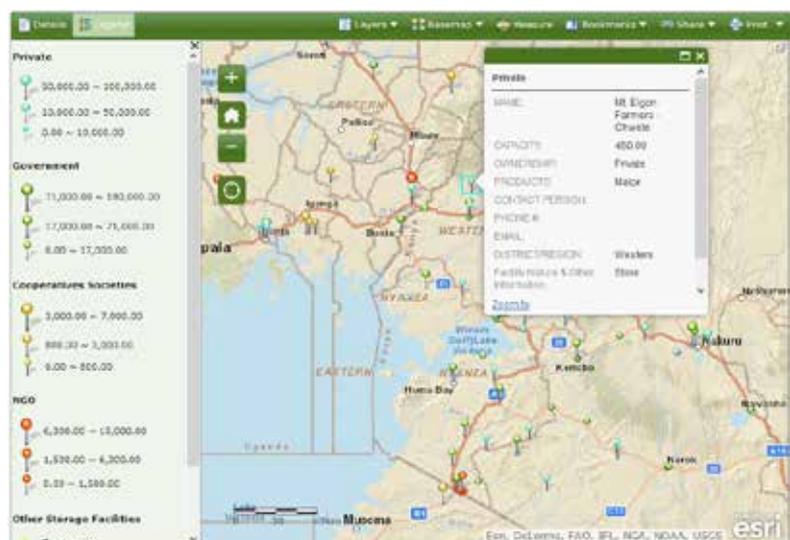


Figure 10. Map of warehouses with a pop-up box giving details of each enterprise

Making the most of your data

Once you have packaged your data, you can now disseminate it to your clients. See the sheet in this series on *Disseminating information to your clients* for ways to do this.

Customizing data

Different users will want different types of analysis. Make sure you understand their needs when deciding what types of analysis to do and how to present the results. Tailor your analysis to suit their individual needs.

It is unrealistic to produce more than a few types of printed materials or radio broadcasts. But customizing information delivered via computer or mobile phone screens is easier. You can allow your clients to choose the information they want:

- A client can type in a code on a mobile phone for a particular market and product, and get a message back with the corresponding price.
- On smartphones and websites, the user can select the data to display and control how it is displayed – as a table or a graph.
- With “pushed” SMS messages you programme the computer to send out information that individual farmers have requested. For example, some farmers will receive information only about maize, while others will receive information about pineapples and other fruits. You can also send alerts to all subscribers, for example if a big storm is expected.

Free or paid?

You may decide to provide a basic information service for free in order to build awareness and attract clients. You can charge for more detailed or up-to-date information, time-series data or in-depth analysis. You can offer users a free trial for a month, then require them to pay if they want to continue.

Five types of assets

A marketing information system generates at least five types of assets. You can convert each of these into revenue streams.

- **Current data.** These are what you supply to clients on a regular basis.
- **Historical data.** Over time you will generate a database on various commodities and markets. You can rework this information into new products: weekly and monthly updates, annual market reports, and custom reports for larger clients.
- **Data-gathering capabilities.** You have a network of enumerators and links with data sources. You can use these to expand into new markets and commodities, or to offer additional services such as market research, training or campaigns.
- **Data-analysis capabilities.** These include the software platform you have built, intellectual property such as patents associated with it, and the human and organizational skills you have developed to analyse the data. You can use these to do other types of analysis, or you can license your software to others.
- **Information-dissemination system.** You will develop relationships with clients (and gather a lot of information about them). You will create expertise in getting information out to people in remote areas. You can use this information and expertise yourself to expand your services. You may also be able to earn money by offering datasets – with the individuals anonymized if necessary – to advertisers, researchers or other companies. But if you do so, make sure you comply with privacy laws and any relevant agreements you have with your clients.

Agricultural market information systems in Africa

Sheets in this series

1. Introduction to agricultural market information systems
2. Developing an agricultural market information system
3. Identifying clients and planning services
4. Deciding on your business model
5. Choosing the right technology
6. Choosing and working with partners
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10. Marketing your market information service
11. Data: Ethical and legal issues
12. Role of donors and NGOs

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