COLLECTING PRICES FOR FOOD SECURITY PROGRAMMING

The how and why of price data collection at WFP

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The how and why of price data collection at WFP

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INTRODUCTION

Prices are an overarching indicator that provides key information for many WFP activities. As the outcome of supply and demand forces, they can give a timely insight into many different drivers that influence the functioning of a market and that are relevant for food assistance programming.

In countries where WFP operates, these drivers include the macro-economic context, natural or human-induced disasters, physical infrastructure and weather associated with crop production, as well as international commodity price volatility and transmission to domestic prices. Against this backdrop, WFP often analyses markets looking at three aspects: i) the **structure,** as in actors and institutions for supply and demand, barriers to entry as a market player, trends in production, and market catchments; ii) the **conduct,** as in competition levels, rules and standards as well as contract enforcements; and iii) the **performance,** as in different methods of price analysis such as seasonality and volatility, market integration, profit margins and income generation, and purchasing power patterns. This is also called the SCP paradigm.[1]

The full set of this information in the form of price monitoring has practical uses for WFP, including the following:

- Monitoring food security to generate cost-of-living indicators, and supporting early warning through price alerts;
- Providing information for cash-based transfers (CBT), including the value of the standard food basket for value vouchers,[2] or expected household expenditure patterns for cash transfers, plus information for adjusting transfer values;
- Contracting retailers and informing WFP's retail strategy;
- Monitoring inflationary trends and comparing prices with shops not directly involved in WFP programming, hereby monitoring the impact of WFP's interventions on local markets;
- Assessing the impact of policies, programmes and projects, and modelling food security outcomes using prices as shock factors;
- Informing decisions over the timing and location of WFP procurement (e.g. local/regional purchase);
- Assisting (small-scale) farmers with agricultural planning and marketing decisions, including insurance premiums and pay-outs; and
- Increasing information and transparency for producers, traders and consumers to improve market efficiency.

Price monitoring therefore cuts across WFP's portfolio of activities. Given its importance, price data collection needs to be organized to avoid the unnecessary proliferation of datasets that do not serve the organization's information needs and that do not communicate with each other. Moreover, well rooted and consolidated data collection and dissemination practices require common standards of quality.

In this context, over the past ten years the Vulnerability, Analysis and Mapping (VAM) unit has been compiling and collating monthly prices for over 1,500 markets in 78 countries where WFP operates.[3] This wealth of information is a public

[1] See WFP, 2011. *Market Analysis Framework, Tools and Applications for Food Security Analysis and Decision-Making.* VAM Food Security Analysis. Available at http://www.wfp.org/content/market-analysis-guidelines

[2] The WFP management plan uses the following terminology: *commodity voucher*, *cash-based transfer*, *cash transfer* and *value voucher*.

[3] In terms of data management, WFP has a decentralized system at the country office level, based on a two-level authorization process (data input and supervisor approval). Every month, local staff can

good available in the Economic Explorer of the VAM shop platform. Most of the price information there refers to official government bodies, even though in several cases WFP actually designs and implements the data collection systems, often with the support of Cooperating Partners.

As a contribution towards standardizing price data collection, this paper aims to explore the core issues related to setting up a price monitoring system, also in countries where no such system currently exists. It describes the factors a country office needs to consider when designing such a system, namely:

- ✓ The objective of the price monitoring and its sustainability
- ✓ Selection of markets
- ✓ Selection of traders
- ✓ Selection of food commodities (and/or brands)
- ✓ Units of measure
- ✓ Frequency
- ✓ Technology
- ✓ Monitoring beyond food

This document does not provide guidance on price analysis, which is ultimately what prices are collected for. Given the variety of possible practical uses, providing a standard for analysis is beyond of the scope of this paper and perhaps would require in-depth guidance itself. Furthermore, we consider this guidance note as a dynamic document that can be updated and expanded with additional and emerging topics.

In the remainder of the paper, in each section we give a headline summary, set out the rationale behind each issue and describe best practice. There are also practical tips for field monitors[4] to make sure they get the best possible data from traders, and advice on how to design a price monitoring tool using digital solutions.

1. OBJECTIVE AND SUSTAINABILITY

WE ARE UNLIKELY TO BE OPERATING IN A DATA VACUUM; BE SURE TO EXPLORE THE USE OF EXISTING PRICE INFORMATION BEFORE STARTING ANY NEW DATA COLLECTION

The more a monitoring exercise is sustainable over time, the wider the use of the information and the greater its effectiveness. Spot price monitoring offers limited analytical potential as the price observations do not fulfil many of the requirements for a solid time-series analysis. However, certain cases merit investing additional resources to carry out spot data collection exercises. This applies for instance when markets in rural areas do not follow the patterns of urban markets – which incidentally are those usually monitored by government bodies – or when researchers would like more frequent price information. Specific objectives can also trigger new data collection, perhaps to compare the

upload country-specific prices into a global database through an Excel-based desktop application that automatically detects potential errors in the data. The full procedure is described in the guidance *How to upload new market prices with the desktop application*.

[4] In the rest of the paper we refer to 'enumerator' as the person employed to collect the data. Enumerators can be further categorized into 'field monitors' if they engage in face-to-face interviews, 'operators' if they conduct interviews using remote calls, and 'contributors' if they spontaneously collect data using their own mobile devices.

effectiveness of delivery modalities, to monitor access to special products that may help improve nutrition, or to investigate profit margins for different actors along the supply chain. In addition, in the context of restricted CBT, it is often fruitful to compare food prices between contracted and non-contracted shops.

Despite these exceptions – and there may be others – the best approach is to rely on one global database. Indeed, if price data are adequately collected over a reasonable timeframe (e.g. one year), we recommend contacting VAM to explore ways to integrate the data into the existing price database.

The objective and sustainability criteria come into play as well, when partners and other stakeholders have their own monitoring system or are interested in synergies through collaboration and data sharing with the potential benefit of increasing coverage and scope, improving quality and comparability, and reducing costs. In this case, all the following steps need to be discussed and agreed with partners to promote the creation of smooth data management systems that allows data transmission and comparability.

2. Selection of markets

Build up your in-country market intelligence to determine which markets need to be monitored

Here we define markets as the physical locations where buyers and sellers come together to trade goods and services.[5] There are **two major questions** to consider when deciding which locations to monitor. Firstly, **how important is the market to the targeted population?** It is vital to monitor local markets because they reveal the food prices that the most vulnerable households are facing across seasons. Secondly, **how important is the market as a hub in the domestic market system**? Prices on hub markets give insight into market basins and trade corridors, giving context to the conditions on local markets. These markets may be national and/or regional.[6]

Local market coverage may focus most on production-deficit areas as this is where most of the people vulnerable to food insecurity live; however, depending on the objective of the data collection, production source locations may also be monitored, especially if domestic price transmission between markets needs to be disentangled. Producer prices collected at the farm gate can also provide information on price levels with minimal or no transaction costs for transport, processing, grading etc. and before crops reach other points of sale along the supply chain.

Ideally, a comprehensive price mapping exercise includes urban and rural retail markets, wholesale markets, assembly markets, cross-border markets and farm-gate prices. By assessing variability between markets in terms of price differentials, trends, cycles and seasonal components, as well as price peaks and dips, we can understand the degree of market integration and identify which markets make the most sense to consider. As a result, we could narrow down the number of markets to monitor (or conversely, increase it). Three additional factors influence the choice of

[5] "Alternatively, markets can be defined as the conditions of supply and demand of a particular commodity, without reference to a specific location; for instance, the 'market for rice' in western Africa doesn't refer to a particular location where rice is traded but rather to economic conditions, actors and relationships that dictate the production, distribution and sale of rice. This latter definition considers not only an aggregation of geographically disparate locations, but also the behaviour of market actors and environmental variables that influence markets more broadly." See WFP, 2009. *How to Conduct a Trader Survey?* VAM, Food Security Analysis.

[6] *Ibid.*

markets: the population served by the market, government priorities and any budgetary constraints for the monitoring.

Purposive sampling should therefore be used to select markets for a monitoring exercise to obtain a balanced view of the market chains, geographical distribution, size and type of markets.[7] For CBT, it is worth monitoring not only the markets directly involved but also nearby control markets where no food assistance activities are underway.

3. Selection of traders

This is more important than it might seem, as it involves classifying trader activities, choosing a sampling method and deciding the appropriate number of data-points to collect

When designing a price monitoring exercise, the main characteristics to define are the type and size of business activities (which determine the nature of the price data to collect), the sampling strategy, and the number of interviews to carry out per market location. While the difference between wholesaling and retailing activities may seem quite clear, the distinction is often blurred when field monitors reach the market and find a wide range of mixed business activities.[8] Huge differences also exist between countries.

Enumerators need to understand the differences between traders. This can be done by examining their upstream suppliers and downstream customers, the nature and variety of commodities they sell, the units of measure, the origin of supply, and the volume/capacity of trade.

A practical example comes from assessments conducted in Darfur,[9] where markets have always been quite specialized with many traders dealing in just one major commodity. As a result, traders were categorized as follows:

- ✓ *Specialized wholesaler*: purchasing from traders, selling to other traders, specialized in one/two commodities, using wholesale units (e.g. sacks, jerrycans), selling the whole unit and not part of it.
- ✓ *Generic wholesaler*: purchasing from traders, selling to other traders, specialized in many commodities, using wholesale units (e.g. sacks, jerrycans), selling the whole unit and not part of it.
- ✓ *Mixed wholesaler/retailer*: purchasing from traders, selling to other traders/customers, specialized in many commodities, using retail units (e.g. *malwa*[10]), selling small quantities.
- ✓ *Retailer*: purchasing from traders, selling to end customers.

Similarly, traders in Zimbabwe[11] were classified as follows:

- ✓ *Local producers and/or local assemblers*, who produce, purchase, stock and trade small quantities of maize grain surplus to neighbouring households or to local small-scale traders.
- ✓ *Small-scale traders*, who usually sell to households using loose grain buckets; they are sometimes involved in informal trade, typically

[7] In urban settings, multiple retail markets can be specialized in different foods (e.g. cereals, fruit and vegetables, meat or livestock), or they can be equally relevant and worth monitoring.

[8] Indeed, some wholesalers whose retail network suffers more during crises (e.g. prolonged droughts, economic downturns, or political/social strife), may end up selling at retail level.

[9] WFP, *Market Assessment in Nyala*, VAM Food Security Analysis, 2013; and WFP, *Market Assessment in Darfur*, VAM Food Security Analysis, 2014.

[10] A *malwa* is a local unit of measurement equivalent to 3.5 kg of sorghum.

[11] Zimbabwe Vulnerability Assessment Committee, *Market Assessment Report*, 2015, pages 22–23.

with minimal trade capacity.

- ✓ *Medium and large traders*, which covers a variety of traders who – at different levels and capacities – operate over long distances, rely on considerable business capital and own warehouses, and mostly sell in bags (50 kg or more) rather than in retail units.
- ✓ *Regional and national millers/retail companies*, who procure bulk maize both in the country and from abroad to store, mill and trade grain nationally (or regionally).
- ✓ *Grain Marketing Board*, which holds strategic grain reserves and sells stock locally and regionally in the lean season.

Devising an appropriate classification of traders requires a certain degree of knowledge of the market. A comprehensive list of ways to categorize traders would be unfeasible and impractical. The degree of the development of the market and the purpose of the monitoring determine whether the classifications above make sense and whether they could be applied in other circumstances or not.

For instance, within the framework of the largest WFP CBT programme, the Lebanon country office needed to monitor food prices in contracted shops. In this case, the classification of traders sought to divide shops into three categories according to their size (large, medium and small) and three objective indicators such as the size of the sales area (i.e. greater than 120 m^2, between 70 and 120 m^2, and less than 70 m^2); the size and proximity of the warehouse; and the number of cashiers. The contracted shops were all grocery stores. It could be important to monitor other types of retailers, namely large chains and supermarkets – which usually trade higher volumes and can offer lower prices without reducing their profit margins – if their activity is instrumental to WFP's retail strategy. Monitoring bigger vendors makes also sense in large refugee settings, when few actors (directly or indirectly) make up the bulk of the business.

Once you define the objective of the monitoring, pinpoint the market locations and classify the traders who operate in the market, the next step is to select individual traders.

Comprehensive lists of vendors are rarely available or accessible in countries where WFP operates. In some cases, chambers of commerce or companies that regularly collect information about market actors might be able to provide such information. This is crucial if the data collection aims to provide a statistically representative sample and ultimately to estimate the characteristics of the whole population of traders in a market location from a sub-sample of individuals.

Alternatively, if the number of vendors operating in a market location is not large, you could consider building a census of traders to then extract a sub-sample for the price data collection. This could prove useful beyond monitoring activities, e.g. for contracting retailers in CBT.[12] In practical terms, this means counting the number of active traders in the zone, categorizing them, drawing a representative sample and dividing them proportionally across markets.[13] This is the most formal approach and may be more feasible if traders belong to well-defined groups, as is the case for vendors contracted for CBT.

In broader monitoring exercises, resources and time usually make such a rigorous approach unfeasible, and purposive sampling may be the

[12] "A more formalistic approach could be employed in an in-depth trader survey, which would include estimating the number of traders in the zone, categorize them, draw a representative sample and divide them proportionally across markets. However, this may be not generally feasible within the time-frame of WFP's food security trader surveys" WFP, 2009. *How to Conduct a Trader Survey?* VAM, Food Security Analysis.

[13] *Ibid.*

way to go. In this case, the objective of the exercise is not to have a statistically representative sample but rather to have a balanced understanding of trader behaviour and of some of the key features of the market environment. See the Annex I for details.

How many traders should you interview? The general consensus in larger monitoring exercises is to interview between three and five traders per commodity and trader type. This rule of thumb is for purely practical reasons: price data collection with field monitors physically visiting markets is costly, time-consuming and is likely to trigger fatigue if not open hostility from traders.[14]

However, in larger markets where heterogeneity amongst traders leads to great variability in price setting behaviours, relying on three to five traders could seem insufficient. Additional features can be considered. Prices may either be freely determined on the market by supply and demand, or controlled and/or (partially) enforced. In addition, the appropriate number of data points to be collected depends whether many traders sell the same commodity or whether one or few dominant traders are price-setters. Clearly, the implications in terms of price setting differ if imperfect competition exists at the wholesale or retail level.

All in all, you should verify at the very beginning of the monitoring exercise the variability of prices among vendors, to be able to define the best number of price observations to collect. Whenever the scope of the activity goes beyond mere price data collection, it is also advisable to have interviews with key people who have some overall knowledge of the market. In addition, it may be possible to examine the gender dimension of food markets and women's empowerment in the markets.[15]

The 'Technology' section in this report discusses the use of new tools. These can significantly relax constraints concerning the number of data points that can be collected given available resources and time.

4. Selection of food commodities

MONITORING DOZENS OF COMMODITIES DOES NOT NECESSARILY LEAD TO GOOD ANALYSIS. MAKE SURE RESOURCES ARE NOT WASTED IN COLLECTING PRICES FOR TOO MANY ITEMS UNLESS THIS COMES AS A CLEAR REQUIREMENT FROM YOUR OBJECTIVES. THINK ABOUT HOW TO SUMMARIZE THE INFORMATION. IT IS IMPORTANT THAT THE PRICES COLLECTED ARE CONSISTENT OVER TIME

In many cases, it is enough to monitor the price of key staple foods, as they make up the bulk of household expenditure and they largely determine food security outcomes. Most of the foods worth monitoring are those high in WFP beneficiaries' preferences, even though expensive food like meat and fish or specialized products may simply be out of reach of the purchasing power of most food-insecure people. Even so, for programming reasons, it may be worth

[14] Fatigue is not a concern in specific data collection and market assessments, which usually take place in one round only.

[15] WFP, *Technical note on use of gender- and empowerment-integrated market assessment surveys*, 2016, and related questionnaires.

monitoring the price of non-staple foods that have greater nutritional value.

The selection of the food item to monitor needs to be carefully defined, as the level/type of detail reported for each commodity can be different. A good example is rice, which can be classified according to variety (e.g. basmati rice, *emata* rice), origin (e.g. local, imported), quality (e.g. first quality, second quality), or simply the percentage broken (e.g. 5% broken, 10% broken, 25% broken). Finally, there may be several brands available. As a result, it is vital to specify clearly which items should be monitored.

It is good practice to include the items mostly commonly consumed by the target population; this could refer to variety/quality/source for unpackaged foods. In countries where markets are more developed, it may be possible to monitor different brands, differentiating between the cheapest, the most commonly consumed and the fortified ones.

If price data collection is already underway, enumerators should aim to collect the prices of all the commodities/brands listed in the survey form. However, the first weeks of a new price data collection may be used to fine-tune this list. Consistency in monitoring is key, but if a specified brand is not available, a substitute brand with similar characteristics can be collected to ensure comparable price ranges. In this case, the new brand should be included in the list.

Specifically connected to CBT, the optimal number of commodities needs to be tied to the delivery mechanisms that WFP implements, as moving from commodity or value-based cash transfers to multi-purpose cash requires dramatically scaling up the number of commodities to monitor beyond food, in order to be able to estimate most of a household's potential needs.

It is always worth keeping in mind how the prices are likely to be used when choosing the number of food commodities to monitor. In many cases it will be enough to report on a few key staples, especially when they constitute the bulk of food consumption. In other cases, it may be worth expanding the list to allow food basket comparisons and to investigate the efficiency and effectiveness of different transfer modalities. When the ultimate outcome of the data collection is a periodical dissemination bulletin, unless we want to overwhelm the reader with hermetic tables full of price changes going in different directions and (likely) failing to provide clear messages, it is wise to consider using summary indicators. This could be the value of a food basket based either on a hypothetical basket bought by the target population or one derived from the caloric contribution provided by different food groups.[16]

5. UNITS OF MEASUREMENT AND CURRENCY

STICK TO CONVERTIBLE UNITS OF MEASUREMENT RATHER THAN TRYING TO REFLECT ALL THE CHOICES AVAILABLE IN THE MARKET

The unit of measurement and the currency are crucial elements to consider and report on when monitoring prices. They ensure prices are comparable, price trends can be established and meaningful averages can be calculated for

[16] In this regard, it may be possible to define a minimum expenditure basket, which indicates the quantities of food consumed by a typical household as in the case of Syrian refugees in Lebanon. The value of that basket is then estimated using the monitored prices. Alternatively, the cost of the basic food basket can be estimated knowing the caloric contribution from a limited number of food groups as described in the approach page of *The Market Monitor*, a quarterly WFP bulletin that provides information on price changes for the most commonly consumed staples.

different geographical or administrative areas.

In many markets in developing countries, especially in rural areas, commodities may be sold in non-standard units of measurement, such as a pot, cup, can, pail, loaf, bunch, heap or sack. These may vary from commodity to commodity, from trader to trader, and from market to market.[17] To standardize and harmonize the prices of such commodities it is essential that these measurements are first converted into standard units such as kilograms, litres, quintals (100 kg) or metric tons. It is also advisable to keep units of measurement constant over time and space. This is because higher weights for single units come with economies of scale, thus with a different cost and eventually with a different price.

In more developed retail chains, the unit of measurement and commodity characteristics are combined in the stock keeping unit (SKU), which is also reflected in a barcode. This barcode with an often used 13 digit coding shows the international article number that combines a prefix, the manufacturer and a product code, and a check digit. Price comparisons between shops or traders and across locations are more meaningful if prices are collected for products with the same barcode.

A very useful and practical set of instructions to obtain the equivalent price in kilograms can be found in the *Market Data Collection Procedures* (Guidelines) for Somalia FSNAU[18] which state that "[t]he enumerator should weigh the local unit several times, product by product, to obtain an average weight and do this each season or each time that you notice a change in weight and/or container. Then they should convert the price of the local unit into the kilogram-equivalent price by dividing the local unit price by the weight of the tin."

Similarly, prices may require conversion if they are not in the national currency – this is particularly the case near national borders. One solution is to use the official exchange rate on the day of price monitoring. However, official exchange rates may not reflect the true value of the currency. The informal exchange rate may be more realistic but it may not be evident or easily available. In such cases, more information outside the market may be needed. The FSNAU practical instructions to enumerators and data supervisors state that to avoid inconsistency in collecting the exchange rate between NGOs and markets, commission should not be taken into account. To avoid inconsistencies in rates for large versus small denomination notes, the enumerator should find out the exchange rate for a single, new US$100 note.

6. Frequency

Context, resources and purpose will determine the frequency of data collection

Prices can be collected with different frequencies, ranging from once a day to once a month or even once a season. Infrequently collected prices can hamper the accuracy of trends and the reporting of actual prices on markets; the same can be true of the 'noise' generated by daily observations. The context, objective and the resources of the price

[17] For example, the weight of a *malwa* in Sudan is 3 kg for sorghum, 3.5 kg for millet and 1 kg for charcoal.

[18] Food Security and Nutrition Analysis Unit. For further details, visit www.fsnau.org.

monitoring will determine how frequently data should be collected. Frequent price changes or high daily/weekly volatility could be triggered by the implementation of food assistance; the onset and recovery from a sudden shock; or erratic supply and demand conditions. Even the method of data collection can induce volatility.

If such volatility should be monitored, then data ought to be collected daily or at least weekly. However, if prices are expected to be fairly stable over a longer period of time thanks to constant demand and supply conditions, monthly prices may be sufficient. These can also consist of averages of one-day-a-week prices.

Data on different commodities can be collected at different frequencies, depending on commodity trading patterns. A shorter list of commodities can be monitored more frequently, leaving a more exhaustive list including non-food items to be checked less often.

In rural areas, market life often revolves on a weekly cycle. Small communities have a weekly (or twice weekly) market, thus people's purchasing behaviour operates on the cycle of a week. If there is only one market day a week, monitors should collect prices at a specified time during that day. If market activity levels do not differ significantly between days, the important question for weekly price monitoring is how often prices should be collected within each week (ranging from one to seven days). Normally, it is best practice to monitor for one day at a fixed, pre-specified time of day.

If activity levels do differ, the market days plus any other day need to be captured, except days with minimal or no activity (i.e. weekends). As expected, weekly prices based on the average of all daily prices results in a smoother weekly curve. On the other hand, one-day-a-week price monitoring shows much more volatility – closer to reality, but it may not be exactly representative of the price volatility of the whole week.

For monthly data, we consider it best practice to average weekly price observations rather than take just one observation a month at a specified week and day. However, the latter approach could be justified for less volatile commodities and by resource constraints. Difficulties arise when converting weekly price data (a Monday-to-Sunday week cycle, for example) into a monthly price which is based on calendar days (1st to 28th–31st). The first and/or last week could be partly in one month and partly in the next. However, a practical solution is to report weekly prices on a particular day of the week. For example, if weekly prices are collected or averaged every Thursday, then all Thursdays falling in that month (sometimes four, sometimes five) can be used to generate an average price for that month. Consistency in the approach is crucial.

7. TECHNOLOGY

PAPER-BASED DATA COLLECTION SHOULD BE AVOIDED AS MUCH AS POSSIBLE. TECHNOLOGY REMOVES MOST TIME AND RESOURCE CONSTRAINTS. BE SURE TO KNOW THE NEW IN-HOUSE SOLUTIONS RELATED TO BOTH FACE-TO-FACE AND REMOTE DATA COLLECTION

VAM provides a toolkit of state-of-the-art mobile solutions for price data collection. Two major innovations are related to the use of (smart) phones.[19] Enumerators who collect data through face-to-face (F2F) interviews can send prices and potentially other information through short message service (SMS) or the internet.

[19] Commonly available data collection tools in WFP are Geo-referenced Real-time Acquisition of Statistics Platform (GRASP), Open Data Kit (ODK), and the forthcoming Mobile Data Collection & Analytics (MDCA) platform.

Alternatively, when F2F interviews are not possible because traders (or households) cannot be easily reached or because of insecurity, price surveys can be done remotely through live voice calls, SMS, interactive voice response calls or web surveys (mVAM). Other potentially interesting avenues for price data collection come from crowdsourcing and web-scraping, and through itemized sales data.

When it comes to price data, there is always a need to remove outliers[20] for each of the tools mentioned above; in fact, this applies to any data collection exercise. The choice lies between two opposing views:

- ✓ Pursue higher accuracy during data collection: This means having fewer observations collected by trained enumerators following statistically representative samples, but relying on simple price averages by market and by commodity.
- ✓ Pursue higher accuracy after the data collection: This involves a higher number of observations collected by untrained enumerators following purposive or random (in a non-statistical fashion) samples, but relying on advanced statistical procedures to detect outliers afterwards.

Before taking a decision, consider these constraints: available budget, data collection frequency and duration, required geographical coverage, safety of physical access, availability of human resources, time pressure (see the table in Annex II) and sustainability in general (e.g. handing over to government).

Potentially, the techniques described below are not necessarily mutually exclusive. They can complement more standard data collection exercises, especially if diversifying the sources of information is an objective in itself, particularly in contexts where there are political issues and little trust in one sole source.

F2F using mobile devices

When it comes to F2F interviews, the advantages of using IT solutions instead of paper are straightforward. A properly designed IT tool will follow the skipping patterns of questions, run on-the-fly validation rules of thumb, contain dropdown lists of possible answers and highlight mandatory fields. This leaves the field monitors free to focus their attention on their interaction with traders, and to assess the quality of the information by politely probing whenever an answer sounds inconsistent. In other words, enumerators can concentrate on the most important part of their work, free from the challenges of complex and convoluted forms. Additionally, the software creates a dataset directly, saving a great deal of time and avoiding the errors[21] that are so common when paper questionnaires are manually entered into information systems. The growing network coverage in many developing countries makes these tools widely useful and data transfers are reasonably reliable with wireless or mobile internet. Field monitors can transfer the data either as soon as the form is completed, or whenever they reach a hotspot (e.g. back at the office). In rural areas or wherever insecurity severely limits business development, WFP is also exploring data-transfer architectures that rely on the wider

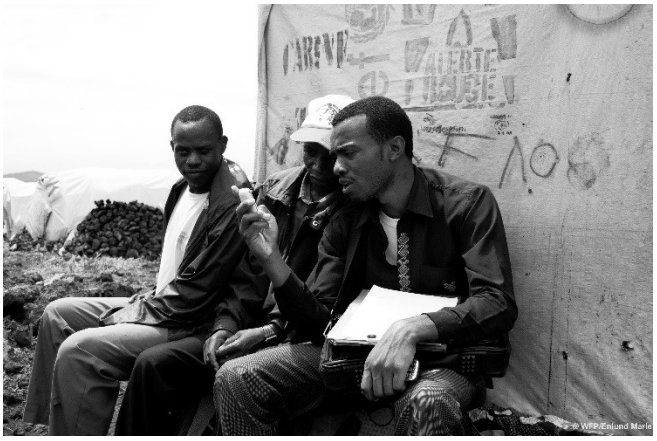
[20] "An outlier is an observation which deviates so much from the other observations as to arouse suspicions that it was generated by a different mechanism." Hawkins, D., *Identification of Outliers*, Chapman and Hall, 1980.

[21] "[These] are format errors, i.e. entries with wrong format that can be detected and screened from system input, content errors, i.e. entries that have correct form, but can be detected as logically inconsistent, and event description errors, i.e. entries that have correct form and are logically processable, but prove inconsistent after subsequent entries" (Smith, W.A., "Nature and detection of errors in production data collection" in *Spring Joint Computer Conf.*, 1967).

Global System for Mobile Communications (GSM) network instead (e.g. in Somalia).

Remote calls

F2F interviews can establish in-depth rapport with traders, which can help create market intelligence in the country. They also help in encouraging traders to answer longer surveys and potentially to share sensitive information. This comes with its trade-offs: costs, time and physical access, the latter becoming increasingly significant for WFP. Recently, remote data collection using voice and mobile text surveys through the mVAM project have avoided the need to confront field monitors with health-related (Ebola) or security-related (Yemen, Iraq, Syria etc.) risk.



mVAM allows different approaches to price data collection in terms of who is called and how. One approach could be to contact mobile phone users at random using contact lists of subscribers – known only to mobile phone network operators – via voice or text message surveys. You need a relatively large number of attempted calls – net from the natural drop-off rate – to collect an adequate sample of completed forms. This approach naturally focuses on households and the demand side. Apart from asking about purchasing prices, these questionnaire forms can include other information about recent household food consumption habits and coping behaviours.

A second approach aims to build a target group of responders who are traders with phone numbers known to WFP. This means making fewer calls and recognising that more accurate price data can be captured directly from traders rather than from households. In addition to prices, these surveys can include contextual information that can be useful in monitoring the 'health' of the market (i.e. its functioning).

Both of these examples require setting up a call centre before starting data collection. This involves hiring operators, setting up space and equipment to make the calls, and building/testing the data collection/entry interface. Finally, you need to create a phone number database, either by contracting a network provider or by asking traders for their phone numbers. Note that for all regions, VAM has established long-term agreements with call centres that can be contracted for different types of work.

Remote surveys need to be short enough to maximize respondent survival rate over the length of the call. Questions need to be chosen carefully to minimize respondent fatigue and to avoid sensitive topics that are difficult to broach even with F2F interviews (e.g. profit margins, income). As these calls are designed to be made frequently (e.g. once a week), only ask for information that is likely to vary greatly from week to week. Respondents may also welcome some form of compensation for their time (i.e. a small amount of mobile credit). Admittedly, when it comes to traders this may be a small incentive. It might be more fruitful to set up a two-way flow of market information (from the traders to the call centre and vice versa), which could make traders more amenable to being contacted repeatedly by WFP.

As with all scientific attempts to measure complex phenomena with data, we need to be aware of certain limitations. Sampling bias is likely for traders and households, either because of the selection of known phone numbers or – in the case of households - with regard to age, education and

wealth status. Despite the growing use of mobiles in developing countries, women, the elderly, the illiterate or the poorest people may be under-represented in the sample. In addition, households can report on prices with a high degree of inaccuracy, making outliers very likely in the data collection and calling for statistical techniques to filter them out as much as possible.[22] However, as this is a relatively new field of analysis, further research may greatly improve the reliability of prices collected from households.

Crowdsourcing[23]

With this approach, we do not rely on field monitors or call centre operators, but on spontaneous contributors. Alternative crowdsourcing methods have been recently tested for food price data collection, as described in a recent comprehensive review of these methods in Africa, in particular using smartphone apps or SMS technology.[24] With the former, contributors can download and install an app on their mobile phones. With the latter, text messages are sent to random numbers, inviting the recipient to participate in the survey. In both cases, the idea is to rely on a relatively high number of local people who can report on prices frequently in return for relatively small payment as a function of the amount and quality of the data they provide.

The value of these methods lies in the high frequency of the data collection, the potential coverage of an increased number of commodities and markets per country including rural and remote markets, and the large numbers of observations that can be collected in a short time.

Crowdsourcing contributors are not required to be trained, so they are unlikely to have a deep understanding of the rationale behind the data collection exercise.

Price data collection using SMS has been widely tested by WFP, for instance during the 2014-2016 Ebola crisis in Guinea, Liberia and Sierra Leone,[25] and in Kakuma refugee camp in Kenya.[26]

With regards to smartphone app technology, WFP has been exploring crowdsourcing in different countries including Indonesia,[27] Yemen, Malawi, Zambia and Zimbabwe in partnership with the private sector. The lack of a close relationship with WFP and the app provider gives rise to quality concerns. Remote quality controls need to be enforced, including a GPS check to understand if and where the data was collected in the markets. Picture checks[28] also help confirm that contributors are reporting on the same variety of food products and that they are using the same units of measurement. Data screening using statistical methods can detect and exclude wide-off outliers.

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[22] Some very simple methods are i) using the median price rather than computing the average of prices; ii) accepting only prices within ± 2 (or 3) standard deviations from the mean; and iii) filtering out prices above (below) the 75th (25th) percentile plus (minus) 1.5 times the interquartile range. A more comprehensive review of (advanced) methods is available in Aggarwal, C., *Outlier Analysis*, Kluwer Academic Publishers, 2013.

[23] The Oxford English Dictionary defines 'crowdsourcing' as the "practice of obtaining information or input into a task or project by enlisting the services of a large number of people, either paid or unpaid, typically via the Internet." For additional details on this neologism, please refer to Howe J., 2006, *The Rise of Crowdsourcing*, Wired, 14:6.

[24] Zeug H. *et al.*, 2017, *Innovative Food Price Collection in Developing Countries, Focus on Crowdsourcing in Africa*, Joint Research Centre (JRC), Luxembourg: Publications Office of the European Union.

[25] See mVAM Food Security Monitoring website on the three West African countries.

[26] WFP, 2015, *Crowdsourcing Food Prices in Kakuma, Kenya*, mVAM blog.

[27] Global Pulse, FAO, and WFP, 2015, *Feasibility Study: Crowdsourcing high-frequency food price data in rural Indonesia*.

[28] However, in some market settings photography is not welcome and can put contributors in danger.

BOX 1. TIPS FOR BUILDING A DIGITAL PRICE MONITORING TOOL

- ✓ Generally try to avoid optional or 'nice-to-have' questions. Having compulsory fields ensures that key information is properly collected. Make sure you know in advance how to analyse each question, and drop those that are irrelevant.
- ✓ Avoid open fields to identify markets, traders, commodities, and unit of measurement. Instead, organize each field with a drop-down menu to dramatically increase data quality.
- ✓ Numeric fields need validation. Use ranges for numbers to prevent inconsistent data, even if for practical reasons those have to be broad. Otherwise consider adding warning messages for enumerators to double check the data input.
- ✓ Design on-the-fly calculation fields where possible, to improve data consistency or when two or more questions are linked. For instance, showing the price change from the last price data collected in a market can immediately detect whether the price was wrongly collected.
- ✓ Branching and skipping logic create 'smart' surveys, where traders can answer relevant questions based on their previous answers. For instance, if a trader sells maize at the wholesale level, then the unit of measurement needs to be in bags (between 50 and 100 kg, depending on the country), while for retailers the unit of measurement would be in kilograms.
- ✓ Avoid skipping patterns that leave empty fields, but always allow for fields like 'item not sold', 'don't know', or 'no answer'.
- ✓ Geo-spatial information matters. Always include GPS coordinates.

Although this approach seems promising, particularly for security restricted environments, evidence suggests[29] that local contributors can face unacceptable threats or even be detained because of their unofficial status in the face of government institutions. This limits the value of this solution in certain unstable contexts. Further limitations include long ramp-up times and difficulties in finding anonymous enumerators who can reach remote markets, all which translates into higher costs and extra work when getting started.

Web-scraping

Almost all websites can be scraped using software that searches for and extracts food prices, without having to rely on Application Program Interfaces (APIs) that allow a direct out-bound data flow from sites. At the time of writing, this approach has been quite promising in constructing daily price indices using prices collected from online retailers to complement official statistics.[30] The technique requires hard coding and data-scientist and econometric expertise to deal with 'big data', and its potential could be quite limited in countries where internet infrastructure and use are less advanced and inclusive.

8. PRICE MONITORING BEYOND FOOD

MONITORING FOOD ALONE IS NOT ENOUGH AS FAR MORE COMPLEX SOLUTIONS FOR FOOD ASSISTANCE ARE IMPLEMENTED

Beyond food, a number of additional items can be monitored for food security. Below we provide a short list of items, including fuel, wage rates, exchange rates and livestock. These are just a few examples, as in a multipurpose food assistance fashion the list could expanded to reflect project objectives, for instance taking into account Water,

[29] mVAM blog, *Crowdsourcing food prices in remote areas: a bridge too far?*, 2017.

[30] See (among others) Cavallo, A., "Online and Official Price Indexes: Measuring Argentina's Inflation". Massachusetts Institute of Technology. 2012; and Breton, R. *et al*. "Research indices using web scraped data". Office for National Statistics. Newport. 2015.

Sanitation and Hygiene (WASH) projects, or the house rental market.

Fuel

Naturally, prices can be monitored for items other than food. Given their high causality to food price changes, fuel prices are always worth collecting. They can help understand whether food price volatility can be explained by fuel price levels only or if other reasons exist (e.g. harvest failure). Fuel scarcity, varying fuel prices and the existence of informal markets are signals that are likely to be transmitted to food prices. Prices should be collected in two or three randomly sampled petrol stations close to selected markets.

During substantial fuel shortages, it is important to keep an eye on the black market. The black market rates for fuel will most likely not be obtained at petrol stations but through backyards known to the local transport community.

As well as petrol/gasoline or diesel prices, kerosene or paraffin and charcoal prices are worth monitoring as they may constitute a significant share of household expenditure and are also important for food security (i.e. food preparation and utilization).

Wage rates

For those most vulnerable to food insecurity, labour is often the main – or only – source of income. As such, "the terms of exchange between returns to labour and food constitute a critical element in the access of the poor and vulnerable to the food that they need."[31] WFP provides detailed guidance on how to collect and analyse labour market information including wage rates at household and community/village levels through key informants[32] focusing on a) expanding the depth of analysis already devoted to labour-related topics in other food security assessments;[33] and b) providing practical guidance to set wages in public works programmes designed for income generation and infrastructure creation.

One of the most straightforward ways of linking wages to food prices is the trend analysis of terms of trade, which is the "measure of the relative value of one commodity to another (or the inverse of their relative prices) and thus a measure of the exchange value of the good or service to be traded."[34] Despite its limitations,[35] the terms of trade indicator gives a direct measure of food access (e.g. how much of a given commodity can a person's wage buy?). This is important particularly when food expenditure comprises a large part of total expenditure and where a staple food contributes the bulk of a person's caloric intake. Further analysis relates to the stability of casual labour opportunities (e.g. how many days a month can a casual labourer expect to find work?) and the comparison of food access by livelihood group.[36]

As WFP seeks to reach the most vulnerable people, the daily wage rates of casual workers are likely to

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[31] WFP, *Labour Market Analysis Guidance,* Analysis and Nutrition Service. 2013.

[32] *Ibid*.

[33] WFP, *Emergency Food Security Assessment Handbook*, Food Security Analysis (2nd ed.) 2009; WFP, *Comprehensive Food Security & Vulnerability Analysis Guidelines,* Food Security Analysis (1st ed.) 2009; and UNHCR & WFP, *Joint Assessment Mission (JAM) Guidelines* (2nd ed.) 2008.

[34] FEWS NET, *Terms of Trade and Food Security Analysis*, FEWS NET Market Guidance No. 5, 2009.

[35] Limitations include i) that wage rates may not necessarily indicate whether labour opportunities are scarce or abundant; ii) that the indicator considers the consumption of just one single staple food rather than a bundle of commodities including non-food items; and iii) multiple income sources are not contemplated (*ibid.*).

[36] For an extensive description, see WFP, *Labour Market Analysis Guidance,* Analysis and Nutrition Service. 2013.

be the main focus of data collection.[37] These can include daily wages in crop production, in non-crop agriculture and in the construction sector. By contrast, monthly wages are usually paid in salaried jobs and are therefore not always monitored unless specifically required for the analysis.

If wage rates are to be collected for monitoring purposes rather than as part of large surveys, neither household interviews nor community focus groups seem viable solutions to generate the data. In many countries, both in rural and urban areas, there are places where casual labourers meet to seek daily work opportunities in agriculture and construction. In this case, it is possible to inquire about daily wages offered at these locations. Traders can also be asked about the payments being offered for casual jobs (usually loading and off-loading goods) if that is of interest for the analysis.

According to the frequency of the data collection, the average wages for unskilled and skilled labour (or any other salary) can be computed from observations collected over the month, to allow for trend analysis and take into account seasonal variations in the labour market. Obviously, wage rates for skilled labour (e.g. carpenters, supervisors) are usually higher than for casual work and should be treated separately from unskilled jobs.

Whenever a cash equivalent is paid in kind, it should also be recorded so as to determine the total wage. There are no golden rules about the minimum number of interviews and practical workarounds apply, as explained in the section discussing trader selection.

Exchange rates

Exchange rates between local and foreign currencies are important determinants for the prices of imported or exported commodities. A depreciating local currency will increase the import bill for net importing countries and thus drive prices of respective commodities up. As such, it is important to keep an eye on both official exchange rates, normally communicated by the national central bank, and parallel exchange rates, which are available through local dealers and become increasingly more important to monitor the more they deviate from the official rate. This is the case when the local currency does not float freely but is pegged to the foreign currency, with the deviation indicating a shortage of foreign exchange. The best way to obtain the parallel rate is to buy local currency: ask national staff who have access to points of exchange.

Livestock

In several countries in the Sahel and the Horn of Africa, pastoralism is a key livelihood. Therefore, when the focus of the price data collection shifts from consumption to livelihoods, it is important to monitor livestock prices. In many cases livestock markets are open once a week, and field monitors

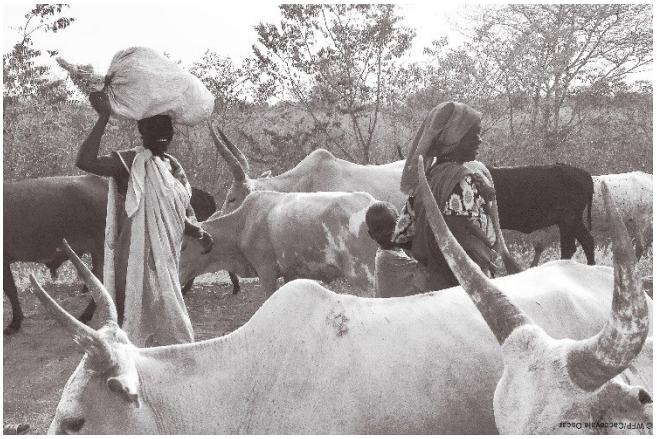
[37] By contrast, wage rates monitored by the International Labour Organization in the Global Wage Database are minimum wages, average nominal wages, average real wages and average real wage growth.

will need to collect prices from at least three different sellers for the same type and quality of livestock (e.g. a one-year-old female sheep; a two-year-old male sheep). Under no circumstances should the prices of live animals be replaced with those of meat sold in butcheries or restaurants.

BOX 2. TIPS FOR FIELD MONITORS

Before collecting price data, field monitors must have a basic understanding of the market locations, actors and dynamics and have full command of data collection tools and questions. A number of tips may smooth the process.

- ✓ Your safety comes first. People collecting market information are not always welcome and can sometimes be met with open hostility. Avoid being in the market alone.
- ✓ Make sure local authorities are familiar with the nature of your activities in the market. Obtain all necessary permissions and security clearances, and meet with the market chief (if there is one) to inform him/her about the exercise before accessing traders.
- ✓ Have a clear plan of your daily visits and minimize travel time. Make preliminary logistics arrangements with traders if need be.
- ✓ Make sure you have a clear understanding of the different categories of traders.
- ✓ Visit the market during peak hours, and observe the overall market activity and some transactions for a while before recording prices.
- ✓ Clearly state who you are and the purpose of your presence in the market. Expect to be mistaken for a local tax officer. Possibly wear visible WFP clothing (badge, cap and/or shirt) to help identify yourself.
- ✓ Emphasize that the information will be treated anonymously.
- ✓ Always ask if you can take notes, whether you are using paper or a device.
- ✓ Always ask permission before taking a picture.
- ✓ Establishing a friendly relationship with vendors can help gain their trust so that the data they provide is more accurate.
- ✓ Be polite, focused and direct. Do not interfere with trading and avoid wasting time. If customers come into the shop, step aside and allow the transaction.
- ✓ Your presence can easily be perceived as a business opportunity. Try to be as unobtrusive as possible, and avoid arriving in a (shiny) car and fancy clothing. Do not make any deal on behalf of WFP.
- ✓ Do not accept any valuables from traders.
- ✓ Use the monitoring form without modifying it in any way. Make sure all the mandatory fields are correctly filled in.
- ✓ If prices are expressed in local units, make sure you understand the unit and how to convert it to the international metric system (kilograms and litres). It may be worth taking pictures at the beginning of the exercise to have a common ground between field monitors. Ideally, verify weights with your scale and adjust prices if necessary.
- ✓ If possible, report prices on the same days and times every week.
- ✓ Read and report the prices on the shelves when displayed.
- ✓ Keep in mind the price recorded the previous week/month, and always triangulate the information received with visual observations. Whenever you feel the information is not accurate, please discard it.
- ✓ Take notes if vendors are willing to share further information beyond your monitoring form. This may be important if unusual price changes are observed.
- ✓ If you have a GPS device, make sure you accurately detect the location of the market (or trader). This can take a bit of time, but it is time well spent because valuable information will come from correctly mapping the data.



ANNEX I - SAMPLING IN A NUTSHELL

Survey Methodologies – Normative Considerations

The normative aspects of data collection fall into two main categories of survey approach: probability methodologies and nonprobability methodologies. The difference between these depends on the procedures followed in the sample design and respondent selection. We give a brief description of each methodology below and compare their respective advantages and disadvantages.

Probability Sampling Methodologies

Probability survey methodology requires a clear understanding and definition of the population, sampling frame and sampling methodology. For example, the objective of a survey could be to establish a representative price for a commodity (the price that sellers sell at or consumers buy at, in case of retail prices) in a given market centre (a village or town). Therefore the population comprises all possible sellers of that commodity in that area. However, it is not possible to draw a sample from such loosely defined population. We need to specify the sampling frame since the population is general and the sampling frame is specific. The sampling frame in our case would be a list of all those sellers/traders of the commodity in the market centre. For practical purposes, our sampling frame could also specify the eligible traders by predefining certain minimum qualifying criteria such as the amount of goods they normally sell, their shop size, their willingness to provide reliable information, etc.

In probability sampling, a sample is drawn randomly from a given sampling frame. Each observation (or information provider/respondent) has an equal chance of being selected. This makes the selected sample representative of its population. There are several types of random sampling techniques, depending on how the population is structured. The most common ones are as follows:[38]

- ✓ Simple random sampling: SRS, where each member of the population has an equal chance of being selected.
- ✓ Stratified random sampling: when a heterogeneous population is split into fairly homogeneous groups/strata based on a factor that may influence the variable that is being measured; then SRS is applied in each stratum.
- ✓ Cluster random sampling: where the population is divided into similar groups/clusters. Each member of the population is assigned to just one cluster. A sample of clusters is chosen, using a probability method (often SRS). Only individuals within sampled clusters are surveyed. It may be more cost-effective to select respondents in clusters. Again SRS or systematic random sampling (see below) is applied in each selected cluster.
- ✓ Systematic random sampling: this involves a random start and then selection of every k^{th} element of the sample frame from then on, where k is equal to the population size divided by the sample size. In this case, if the population

[38] A more comprehensive review is available in many books and is beyond the scope of this guidance. Among the others, see Fuller W.A., *Sampling Statistics*, John Wiley & Sons, Inc., New Jersey, 2009.

is 100 and the sample size is 10, when the first individual selected is the 6th, then only the 16th, 26th,…, 96th respondents will be selected.

These sampling procedures are used in specific circumstances depending on the homogeneity of the population and the inclusion of specific strata/groups/clusters with characteristics that are important to the researcher.

A truly random sample based on scientific principles produces unbiased and representative estimates of the population. Probability sampling is able to quantify the sampling error and thus puts the results in probability terms.

In an SRS, the desirable sampling size for a survey depends on the following parameters:

- ✓ *Allowable margin of error (e)*, as no single sample can perfectly reproduce the entire population results, one has to allow a certain amount of error. Typically the margin of error is between 1 and 10 percent.
- ✓ The *Z*-score corresponding to the *desired confidence level*. Most people use 1.64, 1.96 or 2.58 representing respectively the 90, 95, or 99 percent confidence level, taken from the standard normal distribution table.
- ✓ *Population size*, e.g. the number of traders in the market *(N)*, which determines a sample size that does not change substantially for populations larger than 10,000 individuals.
- ✓ The *response distribution (p)*, which is conservatively set to 50 percent if no prior information exists about the population probability distribution.

The formulas to calculate the number of respondents needed[39] are as follows:

$$n_0 = \frac{Z^2 \times p \times (1-p)}{e^2} \quad [1]$$

$$n = \frac{n_0 \times N}{n_0 + N - 1} \quad [2]$$

where n_0 and n are respectively the sample size without and with finite population correction. Using an example where N is 100, e is 5 percent, and the confidence level is 90 percent, if we substitute n_0 in equation [2] to allow the correction for finite population we would have a sample size of:

$$n = \frac{1.64^2 \times 0.5 \times (1-0.5) \times 100}{1.64^2 \times 0.5 \times (1-0.5) \times 100 + 0.1^2 \times 100 - 0.1^2} = 74$$

always rounding the fraction up.

Provided the sample is large enough, random sampling offers the best chance to obtain a representative sample and to produce unbiased estimates that allow external probability generalization. For example, if the goal of the survey is to produce prices representative of a district or province, then one requires the random sample from the population of all potential sellers throughout the district/province, from all possible markets. Table 1 shows how the sample size changes with different confidence levels and error margins.

Admittedly, for price monitoring in small markets a sampling as such is not the ideal solution since the required sample size is relatively high compared to the overall population of interest; however, it is a viable alternative in large-scale trader surveys.

Table 1 - Survey sample size n

c.l.	90	95	99	90	95	99	90	95	99
e	10	10	10	5	5	5	1	1	1
p	50	50	50	50	50	50	50	50	50
N					**n**				
25	19	21	22	23	24	25	25	25	25
50	29	34	39	43	45	47	50	50	50
100	41	50	63	74	80	88	99	99	100
200	51	66	91	116	132	154	195	196	198
500	60	81	125	176	218	286	466	476	486
1,000	64	88	143	214	278	400	872	906	944
2,000	66	92	154	239	323	499	1,544	1,656	1,785
5,000	67	95	161	257	357	586	2,876	3,289	3,843
10,000	68	96	164	264	370	623	4,036	4,900	6,240

[39] For a non-technical description, see the sample size estimation note in the mVAM resource centre.

Nonprobability Methodologies

Contrary to the situation explained above, if the goal of the enquiry is to gain insights into a phenomenon / individual behaviour / event or to provide an indicative estimate rather than to generalize a population, the researcher may use qualitative methods of sample selection. If the objective of the survey is not the representativeness and the scientific rigour of the estimate, good indicative estimates with much lower costs will do the job. In such cases, non-probability or non-random sampling methods are widely used by researchers as they are more convenient and deliver critical information more quickly. The methods most relevant to market price surveys are as follows:

✓ *Purposive or judgment sampling,*
where observations are selected to fulfil a certain set of purposes defined by the researcher, such as the importance of the market (for market selection) in a given area; and the size of traders' turnover, and their reliability, trustworthiness and willingness to participate in the survey and provide information (for trader selection). It includes a judgment about what constitutes a suitable mix of people to participate in the sample. A fair representation of the population is made by deliberate decisions rather than a random process.

✓ *Convenience sampling,*
where selection is based on certain convenience criteria, such as the ease of access to the market centre, the market or the informant both geographically and in terms of communication.

✓ *Quota sampling,*
which is similar to stratified sampling where the population is divided into groups and a mix of individuals is selected purposively from each stratum rather than randomly.

✓ *Case study sampling,*
where particular information providers are interesting cases given the unique role they play. For example, certain mid-size traders might be selected because they generally cater to the poor, tribes or welfare recipients. There may be traders who are quite the opposite, dealing mostly with upscale clientele. Others could specialize in selling large volumes and thus offer the highest selling grade, quality or brand.

Clearly, these methods suffer from selection bias and thus cannot be used if representativeness is important in the information obtained. Nonetheless, qualitative sampling methods are widely used as they typically rely on a much smaller sample size. They are cost efficient, faster to implement and can improve the consistency of estimates over time.

ANNEX II – COMPARATIVE TABLE OF DATA COLLECTION TECHNOLOGIES

Item \ Methodology	F2F – paper based	F2F – mobile devices	mVAM – calls to households	mVAM – calls to traders	Crowdsourcing	Web-scraping
Enumerator	Field monitor	Field monitor	Call centre operator	Call centre operator	Contributor	-
Number of enumerators needed	Large	Large	Small	Small	Large	-
Enumerator training	Yes	Yes	Yes	Yes	No	-
Potential geographical coverage	Medium to large	Medium to large	Large	Small to medium	Large	Unknown
Most important accuracy check	Before and after data	Before data collection	After data collection	Before data collection	After data collection	After data collection
Dataset size	Small	Small	Big	Small	Big	Big data
Sampling technique	Probability, Purposive, or	Probability, Purposive, or	Probability or Mixed	Purposive	Purposive	-
Frequency	Low	Low	High	High	High	Very High
Possible access problems	Yes	Yes	No	No	Yes	No
Time needed for pre-liminary results	Long	Medium to long	Short	Short	Short	Medium
Budget needed	High	High	Medium	Low	High	Low

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