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***Title of Paper: Use of Latest Technology in Data Capture for Consumer Prices:  
Philippine Experience***

## **Abstract**

The generation of the Consumer Price Index (CPI) in the Philippines started as early as 1945. Since then, data capture was through the traditional paper and pencil method. With the advent of modern technology, android devices (tablets) were used in 2015 to enhance recording, validation and transmission of prices data from the district level to the field offices and to the Central Office at a faster speed and paperless mode.

This paper presents the different phases of activities undertaken in the implementation of android device tablet in the collection, processing, validation and transmission of price data for the generation of the 2006-based CPI for all income households and the 2000-based CPI for the bottom 30% income households. This paper also briefly discusses the features of the system named Price Tag for the android device tablet and the CPI Store Merger system for building up cleaned reference files.

The CPI Store Merger is a Windows-based system that cleans and merges data for the reference files of names of stores/outlets in the two CPI series (2006-based and 2000-based CPI). The output of the said system is a merged reference file containing all the sample stores in the 2006-based and 2000-based CPI.

On the other hand, the android-based data collection system called Price Tag was also developed to expedite data capture in the field and submission to the Central Office. This system enables the price collector to validate the price data collected on the spot by facilitating data validation at the provincial level and Central Office. The method decreases the errors in transcription of the traditional method of data capture. The system also captures the coordinates of the location of the sample stores visited by the price collectors through the use of the Global Positioning System which can be used by the Central Office staff or the field supervisor to check

if price collector actually visited her/his assigned sample outlets/stores. An image for each item in the CPI market basket for each province is developed and incorporated in the system as a guide to the price collectors for purposes of consistency of collecting prices for a specific item.

Problems have been encountered, such as unavailability of internet connections and security in some areas, the use of tablets in collecting, processing and validating price data, nonetheless, provided more benefits that ensures the reliability of price data, provides faster transmission of data and efficiency.

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## **I. Introduction**

There are ten (10) price collection systems currently undertaken by the Philippine Statistics Authority (PSA). Among these price systems, the consumer price index (CPI) is the most important. The CPI is an indicator of the change in the average prices of a fixed basket of goods and services commonly purchased by an average Filipino household for their day-to-day consumption relative to a base year. It shows how much on the average, prices of goods and services have increased or decreased from a particular reference period or commonly known as base year. The base years for the CPI series used in this paper are the 2006 and 2000. As an indicator, the CPI is most widely used in the calculation of the inflation rate and purchasing power of the peso (PPP). Inflation rate is the annual rate of change or the year-on-year change in the CPI. The PPP, on the other hand, gives an indication of how much the Philippine peso is worth in a given period relative to its value in a base period. The CPI series also serve as basis for economic analysis, for collective bargaining agreements, for wage adjustments, and for monitoring the effects of government economic policy.

Hence, the timeliness and reliability of this data set is with outmost concern.

The other nine (9) price collection systems are the following:

1. Survey of Retail Prices of Commodities for the General Retail Price Index
2. Survey of Wholesale Prices of Commodities for the General Wholesale Price Index
3. Survey of Retail prices for Construction Materials for the Construction Materials Retail Price Index
4. Survey of Wholesale Prices for Construction Materials for the Construction Materials Wholesale Price Index
5. Producer's Price Survey for Producer Price Index (PPI) for Manufacturing
6. Farm Prices Survey
7. Retail Price Survey of Selected Agricultural Commodities
8. Wholesale Selling Price Survey of Selected Agricultural Commodities
9. Weekly Cereals and Fertilizers Price Monitoring

## **II. Historical Brief**

The CPI was formerly referred to as the Cost of Living Index (CLI) undertaken by the Labor Statistics Division of the Department of Labor. The CLI series had 1941 as base year and covered only Manila. The market basket contained 66 commodities representing goods and services commonly purchased by low-income families (families living within minimum level of subsistence).

The task of calculating said index was transferred to the Bureau of the Census and Statistics (BCS and now the PSA) on January 1, 1941. The first series constructed by the BCS was in 1945. This series lasted for 18 years (1945 to 1963).

In 1964, weights were based on the results of the 1961 Survey of Income and Expenditures and the average price for 1960-1962 was used as the base price. This series was referred to as the Consumer Price Index for Low-Income Families in Manila (families whose annual income did not exceed ₱2,400). The market basket was almost four times larger as it contained 244 items.

Since the first revision, the CPI has undergone several updating and rebasing exercises. Rebasing was necessary as when the basket of the reference year no longer represents what is commonly purchased by the households, the CPI becomes irrelevant and tends to give wrong market signals. The CPI is an indicator that derives its usefulness in its representation of how much a typical market basket behaves over a specific period of time.

Previous CPI series had 1941, 1961, 1966, 1972, 1978, 1988, 1994 and 2000 as base years. The former NSO came out with the results of its last rebasing exercise, shifting the base year from 2000 to 2006 in July 2011. The rebasing to year 2012 had been completed and results were released on 06 March 2018.

Since the CPI is one of the most widely used price statistics, the continuous improvement and review of existing processes on data collection and validation is important for a speedy and reliable delivery of data.

As such, PSA reviewed the existing data collection and processing system of the price survey for a more accurate and timely release of monthly CPI at the provincial, regional and national levels. This was also done for the PSA to be in-step with the current technology available in the market.

Since 1945, prices for the generation of CPI are collected by personal visits to selected outlets/stores and the use of the printed survey forms in recording prices. These personal visits are made by trained and experienced field officers, who observe actual market prices as well as discuss with the retailers the actual prices on the day of visit. The field officers record all this information on the survey forms generated from the CPI system.

With the current technology available in the market and to take advantage of the benefits of digital revolution, the PSA launched the use of android devices (tablets) in 2015 in recording directly the price data from the sample outlets/stores to facilitate recording, validating, processing and transmitting of price observations from the district level to the provincial offices and to the Central Office at a faster speed and paperless mode. This digital data collection is faster, more reliable, and in many cases, more economical than the traditional survey forms. This mobile technology also records the Global Positioning System (GPS) coordinates of the sample outlets during the price collection in real-time. In this system, the Central Office will enable to check whether price collectors visited the same sample outlets regularly and as scheduled.

### **III. Activities Undertaken for Digitized CPI Price Collection System**

This section discusses the different phases of activities undertaken from the preparatory phase to the implementation of a digitized price collection system for the CPI. Brief discussions of the features of the system and the challenges encountered from the pre-testing, training and implementation are included.

#### **A. Preparatory Phase**

The Philippine Statistical Research Institute (PSRTI), a research institution of the Philippine Statistical System along with the staff of the PSA planned, tested, reviewed, and implemented the use of android-based price data collection system for the generation of the monthly CPI. The team conducted several meetings and brainstorming to determine the required technical specifications of the tablets to be used as well as to develop the processing system suited for the CPI using the android-based device unit. The team members from the Information Technology System and Research Division (ITSRD) of the former NSO, now the Systems Development Division of the PSA attended a special training in developing applications using android-device to equip them in the development of the system.

The important inputs in the android-based system developed for the tablet are the two reference files for the names of stores/outlets by item from the 2006-based CPI (CPI2k6) market baskets for all income households and the 2000-based CPI for the bottom 30 percent income households (CPI2kb30) which the PSA generates. The reference files were cleaned and updated in preparation for the implementation of the use of tablets in the price collection. A customized Windows-based system named CPI Store Merger was developed by the IT team to serve as a tool during the data cleaning and merging of the reference files for the names of stores/outlets of the two CPI market baskets.

The development of databases for the names of stores was a difficult task for the field offices as they have to identify the names of store/outlet for each item in the CPI market basket. The building of databases took some time to be constructed.

Along with the CPI Store Merger System, the User's Guide was prepared. The data cleaning of the two provincial reference files namely, the CPI2k6 and CPI2kb30 were undertaken following the User's Guide. Data cleaning refers to (1) checking when a certain sample outlet is used for the price collection of items for both CPI2k6 and CPI2kb30, its name, address and assigned outlet ID number should be the same or consistent when entered/encoded in the reference files for CPI2k6 and CPI2kb30; (2) removing the duplicates when a store is entered more than once in the database; (3) verifying that each sample areas should have a unique ID numbers from 1 to 6 and the assignment of outlet ID number for the same sample areas in CPI2k6 must be consistent with those in CPI2kb30; (4) correcting the errors in entering the names and addresses of sample stores, i.e. spelling, spaces, abbreviation, etc. Data cleaning is important so that the names of the outlets where prices are collected for both CPI2k6 and CPI2kb30 will appear only once in the consolidated or merge list of sample outlets for the two CPI series. Selected field staff also took time in data cleaning of the databases. Series of

communications between the staff of the central office and field offices were done during the data cleaning process.

The system for the tablet, called Price Tag, was then developed by the IT team in recording, processing, validating, and transmitting of price observations directly from the tablet from the provincial/field offices to the Central Office. The Product Image Capture (PIC) system was also developed for the tablet to allow the user to capture an image for a particular commodity, which will help the price collector to exactly determine the product to price. Pre-testing and pilot-testing were done by the team on the use of the three systems developed: CPI Store Merger system, Price Tag system and PIC system. Initially, twenty (20) Acer tablets were acquired and used for the pre-testing of the price collection system in National Capital Region (NCR) and pilot-testing in the provinces of Pampanga, Rizal and Cebu. Suggestions and recommendations during the troubleshooting of the team were noted and incorporated by the system developers and these further improved the system.

After series of pre-testing and pilot-testing of the developed price collection system and of the merged reference files, another User's Guide in the processing of price data was developed. This guide entitled "The User's Guide on the New Price Collections System Using an Android Device" discussed the detailed instructions on the installation and system configuration of the Price Tag system, the importance of using the new system in the price data collection, detailed instructions on using the Price Tag system in price collection, and instructions in downloading the data files from the web server for consolidation and verification of price data and data processing flow. This User's Guide had undergone several revisions then, to cater several suggestions and comments of the team members. The team conducted a workshop in Baguio City on November 2014 to finalize the two user's guides named "Guide on the New CPI Price Collection and Processing Systems using an Android Device and A Guide in Merging/Cleaning the Reference Files of the Sample Outlets /Stores for CPI Price Collection". These user's guides were finally printed on May 2015.

Meanwhile, the members from PSRTI posted bidding for the acquisition of units that will be used during the implementation phase by the provincial offices throughout the country. Bids and Awards Committee of the PSRTI selected the approved bidder. But due to some technical problems, the acquisition of the units was delayed. Hence, the initial timetable for the acquisition of units and trainings on April to July 2014 were postponed and finally realized when the newly acquired units were delivered on May to June 2015.

## **B. Implementation Phase**

A briefing of trainers on the new price collection and CPI Store Merger systems was conducted in August 2015, and this was attended by the team members.

Prior to the training and implementation phase, an average of six tablets was used by each province.

It was immediately followed by the four batches of second level training which was attended by one regional staff and two provincial staff involved in the processing and price

collection of data for the CPI from each region and province on staggered basis from September to November 2015. The preliminary implementation on the use of tablets in price collection and processing started on October 2015. During preliminary implementation of the activity, simultaneous with the use of tablet, all price collectors were instructed to continue to use the current method in recording prices (through the use of printed survey forms). Data encoding and validation of price data were also done through the use of the current CPI Data Processing system. Likewise, submissions of the data files were done through e-mails and web server. Parallel run of the two systems is done to ensure that complete price data are received on time. Among the challenges encountered during this implementation were (1) some price collectors have difficulties in establishing a GPS signal within the collection area, thereby, GPS coordinates were not registered in the price data sent to the web server through the use of internet; (2) some price collectors were not able to connect to the internet due to weak internet signal in their area, thus, data were not directly sent to the web server.

The final implementation was undertaken in the first quarter of 2016, that was, sending of all CPI price data will be done through the web server.

### **C. Features of the System**

In preparation for the use of tablet in the collection, validation and transmission of price data from the field offices to the PSA web server/Central Office, a system named CPI Store Merger was prepared to help the provincial statistician clean and update/merge the two reference files for the list of stores/outlets used in the price collection for the generation of the two CPI series (2006-based CPI for all income households and 2000-based CPI for the bottom 30 percent income households). The system facilitated the works of the provincial statistician in correcting, updating and merging of the names of stores for the CPI. The output file named *Pricespp.mdb* (where *pp* is a one or two-digit geographic code assigned to each province for CPI purposes) generated by the system was the consolidated reference file/database that contains both the stores in the CPI2k6 and CPI2kb30 which serves as the database reference file in the new price data collection system (Price Tag) using an android device.

Below are the hardware and software requirements of the Price Tag system.

For the hardware requirements, the system required an android device with a SIM (Subscriber Identity Module) card slot and with at least 120 MB Internal memory and operating system version 4.4 (Kitkat version) or higher. The software requirements, on the other hand, are android-based applications for tablet, such as Price Tag and Product Image Capture (PIC) systems, were developed.

The Price Tag system was a customized system used in the encoding, recording, validating, processing and transmitting of price observations from the field offices to the web server (<https://prices.psa.gov.ph>). This system has the following features: (1) a *Manage Store List* module, a module which is used for selecting the sample stores to be displayed in the list of stores; (2) a sorting feature which allows the sorting of commodities by commodity code, commodity description or by customizing the order of commodities in desired position; (3) a store display icon with color coding schemes, to identify if all, some or none of the commodities

in a store are priced; (4) a GPS feature which tracks the exact location of the stores/outlets and registers the exact date and time of visit in the store; (5) a price verification feature, in which a verification message will appear if the price entered in the Price Tag is less than or more than 15 percent higher or lower than the previous validated price; (6) an impute button and built-in calculator, for imputing prices of commodities whose quantities available in the markets are not the ones specified in the market basket, e.g. 500 grams to 1 kilogram; (7) an *Export to CSV* feature which converts and saves the data into a CSV file; (8) a *Send via Internet* feature that allows the price collector to send the data to the web server through internet connection; (9) a *Send via SMS* feature for sending the price data through Short Messaging System (SMS); and (10) a price/remarks indicator which are displayed opposite the commodity code/commodity description. The price entered is displayed for the price indicator while a notepad mark for the remarks indicated by the price collector; (10) and *Download Product Images* which is used for downloading of images of commodities captured from the PIC system. The database Pricespp.mdb generated by the CPI Store Merger system is the input database file in the Price Tag system.

Meanwhile, the PIC system allows the user to capture an image of a particular commodity, which will help the price collector to determine the product specifications to price. The image contains the important price determining characteristics of the item, such as the brand, the packaging, quantity and unit of measure, etc. Only those images selected and verified by the Central Office staff will be included in the product catalogue, using the *Download Product Images* feature of the Price Tag system.

#### **IV. Challenges in the Digitized CPI Price Data Collection System**

Below are some of the challenges encountered according to phases of operation, such as the building of the reference files, pre-testing, pilot-testing, training and implementation phase.

1. Building the reference files
  - a) Some commodity items are incorrectly mapped in sample stores in the databases. Hence, the price collector moved from one sample store to another sample store, and back again.
  - b) The exact names of stores appeared more than twice in the list of stores. This resulted from the encoding of the names of stores in the two separate databases (CPI2k6 and CPI2kb30). Thus, the commodities which were supposed to be priced in one store are being mapped in two or more sample stores
2. During the pre-testing and pilot-testing phase
  - a) For the collection of prices in the sample outlets
    - Some store manager/staff, especially in the open stalls or public markets, price quotations are provided through personal interview, thus, posing a risk on the price collector and the device unit.
  - b) Price collection system

- There is no search option. Search of brand name and/or commodity description by scrolling the list is tedious and time-consuming. On the average, a province has around 478 commodities in the CPI market baskets. The option available in the Price Tag system was the customized arrangement of the order of the commodities to be priced in the sample store.
- c) Sending of report via Wi-Fi connection
- Some price collectors were not able to send the data to the web server even if the place is a Wi-Fi zone. The price collectors were not provided with mobile Wi-Fi.
- d) Safety and security
- The use of tablet PC is applicable in price collection in enclosed and secured area like supermarkets.
  - The use of tablet PCs might pose some problems during wet season.
- e) Weight of the tablet
- The weight of tablet PC caused discomfort when holding the device for a period of time.
3. During the four batches of training from September 2015 to November 2015
- a) On the Price Tag system:
- Filter functions in the Price Tag system are to be incorporated to facilitate the selection of sample outlets by municipality because some price collectors are assigned with more than one sample municipalities, while two or more price collectors are being assigned in one big sample outlet;
  - On capturing images/pictures of commodity items using the PIC system, the following are to be included: (1) to add “Search” engine for commodity items; (2) to have a “Remarks” portion for each item, (3) to customize its display.
  - Establishing the Global Positioning System (GPS) signal takes some time;
  - The remarks entered by the price collector for specific commodity in the previous survey round need to be displayed in the next survey round as reference of the price collector.
  - Specific instructions in setting time in the android device tablet have to be done.
4. During the implementation phase/actual field operations (from October 2015 onwards)
- a) Establishing the GPS signal takes some time;
- b) Some provinces have difficulty in sending the price data to the web server via internet;
- c) Some price collectors do not send their price data directly from the tablet to the web server. Instead, they export the data into CSV files (file format

generated by the Price Tag system which is compatible with the CPI system). These CSV files are the ones they submit to the provincial office.

d) Safety and security of the tablet

- The price collectors are hesitant to use the tablet in open markets.
- The price collectors found difficulty in using the tablet during rainy seasons.

## V. Ways Forward

In view of the issues, problems and concerns encountered during the pre-testing, pilot-testing, training and implementation phase, the following suggestions are recommended:

1. Development/Improvement of price data collection, validation and processing systems using the tablet whereby features such as search option, summary of price quotations collected are to be incorporated;
2. The use of tablet shall be extended to the different price statistics specifically for the generation of the General Retail Price Index, Construction Materials Retail Price Index, General Wholesale Price Index, and Construction Materials Wholesale Price Index;
3. The data on GPS shall be used to check the consistency of the sample stores visited in every survey round;
4. Provision of mobile Wi-Fi connection in provinces identified where internet connection is slow.
5. Building of the reference files for the list of sample stores for the 2012-based CPI price collection and development of the CPI system using the new method in its computation are still on-going.
6. The use of tablet for the 2012-based CPI price data collection, validation and processing systems is targeted by the PSA on or before the second quarter of 2019.

## VI. Conclusion

Challenges experienced such as unavailability of internet connections and security in some areas, the use of tablets in collecting, processing and validating price data nonetheless provided more benefits in terms of reliability of price data, speed and cost efficiency. Continuous improvements of the system should be done.

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