FINAL REPORT

THE GAMBIA BUREAU OF STATISTICS (GBoS)

MOBILE TECHNOLOGIES IN STATISTICAL DATA COLLECTION

PRICE DATA COLLECTION USING ANROID APPLICATION

CONSUMER & PRODUCER PRICE INDEX USING MOBILE TECHNOLOGIES IN THE GAMBIA

MARCH 2015

PROJECT TITLE:

STRENGTHENING THE CAPACITY OF AFRICAN COUNTRIES TO USE MOBILE TECHNOLOGIES TO COLLECT DATA FOR EFFECTIVE POLICY AND DECISION MAKING

(THE GAMBIA COMPONENT ONLY)

PROJECT REF : OP/14/09/LOA/D/023

PROJECT SPONSOR : UNECA

BENEFICIARY : GAMBIA BUREAU OF STATISTICS

SUBMITTED BY:

THE GAMBIA BUREAU OF STATISTICS (GBoS)
THE GAMBIA

TO:

UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA

(UNECA)

DURATION:	**THREE AND HALF MONTHS**
STARTING DATE:	**5TH DAY OF DECEMBER 2014**
ENDING DATE:	**15TH DAY OF MARCH 2015**
REPORTING PERIOD COVERED:	**AS AT 30TH APRIL 2015**
TOTAL BUDGET:	**TWO HUNDRED AND TWELVE THOUSAND, FIVE HUNDRED AND EIGHTEEN DOLLARS AND TWENTY CENTS ($212,518.20)**
FUND UTILIZATION RATE:	**(HUNDRED PERCENT)**
PROJECT FUNDED WITH THE SUPPORT OF:	**UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UNECA)**

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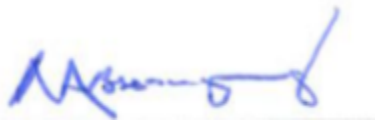
FORWARD

On behalf of the entire staff of The Gambia Bureau of Statistics, I wish to take this opportunity to thank United Nations Economic Commission for Africa (UNECA) for choosing The Gambia as a pilot country. The experience and the benefits derived from this pilot project will contribute immensely towards the roll out of using mobile technologies for data collection in The Gambia. The tool, development experience, the server upgrade and the high quality handheld devices are all great assets that can help us quickly embrace the use of mobile technologies for data collection.

Greatest appreciation is also extended to the School of Information Communication and Technology of the University of The Gambia for their role as the Training and Research Institute (TRI) of this project. Their hard work, cordial collaboration and advice led to the successful completion of this project.

The Gambia Bureau of Statistics in accordance with the Letter of Agreement (LOA) organized and executed all the project activities as part of its implementation. All the activities of the project were implemented within the stipulated time frame.



Signed……

Nyakassi M.B. Sanyang
Statistician General
The Gambia Bureau of Statistics
The Gambia

ACKNOWLEDGEMENTS

The Gambia Bureau of Statistics in collaboration with The School of Information, Communication and Technology (Research Team) of the University of The Gambia wishes to thank the United Nations Economic Commission for Africa (UNECA) for financing the successful accomplishment of this pilot project.

We would like to also thank the Project Management Team for their contributions and preparation of this final report. The shared technical knowledge, experiences, and perspectives have produced a tool that will have a significant positive impact on the capability of Mobile Price Data Collection on Consumer and Producer Price Index for GBoS.

Special thanks are extended to the Software Engineers and the GBoS research team for their dedication and team spirit throughout the project phase. Sincere appreciation is also extended to the support staff of the project for their invaluable contributions.

Project Team

Management Team

Dr. Momodou Jain	Project Coordinator ITC-UTG (TRI)
Mr. Mbemba Hydara	Project Manager
Mr. Saffiong Kebbeh	Research Consultant
Mr. Sheriffo Ceesay	Project Focal Point and Lead Engineer

System Development Team

Mr. Buba Bojang	Software Engineer
Mr. Alfusainey Jallow	Software Engineer
Mr. Lamin Saidy	Developer

Project Support Staff

Ms. Wuday Colley	Application Test Team Member
Mr. Malick Jobe	Application Test Team Member
Mr. Abubacarr Jallow	Application Test Team Member
Mr. Ebrima Darboe	Financial Controller

ACRONYMS

API	Application Program Interface
APK	Android application package file
APP	An app is a type of software that allows you to perform specific tasks
AUM	Application User Manual
CPI	Consumer Price Index
CSPro	Census and Survey Processing
CV	Cumulative Variance
GBoS	Gambia Bureau of Statistics
GPS	Global Positioning System
ITC	Information Technology and Communication
NSO	National Statistics Office
PPI	Producer Price Index
RDBMS	Relational Database management System
SDK	Software Development Kit
TRI	Training and Research Institute
UM	User Manual - see AUM (App User Manual)
UNECA	United Nations Economic Commission for Africa
UTG	University of The Gambia
VM	Virtual Machine

1.0 Project Background and Overview

Mobile technology has become increasingly popular in the past decade due to combination of device portability and advances in communication technology. Smart phones and tablets in particular, are at the forefront of these technologies, enabling national statistics bureaus to remotely track, collect and process data in an efficient and effective manner, using various techniques in real-time.

Most African national statistical bureaus generally use manual data collection methods for specialized surveys; this is attributable to lack of human capacity, and low technology base. Manual data collection method involves printing of paper questionnaires, transporting them to fieldworkers, and getting them back to a central location. These lengthy and error prone processes do not only create delay in the production of data for decision making, but also require huge personnel involvement in data collection and processing, thereby increasing financial costs.

The Gambia Bureau of Statistics (GBoS) plays a crucial role in the overall development and policymaking process of The Gambia as a country by providing the evidence for setting policy objectives, targets and priorities for government and the international community. Manual form of data collection by The Gambia Bureau of Statistics remains a challenge for speedy and efficient processing of data; to overcome this trend, it is deemed crucial to introduce emerging technologies with a view to achieving an efficient and cost effective method of data collection by the GBoS as adopted by national statistics bureaus elsewhere in the African continent.

Realizing the advantages mobile devices have in terms of efficiency and cost effectiveness for data collection, the UNECA in collaboration with The Gambia Bureau of Statistics (GBoS) as an implementing partner, and the School of Information, Technology and Communication of the University of The Gambia, as a Training and Research Institute (TRI) respectively, have successfully undertaken the implementation of a pilot project on "Mobile Data Collection Techniques" for The Gambia Bureau of statistics.

This project is fully funded by UNECA, and has potential to further roll out to other public and private sector institutions.

The project which is centred on market price data will enhance the capacity of The Gambia Bureau of Statistics (GBoS) to effectively collect process and analyse market price data for statistical purposes so as to facilitate effective policy and timely decision making.

2.0 Summary of Impact

2.1 Objectives

The key role and objective of the school of Information, Technology and Communication (TRI) in the pilot project is to develop and implement an automated data collection system for use by Gambia Bureau of Statistics (GBoS) for informed policy and decisions making. This has been successfully achieved. The developed application is Android and web interface platform for Consumer Price Index (CPI) and Producer Price Index (PPI).

In determining the feasibility of the project in The Gambia, the TRI conducted a preliminary survey on the use of mobile devices to collect and analyze data. The result gathered indicates that institutions exist in The Gambia using similar technology.

Pursuant of our main goal and objectives as defined in the project (TOR), TRI managed to successfully accomplish all deliverables according to planned budget and schedule. The project has been an exciting experience for all the participants and the general outcome was a success.

2.2 Key Results Achieved

The results of the project implementation have positive in spite of some challenges. The indicators of achievement by TRI include;

- The mobile data collection method ensures that prices are verified as they are entered directly from the collection point and transferred to the server; thereby reducing the use of manual data collection method and time.

- Besides network connectivity issues experienced in some parts of the country, the data collection survey has been conducted successfully across the country. All supervisors of the respective teams were able to synchronize price

data with the tablet devices to the central server from the selected markets nationwide.

- The use of mobile data collection ensures data is readily available on collection and up-load. There were no problems about data entry errors; and access to content by staff of the 'GBoS Price Statistics Unit' has also gone well without problem.
- The analytical tool used was very much appreciated by GBoS Research Analysts for being able to generate the index with a click of a button.
- GBoS price statisticians thoroughly observed the process and have been satisfied with the results.

2.3 Lessons Learnt

- The new data collection method implemented by the TRI has met the required objectives and is likely to increase the scope of data collection by GBoS.
- GBoS can replicate the technology developed to collect and integrate data for other sectors in a way that strengthens the data collection method.
- There were few occasions during the data collection process where it was difficult to synchronize data to the main server due to weak GSM signal strength.

2.4 Follow-ups and Recommendations

- GBoS to put in place strategies for enhanced connectivity
- As the national Statistics Bureau, GBoS to initiate and established a private Cloud platform to serve as national hub for data harvesting and consumption in the future
- GBoS to expand mobile technology use for data collection to other sectors of development

2.5 The Way forward

The following have been sighted as the way forward for the developed system.

- The application should be scalable to integrate broader analysis of data for other sectors (not only market price index).
- Mechanism to improve physical and logical security of the Tablets devices and the android application.
- TRI to conduct academic research on the introduction of mobile technology for data collection in The Gambia; and findings be published for wider consumption
- Greater collaboration be established between GBoS and TRI for post implementation review.
- The need to establish sub-offices in all regions for data collection, monitoring and maintenance of the devise. This can further enhance production of regional index both rural and at the head quarter (GBoS) level.
- GBoS to organise and encourage regular Training of Trainer short courses (TOT) on the efficient use of mobile data collection method in selected countries very much experienced in Mobile technology use.

3.0 General Project Summary

Project Name	Price Data Collection using Android Application for GBoS
Description	The project aimed at developing a Data Collection Software Application that will provide quality and useful statistical price Information for Gambia Bureau of Statistics (GBoS) to support policy decision making at national and International level.
Project Sponsor	United Nations Economic Commission for Africa (UNECA)
Author(s)	Information Technology & Communications Research Group – School of I.T.C. - University of The Gambia
Date	March 2015

Table 1: Project Sponsor and Description

Project's Major Activities and Milestones

Project Phases	Planned Time (Days)	Actual Time (Days)	Time Deviation (Days)	Major Reason for Deviation
Project Initiation (GBoS-TRI)	5	10	5	Administrative
Project Planning & Organization	8	15	7	Resource Mobilization
Project Implementation	40	50	10	Software Development Cycle
Project Execution and Reporting	15	20	5	Operational Risk Management and Documentation
Project completion	68	95	27	reasons above

Table 2: Project's Major Activities and Milestones

Project Accomplishments

Name	Description
Implementing Partner (GBoS) collaboration	TRI collaboration with GBoS allowed for knowledge sharing and smooth transition of project development phases
Stakeholder Workshop	Created an opening for project kick-off, stakeholder roles and responsibilities were clarified; Expectations and potential risks identified and mitigation strategies considered.
Project deliverables and milestones	All key deliverables and millstones have been successfully completed in time and within Budget.
Assigned responsibilities to members	This greatly helped in ensuring accountability.
Regular status Meeting	Help reduce communication issues, track progress and the way forward
Application Development and execution	Application software successfully developed, tested for functionality and usability; The feed-back is very positive

Table 3: Project Accomplishment

Summary of Lessons Learnt

Description of Lessons	Observations
The experiences documented have shown that mobile data collection technologies for GBoS can be used successfully in The Gambia.	GBoS to adopt the new technology in a more comprehensive way to improve speed, quality and scope of data collection relevant to national policy making
The new data collection method implemented by the TRI is likely to increase the scope of data collection by GBoS.	GBoS continue to enhance data collection at regular intervals to ensure timely availability of data
The need for future roll of mobile data collection to other sectors of development.	GBoS to replicate the technology developed to other relevant sectors to collect and integrate data in a way that strengthens the data collection system

Table 4: Summary of Lessons Learnt

Summary of Project Performance

On Schedule					
Planned Start Date	**Actual Finish Date**	**Variance (in days)**	**On Schedule**	**Ahead of Schedule**	**Behind Schedule**
05-12-14	**15-03 -15**	**None**	✓	☐	☐

On Budget					
Approved Budget	**Spent Budget**	**Variance (in $)**	**On Budget**	**Under Budget**	**Over Budget**
TRI - [$109,676.84]	**[$ 109,676.84]**		✓	☐	
GBoS - [$102,843.36]	**[$102,843.36]**		✓		
Total - UNECA FUNDS [$212,518.20]	**[$212,518.20]**		✓		

Meeting Client Expectations		
Success Criteria	**Criteria Met**	**Comments**
All deliverable Submitted according to requirements (ToR)	✓	Documentations handed over to GBoS

Table 5: Summary Project Performance

Summary of Quality Performance

Objectives	Required Performance	Performance Achieved Yes/No	Reason for Deviation (if any)
To document the status of the use of mobile technologies for data Collection in The Gambia	Report documented and submitted to GBoS and UNECA	Yes	None
To conduct National Workshop to determine stakeholder roles and responsibilities in the pilot project	Workshop proceedings documented and report submitted to GBoS and UNECA	Yes	None
To develop Software Application for use in data Collection	Software Developed; Tested and Deployed	Yes	None
Develop Training Manual and Guidelines	Training manual & Guidelines documented and submitted to GBoS-UNECA	Yes	None
Organise National Training workshop on the developed technology	Workshop successful completed and report submitted to GBoS-UNECA	Yes	None
Undertake and Coordinate Data Collection Fieldwork	Field work successfully conducted; Report on the lessons learned incorporated in the Final Report	Yes	None
Project Completion	Final Report completed and submitted to GBoS-UNECA	Yes	None

Table 6: Summary of Quality Performance

Summary of Project Completion

Category	Criteria	Achieved
Objectives	• The project goal has been achieved in accordance with expectations defined in the project Contract Agreement • All project objectives have been met (as defined in the Terms of Reference)	Yes
Benefits	• The full benefits have been realized as expected in the Project Agreement and the lessons learned documented	Yes
Deliverables	• All deliverables have been completed by TRI (as defined in the Terms of Reference)	Yes
Approval	• All deliverables have been approved by implementing Partner and Sponsor as per the project requirements	Yes

Table 7: Summary of Project Completion

4.0 Project Goals and Objectives

The main goal of Training and Research Institute (TRI) is to develop a feasible, scalable, user friendly and secure software application on a dynamic platform for market Price data collection techniques in collaboration with GBoS and UNECA. The objective is for the school of Information, Technology and Communication to develop an appropriate mobile data collection application using Android to generate quality and useable data. The project deliverables includes full implementation of the application being developed; production of user manual and guidelines, and to document all the deliverables of the project for submission to GBoS and UNECA. The outcome of the project shall determine the feasibility of the use of mobile technology for data collection by GBoS.

The detail project objectives are to;

- Document the experience of enumerators using mobile devices to provide information on consumer and producer price data for statistical production.
- Determined the suitability of such data for the compilation of price and production statistics;
- Establish work flows and processes for converting appropriate data into statistics; and strengthen working relationship between GBoS and ITC-UTG in statistical development.
- Undertake concepts, development, methodologies and applications for the mobile data collection system
- Develop mobile software application for use in market price data collection
- Developed a Training Manual and Guidelines
- Organize National Training workshop to validate the developed mobile data collection system.
- Undertake and coordinate data collection field –work and document lessons learned.

4.1 Project Scope

The scope of the project is limited to the milestones identified in the project contract and post implementation review. It however excludes roll-out of the developed Android Application and infrastructure platform maintenance. Detail scope includes to;

- Conduct a study on the status of use of mobile data collection in The Gambia
- Conduct national workshops on project implementation
- Design the developed application Software to collect market price data using mobile technology
- Test and execute unit and integration testing plans of the Android application.
- Conduct price market pre-testing exercise using the developed Android application.
- Coordinate the collection and processing of collected data.
- Submit all documentations to implementing partner and sponsor; (GBoS and UNECA)

5.0 Case Study:

5.1 The Africa Experiences

Drawing lessons from international best practices, TRI conducted an initial literature survey on relevant studies, specifically on countries that have integrated the use of mobile technologies for data collection in Africa. According to the concept note of the expert group meeting (EGM) held in Tunis in December 2014 on the use of mobile data collection, "most if not all countries in Africa have used digital devices for data collection".

Amongst the first countries that use mobile data collection for a complete statistical cycle using personal data assistant (PDA) was Cape Verde. In 2010, they were able to successfully launch the use of technology for a complete digital population and housing census. This was further extended to other survey assignments in country.

Sao Tome and Principe followed the Cape Verde experience for its census. Senegal also used PDAs for its Population Census, Agriculture and Livestock surveys; an earlier pilot study in Senegal in the year 2008 and 2009 includes digital data collection on maternal and preventative health respectively. The Democratic Republic of Congo also planned to use PDAs for it national censuses. Malawi also conducted national household surveys using PDAs.

The use of mobile data collection technologies proof that several countries in the African continent (Botswana, Côte d'Ivoire, Gabon, Malawi, Cameron, Togo, Nigeria, Sierra Leone, South Africa, Somalia, Zambia and Uganda amongst others) used mobile data collection methods using variety of mobile devices; These includes PDA, CAPI, GPS /Google Tech. to collect data in various sectors including Monthly Prices; Household Surveys; MDG baseline surveys; National Agricultural Sample Surveys; National Census of Commercial and Industrial Businesses and Global Adult Tobacco surveys.

5.2 The Gambia Experience (Baseline Survey)

Given that Mobile devices can be easily deployed remotely; making logistics easier thereby facilitating collection, monitoring and evaluation of collected data in real time, The Gambia experience on the use of mobile technologies for data collection demonstrate a positive outlook in terms of usage in the country. According to TRI baseline survey findings, four out of five organisations that took part in the survey use mobile technology for data collection in The Gambia.

The four respondents were *National Nutrition Agency (NaNA)* in collaboration with *Ministry of Health and Social Welfare (MoHSW)* on Health impact evaluation baseline, tobacco and alcohol use surveys, *World Food Program (WFP)* on Protracted Relieve & Recovery Operation assessment and *Catholic Relief Services (CRS*) on Bed Net Distribution Exercise, and Ministry of Agriculture (Department of Planning) on farmer registration exercise.

Survey on The Gambia Experience			
Organization	**Activity**	**Technology**	**Challenges**
National Nutrition Agency (NaNA) and Ministry of Health and Social Welfare	Health impact baseline survey	Android	Network downtime
World Food Program (WFP)	Protracted relief and recovery operation assessment	PDA	Network downtime and electricity
Catholic Relief Services (CRS)	Bed Net distribution	Android and IOS	Electricity
Ministry of Agriculture (Planning)	Farmer Registration	RLG Smart Phone	Network Connectivity

Table 8: Baseline survey of the Gambia Study

The technology used by these organizations ranges from simple SMS services, Computer Assisted Interface (CAI), PDA's, and Android based application on apple platform. *None of the applications or the devices used by the four agencies was developed locally***.** This development has been attributed to connectivity related capacity constraints and low technology base. The study noted that respondents from the Ministry of Agriculture used RLG mobile smart phones on windows platform as an option to preferred Android applications technology.

Compared with the manual form of data collection, four (4) respondents raised electricity and network downtime issues as key concerns. Besides these concerns, Most of the respondents expressed satisfaction in the use of mobile technology for data collection as a noble intervention in the collection, processing and analysis of data.

In view of the above, it is concluded that the use of mobile technologies for data collection is feasible and timely in The Gambia. The fact that the software application intended for use is being developed locally by Gambians gives confidence in sustainability and expansion of the project to other relevant sectors in the country.

As evident in the workshop proceedings, participants from the various national and private sector institutions, expressed delight about the worthwhile initiative.

With the forgoing facts and conclusions deduced from the survey, it is apparent that timely and cost effective methods of collecting and processing statistical price data using automated mobile technology in The Gambia is fundamental to the efficient operations and service delivery of GBoS.

6.0 GBoS Activities

6.1 First National Workshop

In support of activity 1.3 in the Agreement, on the 19th of December 2014, one day national workshop was held at the Baobab Holiday Resort to formally establish collaboration between GBoS and the partner Training and Research Institution (TRI) [i.e. University of The Gambia, ITC School]. The national workshop was organized jointly by the National Statistics Office, TRI and UNECA to launch the project and modalities of the work, including the roles and responsibilities of each implementing partner.

The participants officially invited to the workshop include the stakeholders, partners and the market communities. Representatives from the Ministries of Agriculture, Trade, Health, Information Communication Technology and the Central Bank of The Gambia were also present at the launching ceremony. The national Radio and Television Services, local print media (Local Newspaper) companies and private radio stations were also invited to cover the workshop. One hundred and twenty (120) participants attended the workshop. *The first national workshop proceeding is attached to Appendix A.*

6.2 Second National Training Workshop

In support of activity 2.2 of the Agreement (LOA), from the 12th to 17th March, 2015, a five day national training workshop was held at Baobab Holiday Resort to train partners, enumerators and stakeholders on the developed application concepts and methodologies for data collection fieldwork.

As in activity one, the workshop was attended by Government line ministries, media houses and development partners such as UNDP, WFP, CRS and NaNA. The Minister of Information Communication and Infrastructure (MOICI) was also present.

On day one, the participants were given an overview of the developed technology, and their comments were noted for the improvement of the tools prior to field work. The training of the enumerators and supervisors continued from the second to the fourth day. On the fifth day, a pre-testing field exercise was conducted. This exercise was very important as it helped the developers to further improve the applications and the tools before the actual field work. ***The proceeding of the second national workshop is attached to Appendix B***.

6.3 Purchase of Handheld Devices

Part of the activities of the pilot project undertaken by the Gambia Bureau of Statistics was the procurement of hand-held devices. These hand-held devices were used as a tool for data collection. After careful analysis of various devices (ranging from Apple, Samsung, ASUS etc) suitable for mobile data collection, it is concluded that Samsung handheld devices which runs on an Android operating system is the best possible solution for the pilot project. Android is a free and open source operating system with a powerful application programming interface that could be used to develop the tools needed for the data collection exercise. Samsung devices are popular and also cheaper compared to Apple devices.

6.3.1 Purchasing Procedure:

The Gambia Bureau of Statistics worked closely with the Gambia Public Procurement Authority (National Procurement Authority) to ensure compliance with The Gambia Government's public procurement procedures. Due to the limited time frame of the project, GPPA approved a restricted tender process and the following companies were invited to bid for the supply of handheld devices.

- Quantum Limited
- YCS Computes
- Sunrise GSM
- SMATEQ
- Lasting Solutions

After careful review by the procurement committee at the Gambia Bureau of Statistics, in consultation with the Gambia Public Procurement Authority, the contract to purchase the devices was awarded to Quantum Net Limited. The supplier delivered the devices within the agreed time line of two weeks.

6.3.2 Devices Bought

The following devices were delivered by the supplier.

SN	Device Name	Conditions/Specification	Quantity	Use
1	Samsung Galaxy Tab 4	Samsung Galaxy Tab 7" LTE 8GB OS (Android), GPS, GSM, 3G	50	Data collection
2	Power Bank – charge time 4 hours	Capable of charging the tablets Input: 5V/1.0 A Output: 5V/1.0 A	50	Charge the tablets in the field.
3	Solar Chargeable.	Yangli chargers, 10 Watt	25	Charge the tablets in the field.
4	Screen Protectors	Original	150	Protect the screen of the device
5	Original Casing For Protection	Good and quality casing.	50	For protection

Table 9: First batch of hand-held device procurement

Upon completion of the first procurement process, additional devices were purchased to enhance the bureau's large scale surveys. This procurement was contracted to Sunrise GSM and details of the purchase is summarize in the table below.

SN	Device Name	Conditions/Specification	Quantity	Use
1	Samsung Galaxy Tab 4	Samsung Galaxy Tab 7" LTE 8GB	24	Data collection
2	Original Casing For Protection	Good and quality casing.	24	For protection

Table 10: Second batch of hand-held device procurement

The total number of hand-held devices bought is seventy four (74).

6.4 Server Upgrade

The server upgrade component of the pilot project has been successfully completed and data is being received from the field as planned. The server upgrade is divided into two major components; the cloud and the in house platform. Both platforms are required for field data collection and synchronization.

Given the electricity supply and Internet connectivity challenges in the country, depending on the local server as primary data repository is not the best solution for this pilot project. Therefore, with the cloud server as a primary repository, issues of Internet connection and electricity can be mitigated.

6.4.1 Server Upgrade Architecture

As depicted in figure 9. There are two server platforms. Illustration 1 shows the local server at Gambia Bureau of Statistics and Illustration 2 shows the cloud server. On a regular interval of 30 minutes, the data from the cloud server is synced to the local server. The advantage of this approach is to guarantee connectivity and availability of data at all times.

The ultimate aim of the architecture is to provide flawless flow of data from the field to the analysis stage. Security is also a factor that has been considered. The local in-house server has the Ubuntu operating system installed. Windows Server 2012 is installed in a virtualbox for accessing reports and other resources on the network.

6.4.2 Storage and Backup

The Dell PowerEdge local server in GBoS is equipped with a 2TB of four 500GB disk for internal storage and temporary backup. Additionally, a 6TB Network Attached Storage device is also mounted to the network. This device is our central repository for all backups.

6.4.3 Server Upgrade Hardware and Software Specifications

After careful analysis and study of current GBoS network, the following hardware and software for the upgrade of the internal network have been adopted as per the specification in the pilot project letter of agreement.

1. **Dell PowerEdge R420:** Local server that stored the data locally. The server is also used as a domain controller which helps us enforce security and maintain IT standards at the Bureau. Hardware specifications are below:

   Memory: 32GB
   Storage: 2TB
   Processor: Intel® Xeon® E5-2440 v2 1.90GHz, 8C, 95W, Max Mem 1600MHz

2. Network Attached Storage (NAS): Used as a backup device to backup the local server and also some important files.

   WD My Cloud EX2 WDBVKW0060JCH- NAS server
   Storage Capacity: 6 TB

3. Operating System: Installed in a virtuabox as our domain controller.

   Windows Server 2012 R2 Standard Edition

4. Power Backup System: This is crucial because of random power outage; a good battery power backup system is our ultimate solution. A 3KVA power system has been installed and its uptime is 8 hours.

5. Server Rack: For security reasons a 24 U server has been purchased to host the local server and the other hardware components including a rack for mounting the rack server.

6.5 Analysis of the current data collection status of the GBoS Price Analysts

The Gambia Bureau of Statistics (GBoS) collect monthly price of 207 items. The data collection covers 28 different market centres spread across all regions in the country; (7 in the Greater Banjul, 11 in South Bank, 10 in North Bank) ranging from Banjul to Basse. Every month, prices are collected at most three times and vary from market to market depending on the market size.

The current CPI has a base year 2004 (2004 = 100) and is the second series derived from the national household expenditure survey conducted in 2003-2004. The indices are estimated from the cost of the basket in the current period's prices multiplied by the quantities of items purchased in the base period. A price index is obtained from the ratio of the re-valued basket to the total price of the basket in the base period. This is referred to as a Lapser's price index.

6.3.1 Uses of CPI

In addition to international Institutions such as; International Monetary Fund (IMF), United Nations Development Programme (UNDP), World Food Programme (WFP), World Bank (WB), and Food Agricultural Programme (FAO), UNICEF, UNHCR, Diplomatic Missions and the private sector notably the commercials banks, national institutions such as Ministry of Finance and Economic Affairs, use CPI regularly.

The Central Bank of The Gambia for example monitors the impact of money supply and changes in exchange rate on CPI. The Ministry of Trade monitors the prices of certain commodities on a weekly basis while Ministry of Agriculture collects prices of food items on regular basis

Currently, the CPI is being revised and rebased based on the 2010 Integrated Household Survey to produce a new series covering the entire country with an increased number of items.

7.0 Project Organisation

To establish functional structure depicting reporting lines was deemed significant during the project initiation and planning phases, hence the following management structure was established:

- The Project Management Team was appointed
- Team roles and responsibilities were established
- Project resources were identified and established
- Project framework and structure was adopted

7.1 The Project Management Team

The management team undertakes roles and tasks in the overall implementation of the project. The team constitute full-time consulting staff, software developers, researchers and support staff. Their roles are dependent on the job at hand and the assigned task each team member undertakes.

Beside the project management team, there exist close collaboration between the TRI and those staff of GBoS who are directly involved in price data collection and

compilation as part of their responsibilities in the project implementation and data analysis. This collaboration creates knowledge sharing and cooperation which by extension gives them firsthand opportunity to jointly participate in a nation-wide field- data collection and testing of the developed application software. Below is the illustration of the Project management structure.

Project Management Structure

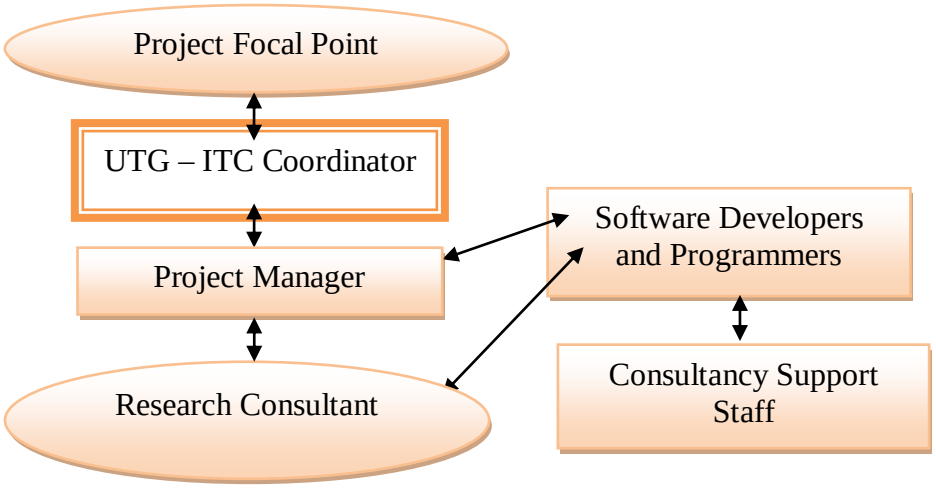


Figure 1: An illustration of the Project functional roles:

7.2 Roles and Responsibilities of Staff

This section details the roles and responsibilities of the project team members.

Roles / Person	Responsibilities
Project Coordinator Nyakassi Sanyang Dr. Momodou Jain Momodou L. Fadia	The team with executive authority responsible for the project's implementation, and have power to approve decisions, subject to oversight by the project steering committee
Steering Committee Dr. Momodou Jain Saffiong Kebbeh Mbemba Hydara Sheriffo Ceesay	Project oversight committee responsible; for final approval of overall project implementation

Project Manager Mbemba Hydara	• Responsible for ensuring that the project produces the required deliverables on schedule as assigned by the project Steering Committee • Ensuring that all required resources are assigned to the project and clearly tasked • Making adjustment to the plan as recommended by the steering committee necessary to provide direction and advice on the project progress. • Assist in ensuring that proper project communication channel is established
Research Consultant Pa Saffiong Kebbeh	• Design, develop and maintain database structure that efficiently supports data collection. • Provide input and analysis of project case study on behalf of the TRI • Prepare or assist in report preparation, publication/presentation
Software Engineers & Developers Sheriffo Ceesay Buba Bojang Alfusainey Jallow Lamin Saidy	• Undertakes all tasks' necessary to design, develop and implement the final product. • Undertake all tasks allocated by the project manager on behalf of the steering committee and (as per the project plan) • Reporting progress of the execution of tasks to project steering committee • Reporting issues to be resolved to the steering committee • Provide technical report on the application design flow, Testing and source code
Documentation / Technical Writer Pa Saffiong Kebbeh Mbemba Hydara Bubacarr Jallow	• Responsible for documenting and reporting all the deliverables of the project.
Research and Testing Teams Malick Jobe Wuday Colley	• Responsible for technical assessment on functionality of the developed application to ensure quality assurance and standards.
Project Accountant Ebrima Darboe	• Directly responsible for managing all financial transactions to deal with procurement, contract expenditure, financial accounting, progress tracking and financial reporting

Data Analyst and Quality Assurance Team Ousman Dibba Lolly Kah Jallow Fatou Darboe Mawdo Gibba Alagi Fanneh Kebba Sanneh Ebrima Manneh Sainabou Jasseh	• Responsible for managing processes and procedures that ensure quality product in accordance with GBoS- UNECA requirement and international standard.

Table 11: Roles and Responsibilities of Staff

7.3 Communications

Throughout the project implementation period, the project team; kept track of project-wide meetings at all important milestones, increased stakeholder awareness, improve team efficiency, productivity and team culture and behaviour.

The table below illustrates the project communication activities.

	Event	Description	Purpose	Frequency
1.	Project Team Meeting	Meeting involving all team members , to discuss tasks and work status	To keep the team informed of the project status and ensure that issues, risks or changes are escalated early for redress	Weekly
2.	Phase Review meeting	Formal meeting held at the end of each phase, to determine whether the quality of the deliverables produced is satisfactory and in line with project requirements	To control the progress of the project through each phase to boost its chance of success.	End of each major phase
3.	Project Steering Committee Meeting	Formal meetings held with the project steering committee to assess the overall status of the project	To determine whether the project has been completed and met full requirements of the client.	End of project deliverables

Table 12: illustration of the project communication activities

8.0 Project Methodology and Approach

From the Project initiation to closure, the TRI adopted systematic management (Plan-Do-Check-Act) approach in an attempt to ensure that project implementation process meets the roadmap. The following are the goals;

- To improve performance through consistent approach, shared best practices, and continuous process improvement.
- To ensure that the project steering exercises an appropriate level of control and oversight over financial, technical, and management processes.

Below is an illustration of the project approach strategy:

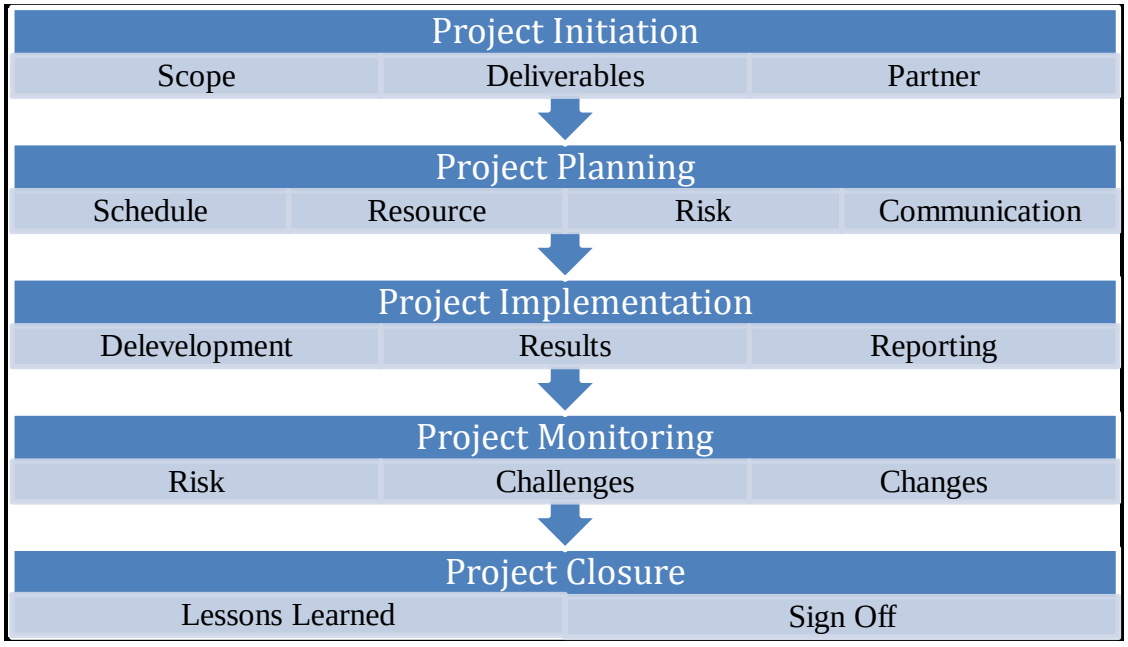


Table 13: The adopted project management model

8.1 Initiation

This phase outline the method applied in the project implementation. Project requirement especially TRI roles and responsibilities, scoping statement and deliverables as defined in the contract agreement were identified and the following established.

- Project objective, scope and requirements
- Project team appointed
- Technology and software application solutions identified
- Project office established

8.2 Planning

Given the project outline and scope, the following plans were developed and established;

- Project plan, Resource plan, Financial Plan, Quality and Risk mitigation plan and Communication Plan.

8.3 Execution

In this phase, the software application development process has been successfully executed in accordance with project objectives. The results of the pre test indicate positive outlook for the developed application functionality, usability and security.

8.4 Reporting

All deliverables required for reporting as per project agreement have been completed on time and communicated. The following reports were duly submitted to GBoS:

- Current Status on the use of Mobile technologies for data collection
- Baseline National Workshop proceedings
- Training Manual and Guidelines
- National Workshop Proceedings
- Final Project Report
- Certified Financial Statement Report

8.5 Project Closure

Given that all key deliverables have been completed as assigned to the project and in accordance with the implementation plan; we look forward to formal approval and closure of the Pilot project.

9.0 Mobile Technology Solution: Android Version 4.4.2

The application used for this project is Android, which is an Open Platform for Mobile Devices. Our desire to use Android as an application for this project motivated by our conclusions that it supports applications and services designed to run invisibly in

the background, *thus*, accomplishing major goals of our application design objectives. Its capability of enabling background services to create invisible application components performs automatic processing without direct user action. Similarly execution allows background applications to become event driven and to support regular updates. It is perfect for monitoring market prices and generating location-based alerts.

9.1 Motivation of Choice

The Android software development kit (SDK) includes everything that was required for developing a product for GBoS. The software stack has all the functions for developing, testing, and debugging the developed Android applications. Included in the SDK are:

- **The Android APIs:** The core of the Software Development Kit is that it provides the developers access to the Android stack. These are the same libraries used at Google to create native Android applications.

- **DBMS:** The enhanced relational database management system capability of Android comparable to CSPRO and other platforms is more robust, scalable and secured. Android has an integrated in memory database called SQLite which is fully ANSI SQL compliant. Unlike Android, most platforms including CSPRO use flat file systems.

- Data storage and access is more efficient with relational databases as oppose to flat file systems

- It's open source thereby making the environment free.

The Android software stack includes application framework that provides services for, and management of, the run time and applications.

9.2 The Product Development Framework

As a result of project development goals, our developers used well known and certified tools for the development of the application. The software application we developed was of quality and has met the user requirements of the GBoS.

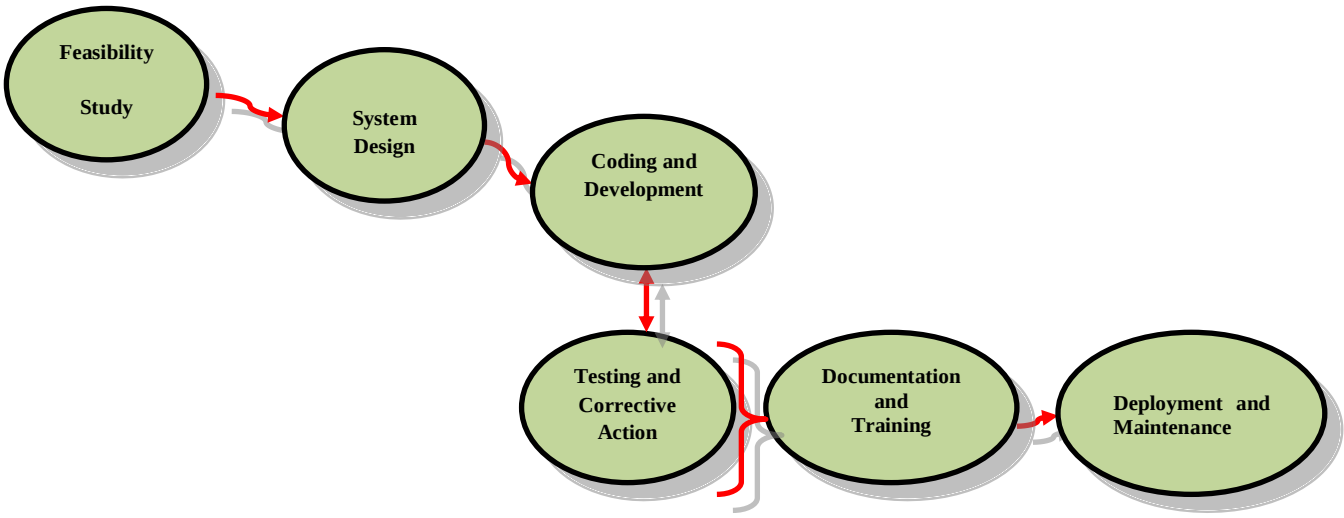


Figure 2: An illustration the development framework and cycle

9.3 Development Strategy

- During the development period, the TRI software engineers spent sufficient time on testing the application with respect to security and performance criterion. This played a vital role in the success of the application functionality.

- The developers follow process oriented approach while developing the price data collection application. Though the process is sometimes time consuming, it was easy to refer back to the code and rectify the app if any errors are reported.

- The developers collected inputs from GBoS, on the existing manual forms used for market price data collection. This process availed our developers to build the apps that integrates value to the GBoS producer and consumer price index

- Efficient planning helped the developers to accomplish milestones within deadlines.

- After the training workshop, participants' feedbacks were integrated to reflect issues of genuine concern.
- For the development of the application, the developers avoided having complex registration and login process of the enumerators and supervisors into the tablet.

10. The Application Development

10.1 Interpretation of the adopted formula

The mobile application development formula used for GBoS is dependent on the current manual formula for producer and consumer market price data collection. This is achieved by using two measures of price dispersion: the sample variance of prices across markets over (CPI), the coefficient of variation, and prices across markets by producers of various products at regular intervals. (PPI)

The analysis of the impact of mobile data collection on the market price index indicates the use of max-min and CV as measures of price dispersion. Below is the adopted manual formula transformed into a mobile data collection application

adjusted_price

```
if standard_unit == 1
        then price = price
else
        if quantity != 0
                (standard_unit * price) / quantity;
```

avg_adjusted_price

```
        if( num_of_quotes == 0)
                avg_adjusted_price =  0
        else
                avg_adjusted_price =  sum_adjusted_price / num_of_quotes;
```

price_relative

```
price_relative($avg_adjusted_price, $base_price)

        if ( base_price == 0 )
```

```
                price_relative =  0;
        else
                price_relative = (avg_adjusted_price / $base_price) * 100;
```

price_relative_weighted

```
    if($wgted_base_price == 0)
        price_relative_weighted = 0;
    else
        price_relative_weighted =  (wgted_avg_adjusted_price / wgted_base_price) * 100;
```

product_moment

```
    product_moment = weight * price_relative;
```

product_moment_wgted

```
        product_moment_weighted = weight * price_relative_wgted;
```

group_index

```
    if( sum_weight == 0)
        group_index =  0;
    else
        group_index = sum_product_moment / sum_weight;
```

10.2 Modality of Execution

In addition to market price data collection, automated data about producer and consumer price index can be collected and viewed on an Android device. To obtain automated information, GBoS supply the enumerators with Samsung galaxy tablets equipped with a GPS so that the location of the market can be determined. The price data collected (item, price, GPS location, time, quantity etc) by an enumerator can be automatically transferred to the GBoS cloud server by the group or market supervisor. The data can be tracked, summarized, and analyzed, allowing the CPI unit in GBoS to check all collected and stored data from the in-house portal.

10.3 Android Client

While Android client application developed for GBoS allows enumerators to add, delete, and modify data, it enables the CPI analysis team to internally configure data types, view and perform summary calculations on data collected. Through the portal, systems administrator can interact synchronize the data up to and down from the cloud, and set up data access controls.

Many features are configured initially by the developer or administrator, who configures tables for a particular price index. Activities configured in the application client has a number of standard built-in views, hence, do not allow enumerators to create their own views. Below is the screen shot of the CPI-/- PPI template on a tablet:

Figure 3: Screen Shot of the CPI/PPI Template

The tables of the different activities use Android's SQLite Data Base (DB) to store both settings information and user data initially. The database is populated with several tables:

10.4 The new GBoS Android Application

The overall process of the application development has two components. Component one focused on the data collection and syncing tool/mechanism. Component two focuses on the interface that enables statisticians to view, edit or modify the collected data. Component one is used on mobile devices and used by enumerators to collect and later sync the collected data.

Component two is developed using latest web technologies and it also available for the public to download reports and view the collected data.

10.4.1 Component 1 Architecture: Data Capture on Android Device.

Almost all the application on the Data Capture devices were programmed using Java. During synchronization of the collected data, PHP which is a very popular language is also used to access the cloud database and insert the collected data into the database.

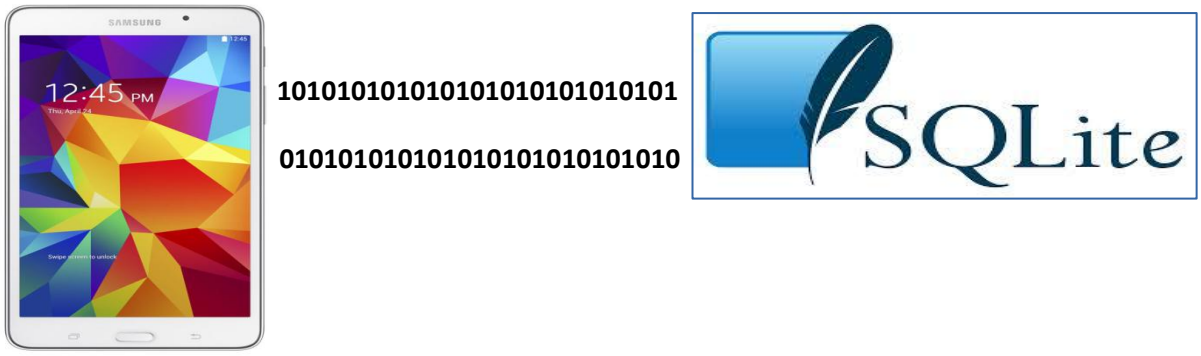


Figure 4: Illustration of Data Storage on SQLite Database

The above figure depicts the architecture of the data storage on the data capture system. Data collected is first stored directly in an in-built memory database called SQLite. The choice of this method is superior to flat file based systems as in CSPro. SQLite is a light weight RDBMS that has fully integrated ANSI SQL features. The advantages of SQLite are enormous and it also helps an easy data migration or synchronization from the device to the cloud / local server through secure https connection.

10.4.2 Data Capture Application

The data capture device has a user friendly interface and the fields are well protected with the right range of values. The application is packaged in .apk file and can be installed in several types of Android devices with different screen sizes. The compatible screen sizes ranges from 3" inches to 10.1 inches.

10.4.3 Accessing the Application

After installing the application, custom settings including default user accounts, markets information and regions are loaded and available for use.

The application's icon can be found on the home screen on the mobile device. The default icon is depicted below.

Tabbing the above icon will launch the application; a splash screen will show up for few seconds and if GPS is not turned on, the user will then be prompted to turn it on. If all goes as expected the login screen below will be displayed.

Figure 5: Login Screen of the GBoS Mobile App

A successful login will display the screen below. The screen below groups the 28 markets by area/region and tabbing on a particular region will show up markets in that region.

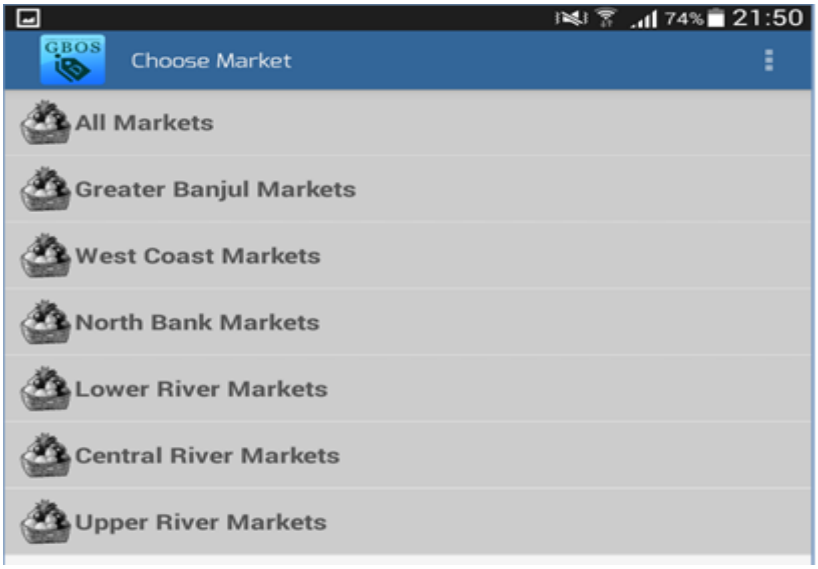


Figure 6: List of Markets Group by Region

Once a market is chosen, another screen will be displayed to choose the type of Price statistics one is collecting. This can be PPI or CPI. Upon selecting one of them the appropriate form will be displayed. The rest of the user interface is the same.

Data can entered, partially stored, edited and saved. The figure below shows data being partially stored.

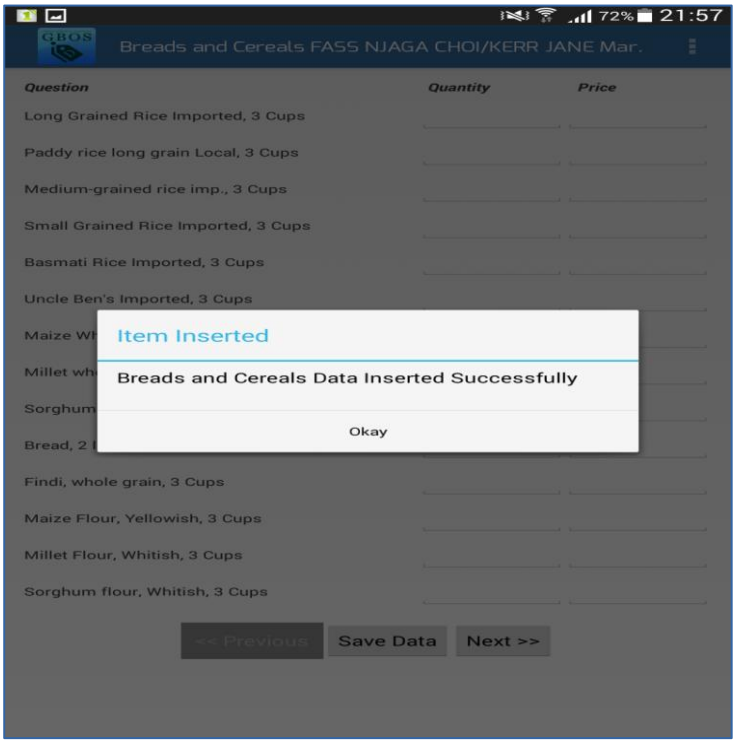


Figure 7: Illustration of Partial Storage of Data

Finally, a user logged in as an administrator can sync data from the additional option menu. From this menu the user can also add user, move to a particular section or category of the application and logout.

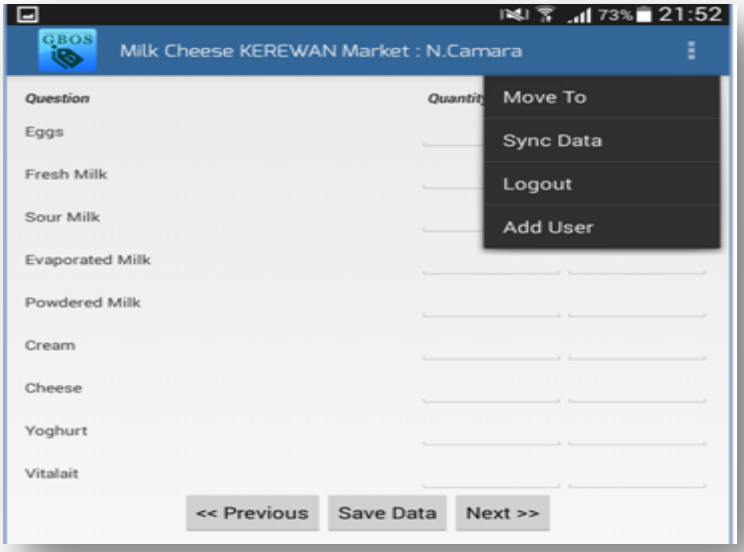


Figure 8: Illustration of Supervisor Administering Data

10.5 Component 2: Cloud and Local Server Architecture

Data collected using the collection application is synced to the cloud server. The cloud server is also periodically synced with the local in-house server. Due to the ubiquity of 3G Internet services in The Gambia, it is much easier and cheaper to synchronize data to the cloud than to sync directly to the local server at GBoS. Both the cloud and local servers have UNIX (UBUNTU Server) installed on them. The DBMS installed in both of the systems is MySQL and the version is 5.5.41. MySQL DB is free and open source and very stable and hence making it a good choice.

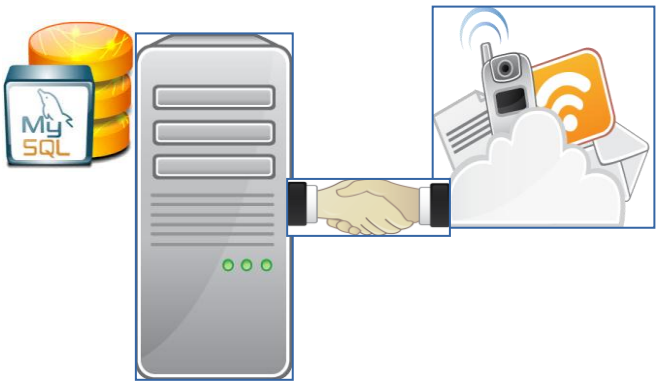


Figure 9: Cloud to Local Server Synchronization

10.5.1 Synchronizing the Cloud and Local Server:

On top of security, one advantages of using UNIX based systems is availability of its powerful Bash scripting system. With Bash we are able to write custom scripts that enable us to synchronize and backup the cloud and the remote server. We also have the option to do duplex (two way) synchronization. Below is a snapshot of the sample script.

```
#!/bin/bash

# @Author : Sheriffo Ceesay
# Date : 5th February 2015
#Project : Use of Mobile Technologies for data collection
#Run : ./backup_db.sh full or ./backup_db

echo "Starting Backup by "
whoami
echo "================="

file=`date +"%d%m%y-%T"`
if [ $# -gt 0 ]; then
```

```
        if [ "$1" = "full" ]; then
                echo -e "Full Backup Started \n\n\n"
                        mysqldump -u root -ppassword cpi > "allBackups/Full_Backup_"$file.sql
                echo -e "Full Backup Finished \n\n\n"
        else
                echo -e "Incremental Backup For Syncing Started \n\n\n"

                mysqldump --no-create-info -u root -ppassword cpi prices --where "synced_to_local
is NULL" > "allBackups/latest_backup.sql

                echo -e "Incremental Backup For Syncing Finished \n\n\n"

                echo "UDATE PROCESS STARTED"
                        mysql -u root -ppassword << 'EOF1'
                USE cpi;
                UPDATE prices SET synced_to_local=1 WHERE synced_to_local is NULL;
EOF1
                echo "UPDATE PROCESSED COMPLETED"
        fi
fi
```

The above script is simple, yet very powerful. While the script is executed by the cloud server, both full and incremental data back-ups can be executed and the result can be synced to the local server for processing. The incremental part will grab all the data that has not been synchronize with the local server.

The second script which resides in the local server will initiate a secure SSH connection to the cloud server and copy the results generated by the cloud server's script, then execute it. Below is the script

```
#!/bin/bash
#@author : Sheriffo Ceesay
#date : 05th February 2015
#Project : Use of Mobile Technologies for data collection
#Run : ./update_db.sh

echo "Updating Local DB -- Started "
whoami
echo "================="
echo -e "Downloading data from cloud server started\n================================"
        rsync -avz -e "ssh -p port" sc@pilotserver:/home/sc/latest_cpi.sql ./
echo -e "Downloading data from cloud server completed\n================================"

echo -e "Merging Remote DB with Local DB started"

        mysql -u root -ppassword cpi < latest_cpi.sql
echo -e "Merging Remote DB with Local DB completed"

#Merge the Data Now
```

After executing the script above, the two servers will have the same content in its price table. The above scripts are scheduled using UNIX's powerful scheduling approach called the CRON. Using the CRON we can schedule the scripts to run on very flexible timings and this will save us having a physical systems administrator on site and at a particular time.

10.6 Web Portal

The web portal is developed to help Statisticians at GBoS, stakeholders and other consumers of Price Statistics to have exclusive and secure access to the data and its results as soon as the data is received and processed.

10.6.1 Security and Availability:

The portal has two main level of security and that is the security embedded in the hosting and in the front end. The web portal is hosted on UNIX base operating system, UBUNTU version 14.10. UNIX based systems are considered to be the most secured operating systems.

These are used as the base system in most enterprise system and it can also manage heavy loads much efficiently than other platforms. The uptime of the server is assured and therefore we can always depend on this server.

Accessing the Web portal: The web portal is accessed through a web browser: A local replica of the online web portal is available for access at GBoS. The online URL as of writing this documentation is: *http://109.74.201.97/*

The above URL will result into the figure below. Every user is given a username and password for access. At the moment public users would also need a guest account to access this portal.

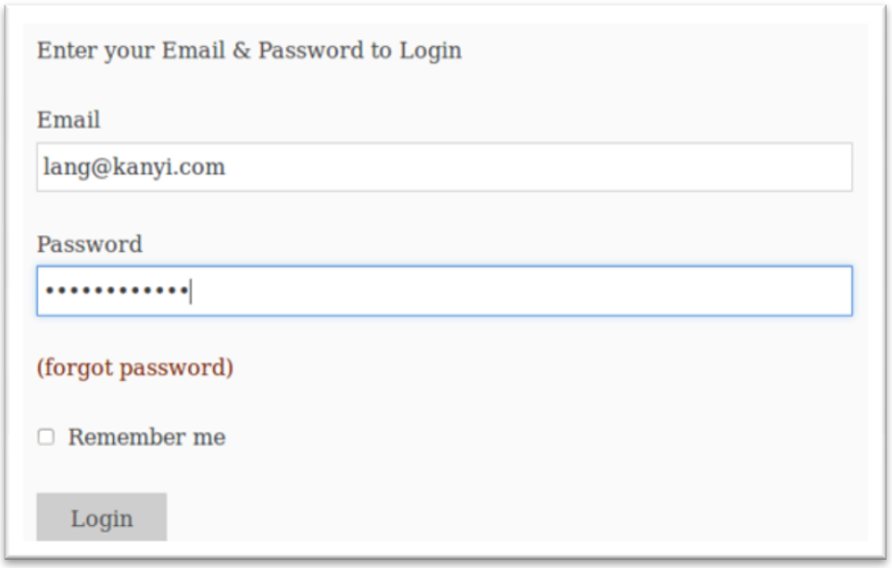


Figure 10: Login Screen Dump of the Portal DBMS

10.6.2 Viewing and Modify Data

From the figure below, data collected can be viewed by category, market, monthly, and yearly. By using the "Price Indices" button, the CPI price indices can be generated.

In the main table, products are displayed with their standard unit, quantity, price, adjusted price and the market data was collected from. The geo-location is also stored in the database. The main database tables are listed below.

For each data record in the table below, an edit action is available to enable modifying records that were incorrectly sync to the server. Products, Categories and all other related data objects can also be edited in similar methods.

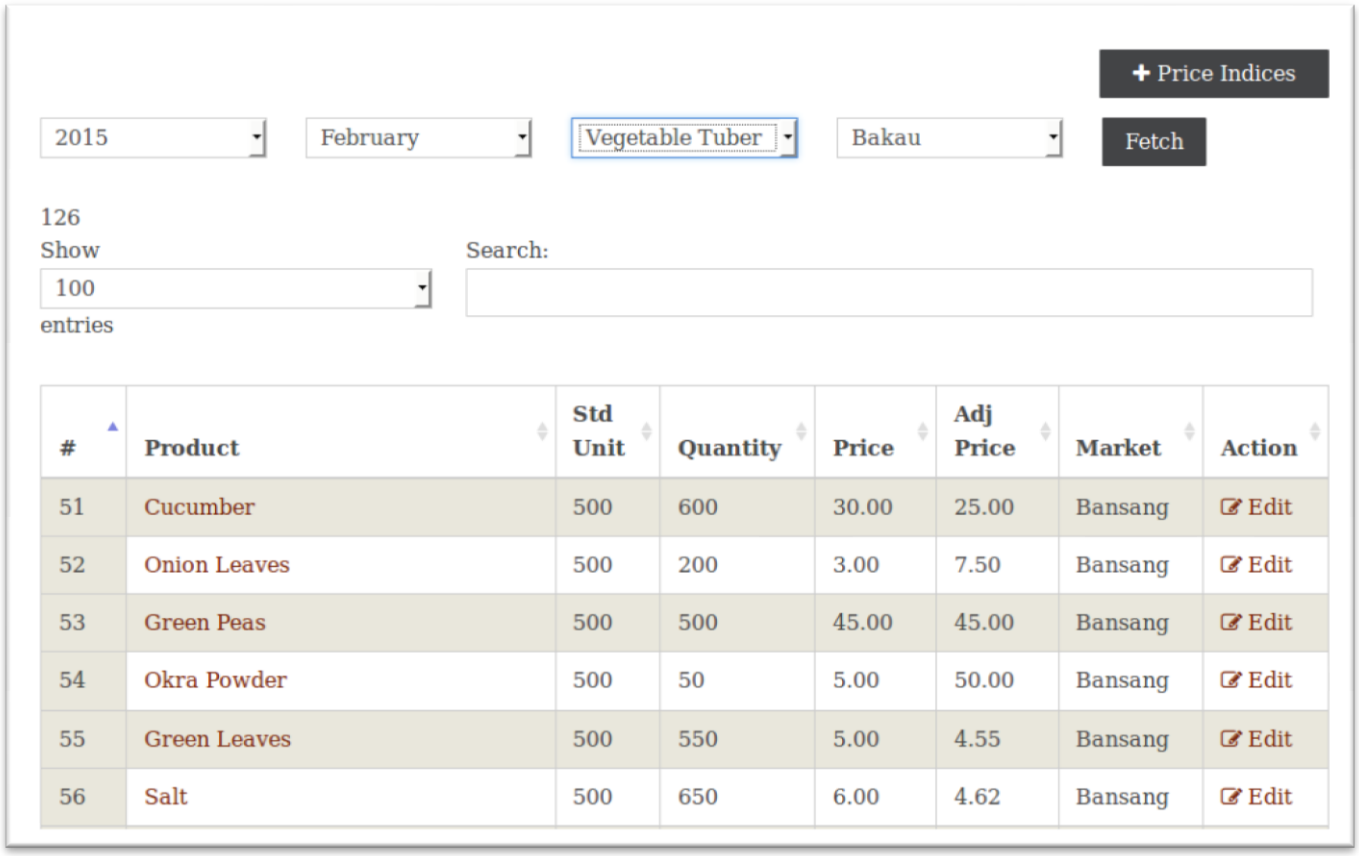


Figure 11: Data display for viewing and edition

Report Generation.

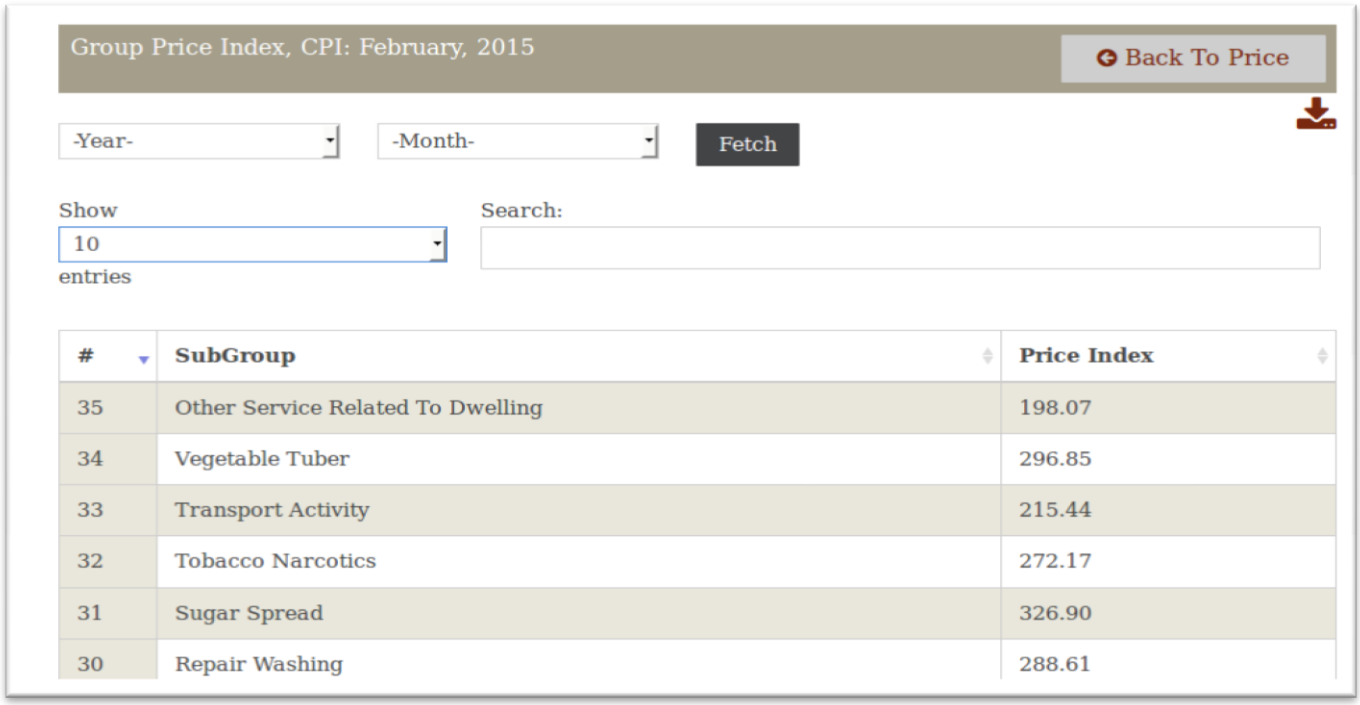


Figure 12: An Illustration of Report Generation

One of the main goals that we strive to achieve is to shorten the time taken to collect, process and generate price statistics. Generating price indices for a particular month simply involves selecting the year and month and click on the "Fetch" button. This report can be downloaded into PDF. **NB:** Note the value depicted above is not the official price indices. This is the results of the data that was collected during the pilot project.

10.7 Software Application Security

Security threats in the 21st century are increasing in volume. Sophistication and diversity of security treats poses increasing challenge to both corporate and states institutions.

In order to ensure quality and reliability of collected data, security features such as end to end encryption technologies have been integrated into the developed Android software application. The security strategy adopted by TRI is intended to ensure functionality at the same time protect clients' business processes by ensuring confidentiality, Integrity and Availability against potential internal and external threats. This forms an integral element of the application architecture and design including the following monitoring mechanism:

- Identify management and access controls.
    - Denial of service and security protection.
    - Error Rate control.
    - Generate concise reports to monitor user activities on the data collection devices.
    - Policy rules -/-AAA (user specified): Accountability, Authentication and Authorization.

- Offer consistent reliable and secure networking.
- Mitigates passive and active attacks.
- Provides wireless device host intrusion prevention and an integrated authentication framework.
    - Super authentication.

- Firewall used to prevent exploitation and vulnerabilities of host devices.
    - To block spyware.
    - To stop SPAM.
    - To block access to pornography.
    - To protect users from web related threats.
    - To prevent phishing attacks.
    - To block Pop ups and anti-spoofing.

11. The Network Connectivity: GSM Broadband

Since the costs of information processing and transmission are greatly reduced to the availability of broadband Internet services, the T.R.I. took advantage of IP technology in order to drastically lower the costs of data transmission between enumerators hand held device to the server infrastructure. In addition to availability of GBoS server infrastructure, we further opted for a public cloud computing service in order to create real time synchronization service between the cloud and the in – house server infrastructure network.

The motivation for the adoption of this model is to ensure that reliable connectivity is available for enumerators to upload the collected price data even if there is network down time at GBoS in a given period. Anytime the connectivity issues or server down time is resolved in-house, there will be an automatic synchronization service between the servers and the cloud computing platform.

The TRI's primary focus is to provide an android application program for GBoS which is to run on a wireless Broadband as backbone of its network that to interface with the application program as a transport system at all locations in the country. The core of the development was cantered on IP technology. The utilization of this latest technology as a data collection mechanism has met all the CPI / PPI data collection requirements of GBoS. This has also help GBoS to substantially reduce its costs for monthly and quarterly price data collection services.

11.1 Technology and Network Configuration

The network layout in Figure 13 below depicts how our deployed application integrates with GSM networks as a backbone infrastructure for our data transmission

and synchronisation. This enhances the capability for GBoS, to utilize the latest technologies to help the Institution, reduce costs on domestic price data collection across the identified twenty eight markets.

Field Work Data Synchronization Architecture:

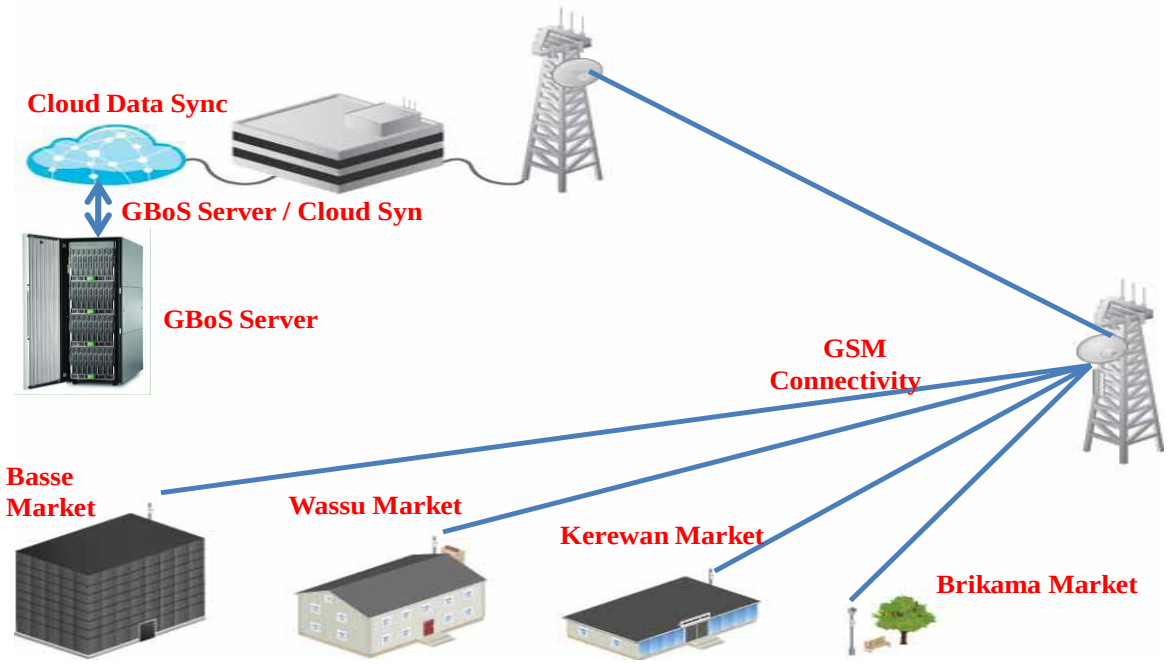


Figure 13 An illustration of the data transmission

The initial configuration includes Samsung Galaxy Tablet 4 devices, which performs the following functions:

- Integrating the IP transport of voice and data communication across the same or different GSM infrastructure.
- Compressing and converting data and vice versa, as well as transmitting and receiving data packets over the IP network.
- Enable two-way communication between the Cloud infrastructure and the Gobs servers.
- De-packetize the data and send it over the GSM network to complete routing the data to its destination.

11.2 Specifications

The equipment, network and communication devices that we deployed have met International standards with the following specifications:-

- Communication Protocols (SIP, H.323) specifying protocols and procedures for data communications providing multimedia communication over packet-based networks.

- Real-Time Transport Protocols (RTP per RFC 1889, RFC 1890) facilitate end-to-end delivery services of real-time data.

- Gatekeeper functions: Address Translation, Admission Control, Bandwidth Control, Call-Control Signalling, Connectivity Authorization and security Management.

- Network Management Protocols (SNMP, HTTP, TFTP, and DHCP) allow processing to be distributed to appropriate levels for scalability, optimum performance, and communication efficiency.

- Vocoders (G.711, G.723.1, G.729 a,b) to perform compression and conversion of data and de-packetize and decompress the data to its original format at the receiving end.

- Echo Cancellation (G.168 at 32 msec trail length) suppresses echoes from the distant end.

11.3 Quality of Service

We ensure that facilities are in place for the monitoring, control and efficient utilization of the resources vital to the application management, and that other applications using this resource on the GBoS network get their fair share without interfering with our mission-critical traffic.

We guarantee that the network management system provides facilities to monitor, control and correct transmission errors with minimum impact to the quality of services. The network devices deployed are of high capacity and fault-tolerant, and

have efficient network management functions that can deliver quality service to GBoS.

11.4 Availability and Grade of Service

TRI is aware of inadequate primary power supply in some areas of the country, which will to some degree affect enumerators' data collection processes, and subsequently the timely collection and processing of statistical data. TRI realize that it is difficult to sustain continuous and reliable primary power supply, especially in developing countries. However, GBoS is equally aware of this situation and has procured enough mobile power banks for the tablets (mobile hand held devices) to provide power on request by enumerators'. This will allow the enumerators have continuous service; access collect and locally store data for synchronization at anytime during the go-live field exercise.

11.5 Storing Data offline:

Storing data locally involves the following steps:

- Collection of the data using the Android tablets is done with inbuilt forms.
- Forms are fully or partially filled
- Once all data is collected, it is safely stored and subsequent edits are allowed before final upload to the cloud.
- Technically storing data involves grabbing all valid data from the form and initiate a connection to the SQLite database and execute an INSERT statement to store the data.

12.0 Application Testing

12.1 Testing Exercise

Testing the application forms is fundamental in any application development process. Upon completion of the android Application development, an in-house testing was done with dummy data from the Prices and Government Finance Statistics Directorate of Gambia Bureau of Statistics (GBoS). Bugs were routinely logged and accordingly fixed.

A collaborative platform was created and used for logging the bugs at **http://clockingit.com**. On this platform a tester will log bugs and assign them to a group of programmers to fix. Programmers will then fix the bug and update the status of the log as fixed. Sample illustration of a bug/suggestion logged by one of the testers and response by a developer is illustrated in appendix B.

The second and most important testing exercise undertaken was the *pretesting field work exercise during the Training workshop*. This exercise was conducted to serve as a simulation exercise for the actual field work. TRI used the feedback from the enumerators to enhance the application functionality as observed by the data collection team.

Bugs fixed were as follows:

- Duplicate or mismatched id's of form resources.
- Form resources id's called in a wrong form.
- Name mismatched for few text fields and
- Log-in problems.

12.2 Live Field Testing

On the 19th February 2015, TRI successfully conducted a fourteen (14) days nationwide field testing. The exercise was intended to test the functionality and usability of the developed system; the outcome of the data collected to be processed and analysed for possible integration into GBoS pricing systems. Despite the limited time of the project, the achievements of the fieldwork prove over whelming. The results of the data collection and the analysis have achieved the objective of using mobile technology in price data collection and the conversion of such data to generate an index.

13. Field survey Analysis

In spite of network connectivity problem in some parts of the country, the data collection survey was conducted smoothly across the country. All supervisors of the respective teams were able to successfully synchronize price data to the central

server with ease in all the market centres visited across the country. This was a milestone achievement.

Secondly, the use of mobile data collection ensures data is readily available on collection and upload. There were no problems about data entry errors; Access to content by members of the GBoS Price Statistics Unit has gone well without problem. Once authority to access is given, content is made available with ease.

Finally, the analytical base use was also very much appreciated as the index was generated with a click of a button. Price statistics experts thoroughly observed the process and have been satisfied with the results although some minor limitations have been sighted which are solvable with time.

13.1 The following analysis and tabulation tasks are possible:

- View indices at different levels of aggregation – from the item-level upward-by period for any number of periods;
- Filter the information to select any combination of primary (item-level) or aggregate indices into special purpose index series;
- Filtered indices can present the aggregates as these are in the system or as derived from the filtered items/groups using the relative weights of all in the selected dataset;
- Seasonal adjustment with ARIMA (Auto-Regressive Integrated Moving Average) forecasting and back-casting;
- Year-to-year, month-to-month and average annual series; and two or more classifications could be adopted, (COICOP, ISEC)

14. Lessons Learnt

14.1 Issues and Remedies

- The functionality and the commercial viability of using mobile data collection for GBoS have enhanced its operational efficiency.

- The new data collection method implemented by the TRI has met the required objectives and is likely to increase the scope of data collection by GBoS.

- There were few occasions during the data collection exercise where it was impossible or difficult to synchronize data to the main server due to either network coverage issues or power failure.

- The network connectivity issue has been addressed by locally saving the data on the handheld device with GPS coordinates and timestamp, which is later synced to the cloud at any closest location where connectivity signal is available.

- Local data storage issue on the tablets were experienced on few occasions, as result of device failure but later resolved.

- The form design provided by GBoS to the software development team was an old version. The new version was later provided and has been successfully incorporated.

- Using mobile data collection ensures that prices are verified as they are entered directly from the collection point and transferred to the main system with geo codes thereby reducing the use of paper and save time.

15. Follow-up Activities and Recommendations

Striking balance between the cost and benefit: mobile data collection method far outweighs the manual method as observed during the course of implementation. With the successful outcome of the pilot project, follow-ups and recommendations for the post implementation phase and sustainability requires - GBoS to:

- Put in place strategies for enhanced connectivity

- Collaborate with TRI to enhance scalability on the developed application

- Initiate and established a private Cloud platform to serve as national hub for data harvesting and consumption

- Expand mobile technology use for data collection to other sectors of development

- Address the issue of security and recovery that will take on board scalability. This may be achieved through introduction of a proxy and secondary servers.

- On long term sustainability that would match with the volume of data to collect and maintained, a private cloud should be encouraged.

- Harness local talent should be explored and encouraged

16. The Way Forward

The following have been sighted as the way forward for post implementation of the developed system.

- According to price analyst, the pilot project indices are successfully generated which was the ultimate aim of the developed application. However, the application in future should be scaled up to allow broader analysis of data collection for other sectors.

- Mechanism to improve Security of Data collection tools such as Tablets should include the development of a policy on data collection tool handling; security awareness training and regular audit must also be established. This includes both the physical and logical security of the handheld devices as well as the end to end connectivity of the developed application.

- TRI to conduct academic research in collaboration with GBoS on the impact of mobile technology for data collection in The Gambia; and such findings be published for wider consumption.

- Greater collaboration be established between GBoS and the TRI for post implementation review

- Field data collection using the hand held devices by enumerators should be adopted to ensure that enumerators familiarize themselves with the device to ensure speedy and efficient continuity of GBoS operations.

- GBoS intends to continue working with TRI to further roll-out the use of mobile data collection for their internal core activities, as well as collaborate with other sectors engage in statistical data collection.

- Organise and encourage regular Training of Trainers short courses (TOT) on the efficient use of mobile data collection method in selected countries which are very much experienced in mobile technology use. Those to train should include not only price Analyst, but also data collection supervisors.

17. Conclusions

As the only mandated institution to officially collect, analyze and disseminate statistical data. The Bureau looks forward to more implementation of the use of mobile technologies for data collection. We hope to roll out the use of this technology in other areas and eventually do away with manual data collection and processing methods in the near future.

With digital mobile technologies rapidly gaining adoption in the developing world, there is more potential for new ways to leverage technology in Information, communication and technological development. The overall mobile technology use for data collection in The Gambia brings improvement and greater efficiency in the production of quality data in the GBoS. The use of this application is considered efficient and more error free compared to the existing manual method. It saves time, money in terms of GBoS operations and provides availability of data for statistical analysis and reporting on timely basis.

With the pilot results, the data collection and analysis have achieved the objective of collecting price data using mobile devices; sending such data to a server from the collection point and then analyze to generate an index. Although, there has been minor issues observed in the index generation, but overall it was satisfactory.

Despite the TRI has met all the requirements of the project deliverables, the GBoS price department has identified more enhance features to be incorporated in the application upon roll out.

Despite some issues spelt out in the report, the Pilot project has been successfully implemented.

- All deliverables have been completed within the timeline.
- The project management strategy adopted; coupled with the spirit of cooperation and collaboration of all participants contributed to a successful outcome of the deliverables.
- On sustainability and assurance in the efficiency of the systems, it is recommended that capacity building for staff of GBoS; users and technician and Price researchers/Analyst be organised and regularly maintained.

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[3] Concept Note, Ad hoc expert group meeting (EGM) se of Mobile on the use of Mobile Devices for Data Collection, organized by African Union Commission (AUC) and United Nation Economic Commission for Africa (UNECA), Data Technology and Geo-information and sectoral statistics sections, 8th to 12th December 2014, Tunis, Tunisia.

APPENDIX A: Workshop 1

Report

On Workshop Proceedings on the use of Mobile Technologies for Data Collection in The Gambia

The Gambia Component

Project Ref:	**OP/14/09/LOA/D/023**
Project Sponsor:	**UNECA**
Beneficiary:	**Gambia Bureau of Statistics (GBoS)**
Date:	**19th December 2014**

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Theme:

Use of Mobile technologies for Data Collection in The Gambia

Program Schedule:

SN	Time	Topic	Facilitator
1	08:30 – 09:00	Registration of participants	
2	09:00 – 09:25	Welcoming and opening remarks	Statistician General, GBoS Mr. Nyakassi Sanyang
3	09:25 – 10:00	Remarks by Ag. Head of School of Science and Technology, University of The Gambia	Dr. Momodou Jaine (TRI)
4	10:00 – 11:00	Morning Coffee Break	-
5	10:45 – 11:00	Remarks by Director of ICT, GBoS	Mr. Momodou Lamin Fadia
6	11:00 – 11:20	Price data, its importance, compilation and the need for better data collection method	Director of Prices, and Government Finance Statistics Mr. Ousman Dibba
7	11:20 – 12:00	Pilot project and Importance of Mobile Technologies in Statistical Production, Roles and Responsibilities of GBoS.	Focal Point of the Project, Mr. Sheriffo Ceesay
8	12:00 – 13:00	Roles and Responsibilities of ITC-UTG (TRI)	Mr. Mbemba Hydara
9	13:00 – 13:30	Roles of Enumerators	
10	13:30 – 14:45	LUNCH BREAK	-
11	14:45 – 15:20	Agreed technologies to be use for the mobile data collection	Mr. Pa Saffiong Kebbeh, UTG (TRI)
12	15:20 – 15:40	Afternoon tea break	-
13	15:40 – 16:00	Closing remarks	Statistician General, GBoS Mr. Nyakassi Sanyang

Key Speakers and Presenters

Moderator Dr. Momodou Jain, Acting Head of School of Science and Technology, University of The Gambia.

Speakers Mr. Nyakassi Sanyang, Statistician General GBoS

Mr. Sheriffo Ceesay, Project Focal Point

Mr. Mbemba Hydara, UTG

Mr. Pa Saffiong Kebbeh, UTG

Momodou Lamin Fadia, Director of ICT, GBoS

Report written by Mr. Makaireh "Max" JONGA 

Mr. Hamang Manjang

Introduction

Mobile technology has become increasingly popular in the past decade due to combination of device portability and advances in network and internet technology. Smart phones and tablets in particular, are at the forefront of these technologies, enabling national statistics bureaus to remotely track, collect and process data in an efficient and cost effective manner using various techniques in real-time.

It is against this backdrop; the United Nations Economic Commission for Africa (UNECA) in collaboration with the Gambia Bureau of Statistics (GBoS) as an implementing partner, and the School of Information, Technology and Communications of the university of The Gambia, as a Training and Research Institute (TRI), have undertaken the task of developing a pilot project on "Mobile Data Collection Techniques" for The Gambia local market prices on various identified products across thirty-two (32) targeted markets.

In the light of the above, on the 19th of December 2014, a national workshop was organized by The Gambia Bureau of Statistic (GBoS) in collaboration with the TRI for all stakeholders and implementing partners to; identify and to agree on the modalities of implementation and clarify roles and expectations, technology to be used, including enumerators.

Welcome and Opening - The panellists

Statistician General. GBoS

Mr. Momodou Lamin Fadia, Director ITC at GBoS, welcomed the attendees on behalf of the GBoS Statistician General (SG) who extended apologies for not being at the opening, due to a Parliamentary engagement, but would be joining the workshop later. He introduced the panelists and speakers on the high-table. He thanked all attendees for their impressive turnout, and looks forward to fruitful deliberations.

Mr. Fadia explained that the reason for the workshop is to spearhead The Gambia's efforts at catching up with other countries in this area of technology. Following a recent conference held in Cape Verde, The Gambia was selected as one of five (5) countries to run a pilot project in Africa, to determine the feasibility and establish methods and benefits.

This is also supported by GBoS's endeavor to phase out paper surveys, and usher in electronic methods and their inherent benefits.

Mr. Fadia handed over to the Moderator / Chairman of the meeting to proceed.

Chairman/Moderator – Dr. Jain, UTG

Dr. Jain started by welcoming all attendees and thanked them for their presence.
He explained that the need for statistics is very important because of the need to plan. We need to identify a base, find out about our current status, and obtain statistics to enable policy makers generate national strategies, for example, in health, education or trade interventions.

Mr. Jain stated that Cape Verde uses mobile phones for data collection, to generate their national Consumer Price Index (CPI). He posited that with the joint effort of all stakeholders, it should not be difficult to institute the same systems in The Gambia. He opined that it will help when donors and development partners request figure and statistics, which would be readily available. He stated that accurate, quality and timely statistics will help in national policy formulation in different areas.

SESSION 1 – Panellists' Introductory Statements

Ousman Dibba – Director of Prices and Government Finance statistics, GBoS

Mr. Dibba welcomed all attendees and thanked everyone for gracing the occasion. He informed the workshop that he will be talking about ***price statistics and their importance***.

- Everyone is affected by pricing, with particular reference to inflation. When prices go up and wages remain constant, living standards are generally affected.
- Price statistics help in corporate and business planning. Politicians will make more informed decisions with required price statistics.
- Publicly and commonly used goods are very important in price statistics. An increase in the price of one essential product in relation to others will affect consumers.
- Analysis of market trends are important with CPI reports composed through analysis of essential items and their prices.
- If, for example, there is deflation it impacts consumer activity and Central Bank's policy on interest rates. Currency exchange rate speculation is also affected, which may necessitate the Central Bank's market intervention to adjust relevant rates or policies accordingly.
- CPI's are used by central banks and governments in policy decisions. This is one of the most important drivers of political trends.

Moderator: Dr. Jain

Dr. Jain thanked the presenter. He added that consumer behavior, e.g., hoarding of essential items, are affected by price perception. If an increase in price is expected, consumers will buy more and hoard. The reverse is also true, where consumers would postpone purchases when they expect lower prices, to make purchases later.

Dr. Jain reiterated his opinion that all departments and major institutions should have resident statisticians for planning purposes.

Mrs. Loli Jallow, GBoS

Mrs. Jallow thanked the panelists, project team members and workshop attendees. She said she will discuss the way statistics were collected before, and how GBoS plans to do it after this pilot project.

The current process involves:

i. Sample testing
ii. Survey designed and verified / approved.
iii. Enumeration:
    a. Mapping of geographic areas / division of enumeration area.
    b. Sample selected
iv. Coding on paper for survey
v. Data entry clerks trained
vi. Data entry done

vii. Concatenation
viii. Tables produced, checking on consistency
ix. Reports produced

This is quite a long process, and is error prone, time consuming, and needs much more resources.

The proposed theme for this workshop, upon successful implementation, will help more in speed, accuracy, availability and accessibility.

Using mobile technology will aid in vastly reducing the amount of paper used in data collections. Responses are loaded lie to the servers and analyzed in real time.

She iterated the importance of enumerators being devoted, honest and accurate in their work, as this will in turn help GBoS produce accurate and reflective reports for policy decisions.

Moderation: Dr. Jain

Dr. Jain emphasized the importance of honesty, as cheating in enumeration is not allowed, with serious consequences. The tablets that will be used, will be taking constant hotographic and other evidentiary information to ensure that enumerators do not cheat (for example, by mass entry of non-respondent or false data.

Twenty (20) years ago, few people had access to telephones, and then came the phone booths, home phones and now mobile phones. We need to move along with technology to realize its benefits.

Translations: Mr. M L Fadia

Mr. Fadia gave a synopsis of the proceedings so far, in two local languages (Wollof and Mandinka) for the benefit of attendees who may have difficulty understanding the English versions.

Introductions: All Attendees

Mr. M L Fadia coordinated the self-introduction of all workshop attendants, by standing up, stating name and department or institution being represented.

A list of all attendees is included as **Appendix 1**

Moderation: Dr. Jain

Dr. Jain expressed his appreciation once more, and stated that he was very impressed with the attendance/turnout, from such a wide stakeholder base.

The workshop as then adjourned for the **morning coffee break**.

SESSION 2 – Presentations and Discussions

Presentation 1: Sheriffo Ceesay – Project Focal Point, GBoS

Subject: ***Pilot project and Importance of Mobile Technologies in Statistical Production, Roles and Responsibilities of GBoS.***

Mr. Ceesay started his presentation by informing the workshop that:

- The project is sponsored by UNECA
- GBoS is the beneficiary
- ITC –UTG are the implementing partners
- The duration would be 3.5 (three and a half) months.

A copy of the presentation is attached as **Appendix 2**

Comments, Questions and Answers:

Moderation: Dr. Jain

Dr. Jain invited all participants to ask questions or proffer comments after each presentation. He expressed his support for the use of local skill, and doing all the work locally that used to be done by foreigners and external consultants.

Question: Honorable Pa Manneh, (Member of Parliament).

Hon. Pa Manneh, MP, conveyed his delight with the project. He expressed concern about the probability of job losses and the effect on unemployment due to the new technologies being introduced. However, Hon. Manneh told the workshop that he was satisfied that development comes with its price, and job losses will need to be borne as a consequence.

Comment: Mr. Max Jonga

Mr. Jonga commented that technology should not be feared due to its effect on employment. It introduces efficiency, and generally creates more jobs than are lost. There are much more jobs in the communications field today, than 20years ago, despite the huge technological developments and the inherent improvements ushered in.

Question: Yaya Jallow, Consultant.

1. Is the new system going to maintain the same traditional items that prices were collected on, or is GBoS going to expand the price data collection items to include all important items in the calculation of CPI?

2. Is the frequency of the new system going to be a one-off annual exercise, periodic, or done monthly?

Comment: Dr. Jain

Dr. Jain explained that this is a ***pilot*** project. If it works as expected, then it will be fully implemented, most likely to cover all areas of the economy. All concerns raised in this forum will be recorded and taken into consideration.

Answer: Mr. Ousman Dibba, GBoS

In GBoS's system, any item to be included in the CPI computation is derived from household surveys. The items are not derived subjectively or speculatively.

The more important and consistently required items by households are included in the computation, from the CPI household survey.

Comment: Mr. Mbemba Hydara, UTG

A brief survey to assess the feasibility of this pilot project was conducted recently. Similar concerns were raised, but based on the results obtained; the highlighted concerns were all addressed.

Question: Abba Sankareh, Deputy Director, Planning Services Unit, Ministry of Agriculture

1. Did the project team review the very important issues of viability, sustainability and local support? Mr. Sankareh expressed concern about continuity and sustainability.
2. The presenter mentioned that thirty (30) markets are covered countrywide. Does this cover the weekly flea markets, locally known as "lumo" markets?
3. Can GBoS include, or consider including staff from the Planning Services Unit, Ministry of Agriculture, since we collaborate heavily and have experienced staff?

Comment: Enumerator

An enumerator expressed very strong concern about NAWEC and the GSM companies. He posited that they are not helping at all in the national development endeavor to close the gap with other countries. This project could as well be adversely affected by the electricity and communications industries.

Question: Mbassey Sanneh, NDMA

Mrs. Sanneh commended GBoS for this laudable effort.

Is GBoS limiting the training on this project to their staff only, or can they expand the scope to include relevant partners and stakeholders (such as NDMA)? Can GBoS include, or consider including staff from the Planning Services Unit, Ministry of Agriculture, since we collaborate heavily and have experienced staff?

Answer: Momodou Lamin Fadia

Mr. Fadia reiterated that ***this is a pilot project***. Consequently, the scope of inclusion is very limited and other stakeholders cannot be included yet. The transition from paper to electronic methods is being tested, thus limited to GBoS. He promised however, that in the future, GBoS will include all relevant stakeholders when required and necessary.

Dr. Jain explained that this is a pilot project. If it works as expected, then it will be fully implemented, most likely to cover all areas of the economy. All concerns raised in this forum will be recorded and taken into consideration.

Comment: Balla Kuyateh (Ministry of Trade)

The Ministry of Trade, Industry and Employment (MOTIE) conducts similar exercises for weekly presentation to Secretaries of State at Cabinet meetings. Their reports show price behaviors, and hope to work closer with GBoS, as these are very essential, albet seemingly duplicated by the two institutions.

Comment: Hafigi Sisawo (GAMCEL)

After commending GBoS and the research team's efforts for this project, Mr. Sisawo stated that even though it is a pilot project, issues of security with reference to the devices being used as well as the collected data must be fully addressed as paramount. Stable and consistent availability of connection must also be addressed.

Answer: Pa Saffiong Kebbeh, UTG

Regarding the connection issue, the project team will not be restricted to one GSM/ISP operator. He is of the opinion that with all GSM/ISP operators merged in terms of geographic coverage, every region of The Gambia is covered. If any operator fails to provide coverage in a particular area, another operator will be used.

With regards to security, testing will be done to ascertain the security of both the devices and the data being collected and transmitted. Compression and encryption technologies will be used. Mr. Kebbeh said that these issues will be covered in his forthcoming presentation after the lunch break.

Question: Yaya Jallow, Consultant.

1. There are some attendees who don't speak English, why were they invited if they won't understand or have the opportunity to participate in the proceedings?
2. Although this is a pilot project, I still believe that other relevant stakeholders should be included.

Answer: Momodou Lamin Fadia

Mr. Fadia reiterated once more, that ***this is a pilot project*** and is yet no means the end of proceedings. GBoS will respond to any institution's training request, but currently GBoS has to work with sponsors on pre-defined parameters.

He also apologized for the language and translation issues, but noted that it was only due to the time constraints. When necessary, participants can speak in a local language and a team member will translate to English, and vice versa.

Comment: Sainey Sanneh (MOHSW)

Mr. Sanneh thanked the presenters and remarked that although The Gambia may be a late starter, this is a very worthwhile project and very necessary.

His line ministry has had experience using mobile devices (tablets) to collect health data. He affirmed his belief that every department should have a planning unit. He proffered his confidence in the success of this pilot project.

Mr. Sanneh posited that sustainability is very important. He is glad that the main development, software coding and analysis are done locally, and this ensures a degree of continuity.

Question: Mr. Sallah (Dept. of Planning)

1. How do you intend to publicize/disseminate the information obtained and results of surveys, especially to those institutions and individuals that need it?

Answer: Momodou Lamin Fadia

Mr. Fadia responded stating that the information collected is verified first, through their established mechanisms, and then published on the GBoS website.

Comment: Fatou Choye, Serrekunda Market

Mrs. Choye stated that most of the traders at the local markets are not technology conversant. If they need to use technology, for example, to place orders, research prices etc, they need to be trained, especially on this initiative to use mobile technology.

Comment: Mr. Abba Sankareh

Information Technology is key in everything now. GBoS can publish their results online, but not all stakeholders or prospective users of this information have online access or skills. He suggested using the other media outlets such as print, radio and television.

Moderation: Dr. Jain

The comments above are all genuine and relevant. Mr. Jain expressed appreciation of the level of participation and interaction. He expressed satisfaction that there is a good understanding about the need for planning and statistics, especially from the representatives of the departments of Agriculture, Finance and Trade.

Comments: Mr. Bubacarr Sillah, Chairman, Brikama Market Committee.

Mr. Sillah spoke in Mandinka and Mr. Fadia translated in English for the audience.

1. We recently saw GBoS staff at the market with their papers, and traders came to us, committee member, asking what these people were doing. We were unaware of their mission, and told the traders that we don't know. Some days later, I heard about this initiative on the radio, and realized that the traders were giving wrong information to GBoS. Some increased or reduced prices and business data given to GBoS.

2. GBoS needs to increase sensitization and communicate with the right prople at all times, to help them get the correct information they need.

3. We realize that this initiative is not for immediate impact, but feeds into policy decisions that the relevant sectors in the long term. If there is improper planning, then we're planning to fail.

Presentation 2: Mr. Mbemba Hydara, UTG Research Team

Subject: ***Roles and Responsibilities of the Research Team***

Mr. Hydara delivered a presentation on the above topic, attached as Appendix 3.

Comments, Questions and Answers:

Comment: Mr. Momodou Lamin Fadia, GBoS

Mr. Fadia expanded more on the roles of stakeholders, especially at the markets where the source data comes from. He implored on them to cooperate with GBoS staff and provide timely, accurate information for the benefit of all. He requested the attendants to convey the message to all traders at the market, for common understanding and cooperation.

Mr. Fadia stated that the attendees were invited at this early stage so that everyone takes ownership and acts in accordance, as relevant stakeholders.

Comment: Mr. Badou Faal, Chairman, Latrikunda Sabiji Market

Mr. Faal praised this initiative by GBoS.
He however expressed concern at the way GBoS enumerators approach the traders at the market level. He emphasized the need for GBoS to sensitize and always alert market committee members prior to surveys, as the committee representatives can swiftly and greatly assist in getting the right data, the first time.

He expressed delight and hope, stating that this is very encouraging, needs to be institutionalized across the board, and will prove indispensable. He added that he is aware of technology's enabling qualities, and strongly believes in the success of this project.

Comment: Mr. Ebrima Sillah, GBoS (CPI)

Mr. Sillah stated that he goes for data collection all over the country. He said that whatever technology GBoS utilizes, if the traders give incorrect data, the whole exercise is rendered useless.

He said that the effect of these exercise take time, and results are not immediate.

He reiterated previous pleas to market representatives to sensitize their colleagues in order to ease future interaction.

Comment: Alh. B.S. Jaiteh, Enumerator

Mr. Jaiteh expressed appreciation for the information shared and the presenters for their efforts. He continued to express hope that upon completion and implementation, the exercise will assist in quicker policy decisions to close the price gaps countrywide, as information will be at everyone's fingertips

He ended by opining that standardization in terms of pricing and information available, will be helpful to all merchants, the government and the populace as a whole.

Comment: Banna Jammeh, Talinding Market

Mrs. Jammeh made a strong plea to GBoS staff to keenly advise all enumerators that when they go to the local markets, they will be meeting with their elders and parents' age-mates. The markets are different now from before. GBoS enumerators scare these small traders with their approach clutching papers and looking menacing. The traders think they will be requested to pay more taxes and fees. In order to avoid that, they either refuse to divulge information or provide incorrect information, sometimes resulting in altercations.

She said she understands GBoS's efforts to help traders and the nation as a whole, but the approach of their enumerators leaves a lot of room for improvement.

Comment: Sambou Jawara, Serrekunda Market Committee Member.

Mr. Jawara also elaborated on the approach by enumerators. He advised that GBoS takes proper note that all markets have a committee, and interaction should start with the committee first. Traders will be reluctant to give information or give false information, unless committee members advise them that it is safe and beneficial to all.

He reiterated the fear held by all traders about more taxes, fees and other levies. The traders' nemesis, Gambia Revenue Authority (GRA), takes that intimidating approach.

Comment: Mrs. Lolley Jallow, GBoS

Mrs. Jallow thanked the contributors above for their comments. She advised that all their comments have been heard and well noted. She reassured the attendees that GBoS s not GRA and is not doing the work of GRA. There is no activity by GBoS at market level regarding collecting taxes or imposing fees. Their only purpose is to get pricing data.

She also informed the workshop that all enumerators are well trained before deployment, to have a proper and respectful approach at all times, with the right persons. However, this will be re-emphasized.

LUNCH BREAK: Dr. Jain, Moderator.

At this point, the meeting was adjourned for Lunch and Friday prayers.

SESSION 3 – Presentations - PART II

Momodou Lamin Fadia, GBoS

Mr. Fadia welcomed all attendees back from lunch, and informed the workshop that the Statistician General (SG), Mr. Nyakassi Sanyang, has graced the meeting, from his earlier engagement at the National Assembly.

Mr. Nyakassi Sanyang, Statistician General (SG), GBoS.

SG Sanyang thanked all attendees and workshop participants. He stated that he was very impressed with the turnout, and the feedback he received from the team. He noted that today is a non-working day, so it is even more heartening to see such a wonderful turnout and interaction.

SG Sanyang emphasized the need for **Quality Statistics**, which can only be achieved with timely, complete, relevant and accurate data. He said that he trusts the resource persons and experts will certainly deliver as expected.

Dr. Jain (UTG), Moderator

Dr. Jain introduced Mr. Pa Saffiong Kebbeh, to deliver a presentation on the proposed technology.

Presentation 3: Mr. Pa Saffiong Kebbeh, UTG

Subject: ***Agreed Technologies for Mobile Data Collection.***

Mr. Kebbeh thanked the audience for their presence, and advised that he will be delivering a presentation regarding the platform, the tasks and the technology to be used for the project.

The presentation is attached as Appendix 4.

He started with a detailed genesis of the Android technology, up to version 4.1. He described the proposed hardware, and details of the software solution (Android App) developed locally, as well as the connection strategies for uploading and storing the data for analysis.

Mr. Kebbeh emphasized that the connection aspect of the project is not tied to any single ISP or GSM service provider for connectivity to upload or synchronize data. Where one ISP is unable to provide coverage, the enumerators can easily switch to a better carrier by changing the SIM card in the tablet.

Comments, Questions and Answers:

Question: Yaya Jallow, Consultant.

Mr. Jallow thanked the presenter, Mr. Kebbeh, and proceeded to express his concerns as follows:

1. The assumptions about connectivity might not be accurate. There are still some populated geographic pockets that have no GSM or Internet signal.
2. The tablets may run out of battery power in areas where recharging may be difficult, if not impossible. Android systems use up battery power very quickly. Are there any other options considered to provide additional battery power?
3. Are there any other means of storing the already collected information, in case power is lost, or the device develops technical problems that render it inoperable?

Answer: Mr. Kebbeh

With this proposed solution, the operating system (Android) runs on the device, then the data collecting application (App) runs on the OS.

We have provided extra battery power, solar charging systems and battery power bank to enable operation for many hours.

As far as connection is concerned, he reiterated that the project is not tied to a single GAM/ISP operator, and they will provide SIM cards for all active operators to the enumerators.

There is enhanced security through data compression and encryption, and the systems use HTTPS (Secure Hypertext Transmission Protocol), a secure browser connection technology.

The data is uploaded to a cloud server, which in turn is replicated to a server at GBoS, protected by a battery bank for continuous availability.

The tablets used to collect data can also store temporarily until a connection is available, then the data will be synced to the cloud server.

Comment: Mrs. Lolley Jallow, GBoS

Mrs. Jallow noted that it's encouraging that the software development is being done locally, to avoid licensing fees, modular development fees, upgrade and proprietary issues.

She mentioned the need for technical and maintenance teams to keep all systems fully operational at all times. The information being harvested and analyzed is very important, and should be available for access and update at all times.

Comment: Mr. Sheriffo Ceesay, GBoS

Mr. Ceesay clarified, as explained above, that there will be a local server at GBoS, but the data from the enumerators' tablets are uploaded directly to a cloud server, and replicated to the local server.

In answer to a **question about safety from hackers, spyware** etc., Mr. Ceesay responded that all devices are protected with a UserName and Password, available only to the assigned enumerator.

Comment: Mr. Hydara

Mr. Hydara stated that the platform to be use will utilize secure HTTP or HTTPS, the same technology used by banks, other finance institutions and organizations that handle confidential information.

Question: Hafigi Sisawo

Can you explore using VPN tunneling where even if the internet is down, access to upload data will still be available?

Answer: Mr. Kebbeh

VPNs are Point to Point or PTP, or otherwise very expensive. We have considered all these options. Our assessments have indicated that connections shall not be an issue. Many positive comments and suggestive ideas have been received, which will be considered.

Comment: Sainey Sanneh (MOHSW)

Mr. Sanneh offered to share some information about pertinent experience. He said that the ministry of Health used PDAs to collect information on non-communicable diseases, which was a very successful and fruitful exercise.

As a Ministry, they wish to express appreciation for the availability of this technology, and would love to share data, as warehoused centrally and relevant to both institutions' work. He finally expressed thanks on behalf of the Ministry of Health and Social Welfare.

Answer: Dr. Jain

In response to a trader's question about the possibility of including some traders as surveyors to help get better information, Dr. Jain said that was exactly why wide cross-section of stakeholders were invited for their brilliant ideas. He reassured the workshop that after the pilot project, GBoS will work with stakeholders wherever possible to improve results and cooperation.

Comment: Mr. Nyakassi Sanyang, SG, GBoS.

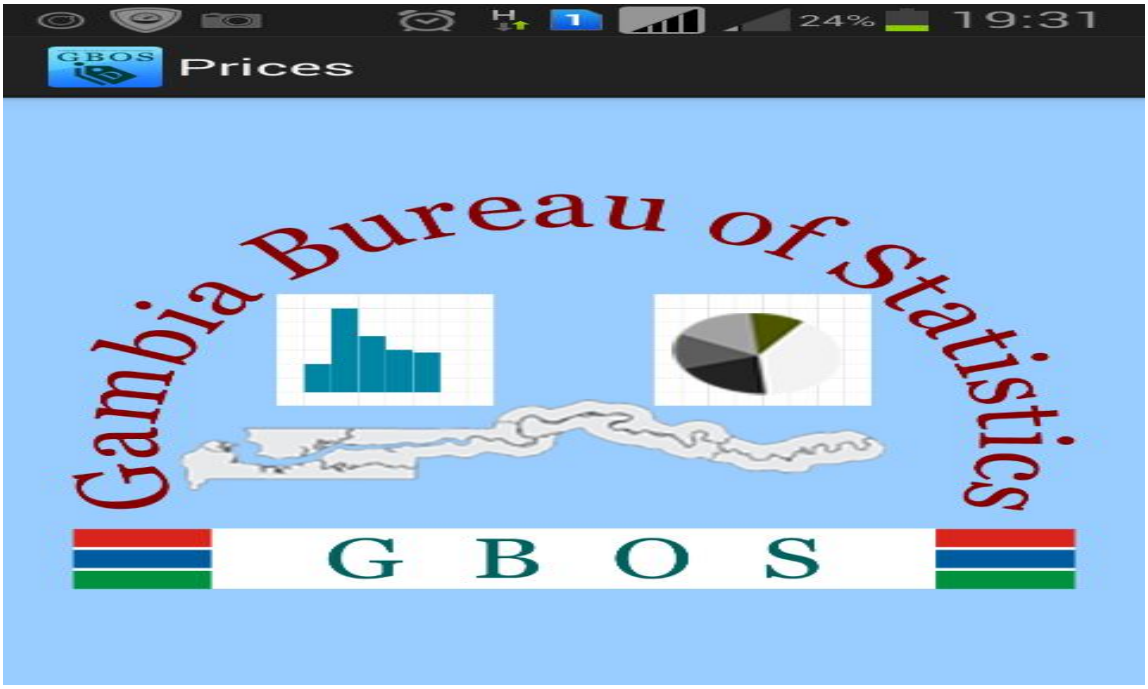
GBoS is moving more towards collaborating with the markets and traders. This is just a start, as we will include more stakeholders in both CPI and PPI data collection processes.

Closing remarks: Mr. Nyakassi Sanyang, SG, GBoS.

SG Sanyang thanked everyone for attending the workshop, especially on a Friday, a non-working day in Gambia, and for participating so vigorously. He stated that he did not even expect such a high turnout.

This has shown how important this issue is, to all attendees, and reassured all that GBoS will use all the interactive exchanges to make this and other future processes easier and more inclusive for the benefit of all. There being no other issues to discuss, the workshop was declared closed at 16:00 hours.

APPENDIX B: Training Workshop (5 days)



Training Workshop Proceedings

VENUE: **Baobab Holiday Resort, The Gambia**

HOST: **Gambia Bureau of Statistics & I.T.C. – U.T,G**

FUNDED BY: **United Nations Economic Commission for Africa**

Theme:

Use of Mobile technologies for Price Data Collection in The Gambia

Program Schedule:

SN	Time	Topic	Facilitator
1	08:30 – 09:00	Registration	-
2	09:00 – 09:25	Welcoming and opening remarks	Statistician General, GBoS Mr. Nyakassi Sanyang
3	09:25 – 10:00	Remarks by Ag. Head of School of Science and Technology, University of The Gambia: Objectives of the Project	Dr. Momodou Jane
4	10:00 – 11:00	Morning Coffee Break	
5	10:45 – 11:00	Remarks by Director of ICT, GBoS	Mr. Momodou Lamin Fadia
6	11:00 – 11:20	Price data, its importance and the need for better data collection method	Director of Prices, and Government Finance Statistics Mr. Ousman Dibba
7	11:20 – 12:00	The project framework and activities. Mobile Technologies in Statistical Production and Demonstration of the developed Android App	Focal Point of the Project, Mr. Sheriffo Ceesay
8	12:00 – 13:00	Project Approach, Methodology, Accomplishment, Challenges and the way forward	Mr. Mbemba Hydara
9	13:00 – 13:30	Roles of Enumerators and Supervisors	Mrs. Fatou Darboe
10	13:30 – 14:45	LUNCH BREAK	-
11	14:45 – 15:20	The Technology Configuration, Connectivity and Platform:	Mr. Pa Saffiong Kebbeh, UTG
12	15:20 – 15:40	Interactive Session. Q & A	-
13	15:40 – 16:00	Statement and Remark by UNECA Rep	-
14	16:00 – 16:40	Afternoon Tea Break & Closing	

Key Speakers and Presenters

Moderator Dr. Momodou Jain, Acting Head of School of Science and Technology, University of The Gambia.

Speakers

Momodou Lamin Fadia,	Director of ICT, GBoS
Mr. Sheriffo Ceesay,	Project Focal Point
Mr. Mbemba Hydara,	I.T.C. - .UTG Research
Mr. Pa Saffiong Kebbeh, ,	I.T.C. - .UTG Research

Report written by ITC-UTG Research Team

Introduction

This second workshop was centred on presenting the GBoS Price Data Collection Software that has been developed by I.T.C. – U.T.G. as well as training sessions for the enumerators, supervisors, and other key resource persons. The workshop was well attended by all stakeholder sectors, including GBoS staff, UTG research team, market traders, enumerators, government representatives, the general public and the private sector. The deliberations highlighted the project's achievements, and the way-forward. The key presenters gave detailed presentations in different areas, and fielded questions from the workshop attendees.

Welcome and Opening - The panellists

Statistician General. GBoS

Mr. Momodou Lamin Fadia, Director ITC at GBoS, welcomed the attendees on behalf of the GBoS Statistician General who extended apologies for not being at the opening, due to prior engagements. He introduced the panellists and thanked all attendees for their turnout.

Mr. Fadia explained that this session will be different from the previous workshop, in that the presentations will be held in the morning session, then only the enumerators and supervisors will remain in the afternoon, to start their training on the GBoS Prices App and the equipment to be used (tablets).

Mr. Fadia handed over to the Moderator / Chairman of the meeting to proceed.

Dr. Jain, UTG - Chairman/Moderator

Dr. Jain started by welcoming all attendees and thanked them once again for returning to the second workshop in the series.

Dr. Jain proceeded to allay the general fear from the public and attendees about technology, particularly on jobs.

He also stated that some of the responsibilities of the University (UTG) to society include:

- Teaching
- Research
- And service to the community.

He emphasized that this is a pilot project, which has been well tested and the team is confident that it will work well. He stated that capacity will be developed for new systems, and we should all embrace these developments. He expressed his hopes that the same project can be replicated elsewhere in the sub-region once the rollout is completed.

Dr. Jain reiterate the need to focus more on local application development to solve local ICT needs, as these apps for use by local businesses and institutions can go a long way in alleviating many issues as well as generate fitting solutions.

Mr. Momodou Lamin Fadia - Director of IT, GBoS

Mr. Fadia encouraged the attendees to be more involved in learning, especially with regards to technology and new skills.

He stated that UNECA are the main sponsors of the project. A representative from the commission was supposed to be with us but due to flight delay he will be joining the workshop later.

He explained that GBoS collaborated with ITC-UTG to develop an Anroid Software application to enable mobile price data collection for GBoS consumer and producer price index. He said that all participants will be able to get a physical feel of the tablets that the software will be running on.

Mrs. Loli Jallow - GBoS

Mrs. Jallow thanked attendees, and reiterated the institution's support for this laudable project. She said they will encourage the users to dedicate themselves to learning the Android app very well, and properly apply their learned skills in their active work roles.

At this point, the microphone was passed around, and all attendees introduced themselves by name, designation and institution represented.

Dr. Jain once again stated his satisfaction with the cross-section of society represented.

He introduced Ms. Asifa, Senior Economist from UNDP, who was also in attendance.

Ms. Asifa - UNDP (Gambia)

Ms. Asifa expressed her gratification to be at the workshop. She congratulated the organizers. She stated that UNDP and GBoS are partners in development, and thus have collaborations. They want GBoS to have cutting edge technology tools to collect, analyze and report on statistical data countrywide.

Mr. Fadia - GBoS

Mr. Fadia acknowledged the presence of two representatives from **World Food Program** (WFP).

Dr. Jain - Chairman/Moderator

Dr. Jain said he appreciates the UNDP's presence and their willingness to sponsor capacity building at all levels. He reiterated the importance of statistics for social planning and policy decisions by government, for example, in education, health, infrastructure, etc.

Mr. Fadia - GBoS

Mr. Fadia said that he has seen the output of the project efforts and can confirm that a good job was done. He stated that The Gambia is far ahead of other West African countries, in the implementation.

The Project Technical Team presented as follows:

Names	Roles	Presentation
1. Sheriffo Ceesay	Focal Person	*Demonstration of the App*
2. Mbemba Hydara	I.T.C. - Research	*Implementation approach, Methodology, challenges, accomplishments and the way forward.*
3. Ps Saffiong Kebbeh -	I.T.C. – Research	*Technology and configuration of the platform, including the connecting architecture, security parameters, etc.*

Breakfast Break at 10:00 am

Technical Presentations

Presentation 1: Sheriffo Ceesay – Project Focal Point, GBoS

Subject: The GBoS Prices App - Demo.

Mr. Ceesay's presentation covered the following:

- Step-by-step demonstration of the GBoS Prices App, showing screens from login to market selection, data entry and storage. The project is sponsored by UNECA
- Key items include:
  - Data is stored on the device using SQLite
  - Synchronizing of data is primarily to an online cloud server, which is in turn replicated to the GBoS hosted servers.
- Demonstration of the web interface

A copy of the presentation is attached as **Appendix 1**

Comments, Questions and Answers:

Question: Security and Data Validation.

Using tablets to collect, store and upload information leaves a few security issues to be covered. How secure is the collection, storage and transmission of the data, from prying eyes as well as interception, as well as validation of correct information being handled?

Answer

Appropriate security controls have been embedded into the App, including the back-end and transmission mechanisms.

- User input is inserted- and parameter-validated
- Supervisor also reviews and validates all data.
- Only supervisor can synchronize / upload data.

Question: WFP Rep - Availability of App on Google's Play Store

Is the application available for download from Google's Play Store?

Answer

Not yet. This is still in a pilot stage. The app is only made available to GBoS staff, as it is proprietary. It will not however be made public; only GBoS staff and the enumerators can and should have access to the app to use it.

Question:

What happens if the tablets run out of charge, especially in areas where electricity is still not available? Smart phones use up their batteries quickly, especially while online. In case batteries run out, what will enumerators do? Can data be uploaded using dumb-phones?

Answer

Enumerators are provided with additional charging banks. The systems will normally be capable of operating until charging can be done again, on average at least 24 hours.

The system is not designed to interact with anything else, but GBoS Prices App, so data cannot be sent from a dumb-phone or any other smartphone that does not have the App.

Comment – Mr. Kebbeh

We chose an external cloud server as an initial storage point for security, redundancy and availability at all times. Note that there is live replication between the cloud server and the local GBoS server infrastructure. This means that enumerators can always upload data anytime irrespective of their location even when the GBoS systems are offline. Synchronization can always take effect between the cloud and GBoS servers.

Question: Mrs. Jallow –

Who resolves locked-out users when they are out in the markets?

Answer

The individual supervisors of the enumerators have access rights to resolve locked - out enumerators while in the market. The Supervisors have administrative ID, and one of their functions is user id management. This includes creating users, unlocking blocked users and password management.

Question: Market and item categorization.

How are markets categorized? Also the different items that price data are collected on?

Answer

There are 28 markets country wide. Once the user is in a particular market, he/she can skip to any category of items for data input. The categories are uniform across all markets.

Question:

Mr. Jobe – Director of ICT, Ministry of Information, Communication and Infrastructure (MOICI)

Are the developers of these Anroid App students at the University of The Gambia?

Answer

No, they are members of the school of I.T.C. – U.TG. Research Team and their teaching assisting teams.

Presentation 2: Buba Bojang – DEVELOPER (Portal Side)

Subject: ***The Backend or the Database Portal Side.***

Mr. Bojang's presentation centred on the backend / office systems of the project and included a live demonstration covering:

- Login (based on assigned rights – supervisor or enumerator)
- Dashboard (Managing: editing, adding, deleting etc)
    - Markets
    - Groups
    - Subgroups
    - Products
    - CPI Prices
    - PPI Prices
- Processed reports are posted to the GBoS website for public access/download. These are stored in PDF format for security.

Mr. Bojang's performed a live demonstration of the backend system, thus no presentation material is attached.

Comments, Questions and Answers:

Question: Mr. Tunkara – WFP: Security and Data Validation.

The Word Food Program (WFP) has been collecting data using cellular phones. This system being demonstrated is quite interesting. Is there any verification or validation of the location of the enumerator in relation to where he/she should be?

Answer - Mr. Ceesay

GPS locations are stored as meta-data along with all information collected and stored. The App does not permit any access and data entry unless the GPS service of the tablet is turned on.

Question: Mr. Tunkara – WFP: Security and Data Validation.

If data is entered while in one market location, can the user then login later while in another location and edit the data? This can have some undesirable effects.

Answer - Mr. Ceesay

Supervisors and enumerators work together, but only a supervisor can edit data that was already saved, and synchronize to the server.

Question: Mrs. Jallow – GBoS: Syncing.

Can a supervisor synchronize incomplete data?

Answer - Mr. Ceesay

No. The data has to be complete before the data is synced.

Comment: Mr. Tunkara - WFP

Mr. Tunkara reiterated his opinion that automatic syncing to the servers is better.

Comment - Mr. Fadia - GBoS

The gentleman's opinion is well noted and will be discussed in-depth for possible inclusion.

Question: Mr. Jallow

What happens when partial data is entered and the application freezes, as common with electronic devices? Is there any data loss?

Answer

No. Data that is entered is immediately saved in tablet locally. It is not removed from the tablet unless fully synchronized. Also, the project is not doing away with the paper surveys yet. These will run in parallel before the paper is phased out after the electronic versions are fully successful and established.

Question: Mr. Jallow

If data is collected in one location and then the enumerator moves to another location and enters more data, which coordinates are synced for that market?

Answer

Anytime data is entered, the coordinates for that record are stored. Multiple locations for data from one market will result in the data being flagged for verification.

Question: Modou Njie - Security

Are passwords saved on the device for automatic access, like some Android apps like Facebook etc? Is there automatic logout after a set time?

Answer

The system will log you out only when you select "LOGOUT". The enumerators and supervisors will be trained to ensure that they logout after every session.

Presentation 3: Mbemba Hydara - Research

Subject: ***Project Approach, Accomplishments, Challenges and the Way Forward.***

Mr. Hydara's presentation updated the Workshop with the following:

- Approach:
  - Project Initiation - Completed
  - Project Planning - Completed
  - Project Execution - In progress
  - Project Closure - Pending

He also ran a brief comparison to the stages of development in other regional groups, showing that Gambia was ahead of the other territories.

He reassured the Workshop that they the team reviewed all challenges and came up with the best possible solution.

A copy of the presentation is attached as **Appendix**

Comments, Questions and Answers:

Comment: Mr. Jobe – Ministry of Information, Communications and Infrastructure (MOICI).

Mr. Jobe commended the presenter and those before him, on the brilliance of the product, albeit in pilot stages still.

There are similar technology pilot projects in the country such as The Gambia e-Government and e-Commerce projects that are UN supported. These are very laudable Gambian initiatives. It is worth mentioning that the nation's ICT infrastructure is well developed, and final touches are being made to bring the benefits to all end users.

There is even an initiative which is in progress, to institute a national Data-Center to provide cloud facility for Gambians. It is high time Gambians are encouraged to delve into providing local solutions such as software development and solutions such as the one being discussed at this Workshop.

Comment: Mr. Sheriff Bojang Honorable Minister of Information, Communications & Infrastructure

The Minister asserted that he is very impressed with the exercise and the presentations. He informed the Workshop that he has just been called for other engagements and begs to leave. He encouraged to continuation of these laudable efforts and appreciated the time.

Comment: Mrs. Asifa – Senior Economist UNDP

Mrs. Asifa also expressed her regrets and informed the Workshop that she has another engagement and needs to leave. She thanked the meeting for accommodating everyone and encouraged the workshop to continue to exert efforts for success.

Comment: Abba Sankareh – Director of Planning, Ministry of Agriculture

Mr. Sankareh thanked the presenters for the information imparted to the Workshop attendees. The West African Producer Project (WAPP) has an online farmer registration component. The enumerators are very well trained but are always having problems with the systems. He encouraged the trainers to ensure the proper skills are imparted as well as the importance of completeness and accuracy.

He expressed his pride that this is a locally owned project. Previous projects were always outsourced to external consultants, and we always end up with severe problems or failure after launch.

Comment: Dr. Jain – Chairman / Moderator

It is good to note the local advantage over external/foreign products. All enumerators, designers, supervisors, technical support, developers etc., will be local. Mr. Sankareh thanked the presenters for the information imparted to the Workshop attendees.

Presentation 4: Pa Saffiong Kebbeh

Subject: ***Technology Platform and Configuration.***

Mr. Kebbeh, the project's Research Consultant presented on the following:

- Platform – Android Operating System:
    - Chosen after thorough research, discussions and evaluation of foreign experience in other regions.
    - He gave a genesis of the Android OS, features and uses.

A copy of the presentation is attached as **Appendix 3**

Comments, Questions and Answers:

Comment: Dr. Jain – Chairman / Moderator

Dr. Jain thanked Mr. Kebbeh for his presentation. He said he is sure that within one year, the connectivity worries and issues that bother internet users in the country would be a thing of the past.

Concern: Mr. Mustapha Conteh – Department. of Population Affairs (UNFPA)

Mr. Conteh expressed his appreciation for this great initiative. He said his main concern is viruses and malware. He has not heard any discussion about malware protection, as users may proceed to download and install software that may open the systems up for hijacking or corrupting the data collected and transmitted.

Answer: Mr. Kebbeh

Mr. Kebbeh reassured the meeting that the point is well noted. Despite not seeing an antivirus package installed, the embedded architecture of the software is very secure. The tablets will only be used for data collection and transmission, thus strengthening the resolve against malware infections.

Concern: Yaya Jallow – Participant

The chain of data handling is: Input and storage at Device > Upload to Cloud > Sync to GBoS server. What security measures are in place? Who determines who can access the data during and after transmission, as well as at GBoS?

Answer: Mr. Kebbeh

GBoS has a network policy which completely excludes access to everyone, unless he/she is explicitly granted permission to access a resource. This means that without unequivocal network permission (which is given in levels), a user will NOT be able to access any statistical data or other information.

Question: Mrs. Jallow - GBoS

Can we have a way to confirm that the data which has already been verified and validated by a supervisor is ok and not tinkered with?

Answer: Mr. Kebbeh

The supervisor, once he / she validates the data and transmits it, cannot do anything else to the data. Once this arrives at the GBoS servers, another validation is done before the information is appended to the database and analysis performed. At the level beyond the supervisor transmission, only Systems Administrators of the backend have access to the database and any changes would be recorded through an audit/change log.

Question: Karen – Banjul City Council

Karen expressed concern that she has not heard anything being said about the Area Councils, and what roles they play in this project. Will they be able to access the data?

Answer: Mr. Kebbeh

Mr. Kebbeh responded, stating that once the analysis is completed, the public consumable reports will be posted on the GBoS website. Only these reports will be accessible. Perhaps the Area Councils would need the output in order to calculate local rates and tax filings, Licensing and duty payments etc. They may also look at the model, and if required, a similar system can be developed for their own data collection as relevant to their exclusive operations.

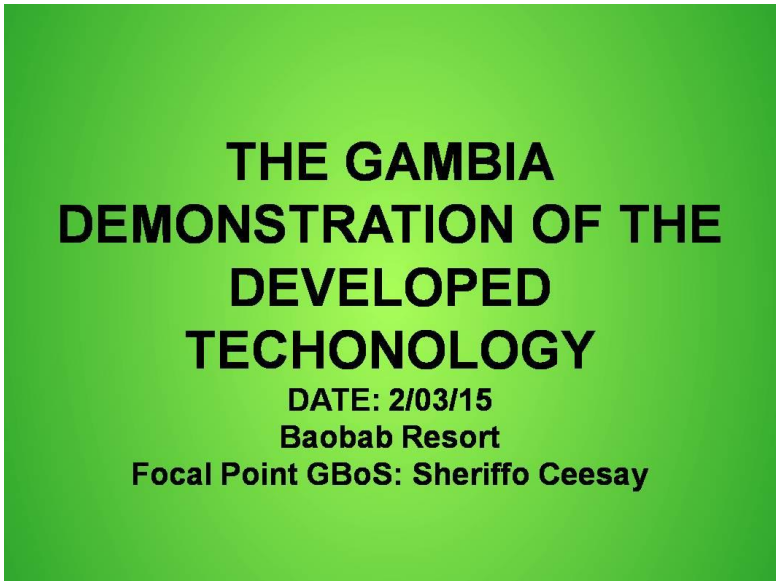
Concern: Ebrima Bah - Participant

Mr. Bah expressed his happiness that we have a vibrant, young skill set available for local technology production. His concern is about cost for many departments or institutions.

Answer: Mr. Kebbeh

Mr. Kebbeh explained that the research, determination of need and identifying a solution is always the most expensive portion of such projects. Storage and infrastructure could also be a bit expensive, depending on the scale of deployment required. The institution must strike a balance between internal infrastructure solutions, and outsourcing.

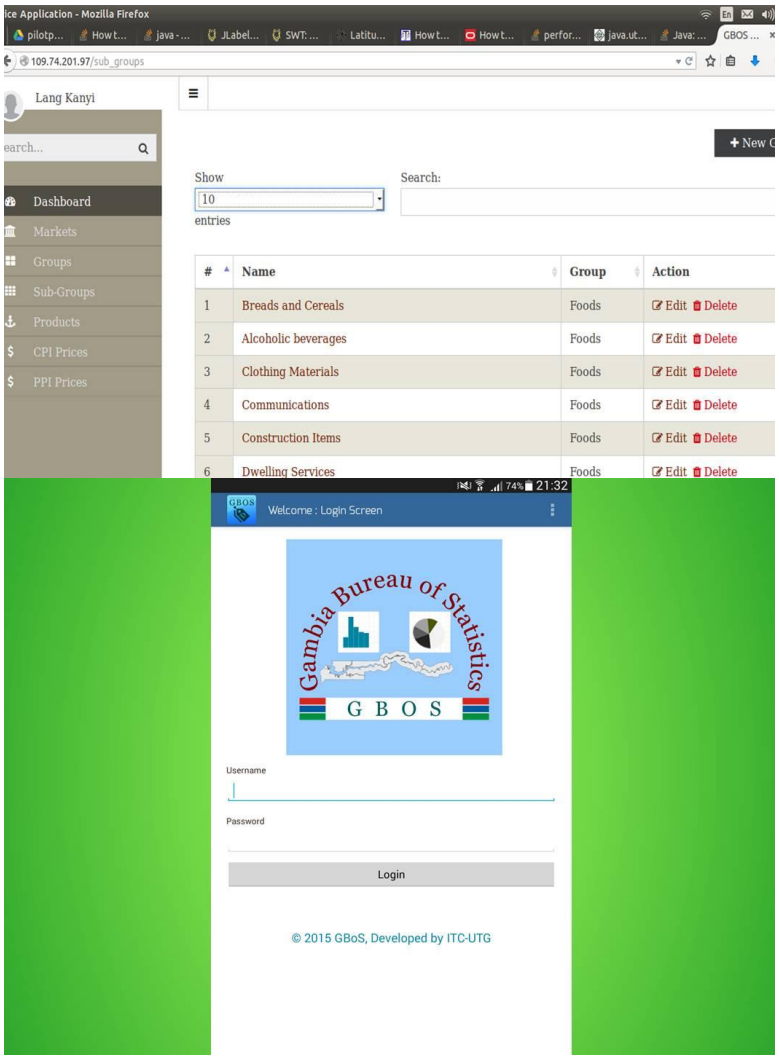
APPENDIX C: Presentation by Sheriffo Ceesay



Architecture of Data Collection App

Architecture of The App

Part 1 : Collection
Part 2 : Storage and Analysis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entries
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2 Alcoholic beverages Foods Edit Delete
3 Clothing Materials Foods Edit Delete
4 Communications Foods Edit Delete
5 Construction Items Foods Edit Delete
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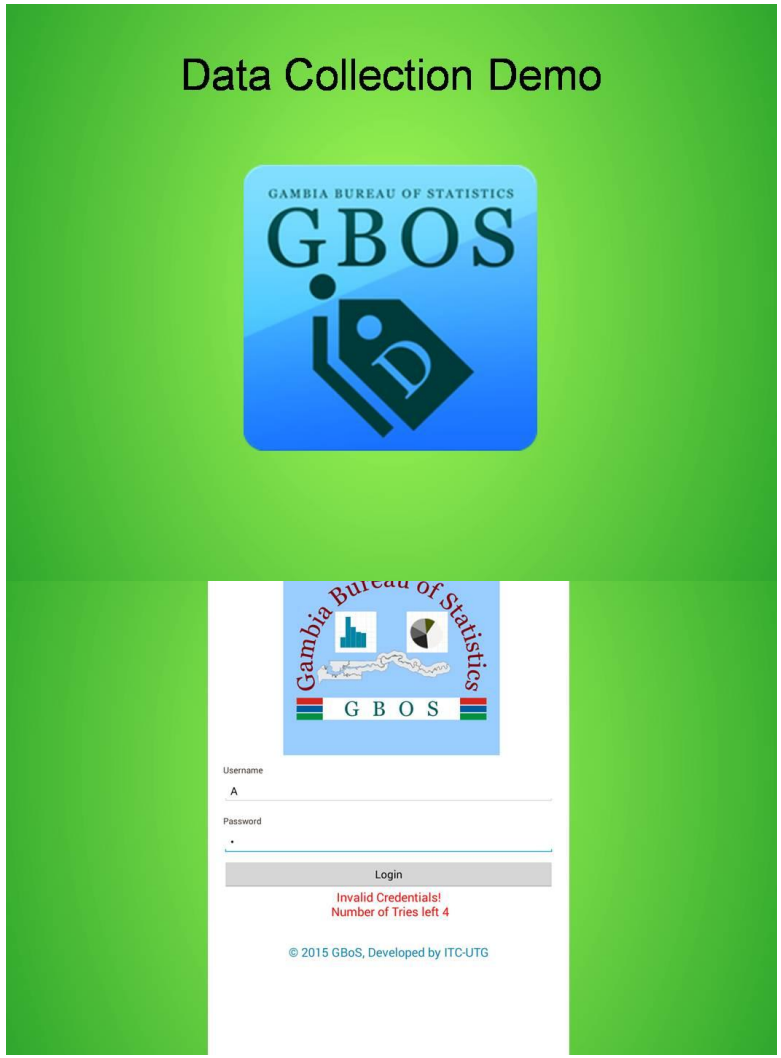
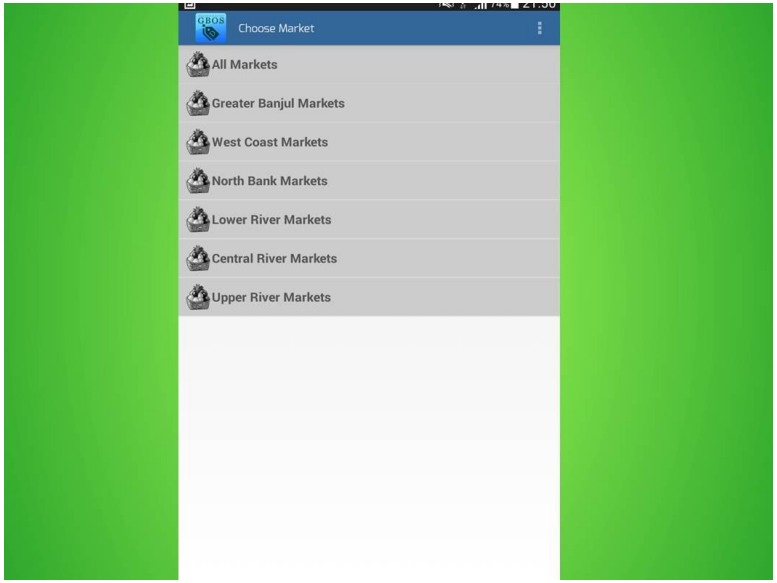
Welcome : Login Screen
Gambia Bureau of Statistics
G B O S
Username
Password
Login
© 2015 GBoS, Developed by ITC-UTG


Data Collection Demo
GAMBIA BUREAU OF STATISTICS
GBOS
Gambia Bureau of Statistics
G B O S
Username
A
Password
Login
Invalid Credentials!
Number of Tries left 4
© 2015 GBoS, Developed by ITC-UTG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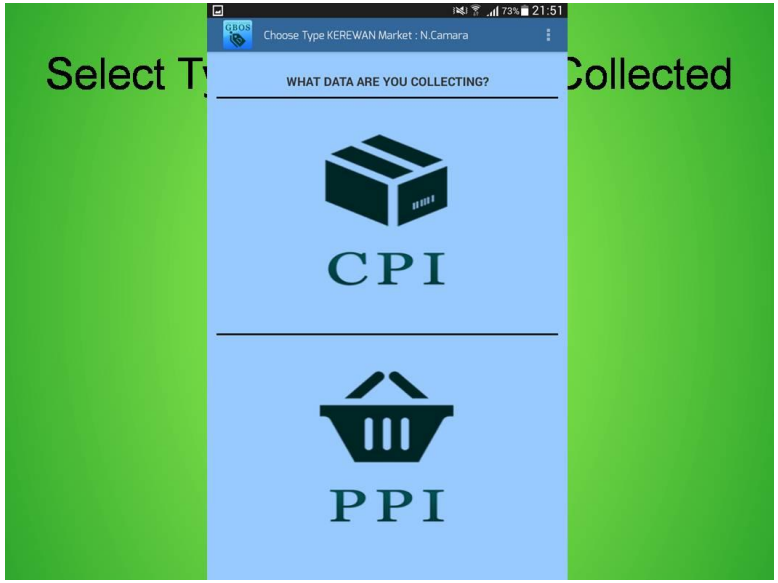
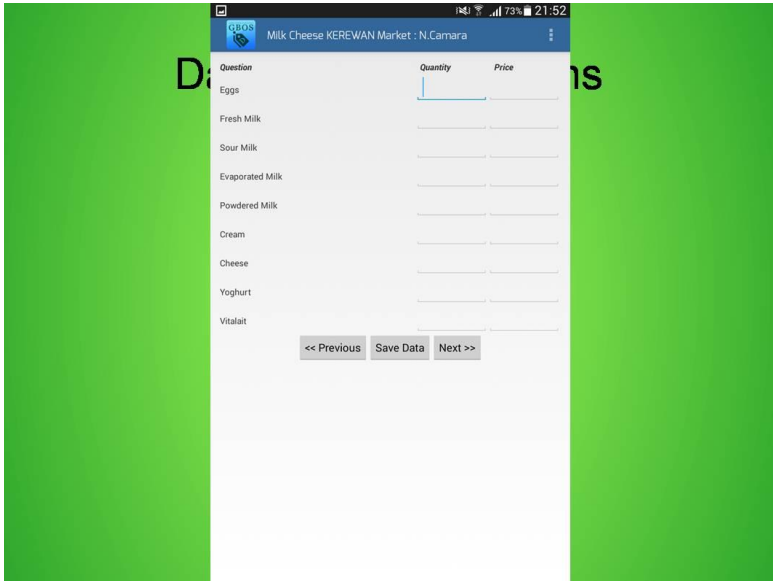
Greater Banjul Markets
West Coast Markets
North Bank Markets
Lower River Markets
Central River Markets
Upper River Markets


Choose Type KEREWAN Market : N.Camara
WHAT DATA ARE YOU COLLECTING?
CPI
PPI


Milk Cheese KEREWAN Market : N.Camara
Question
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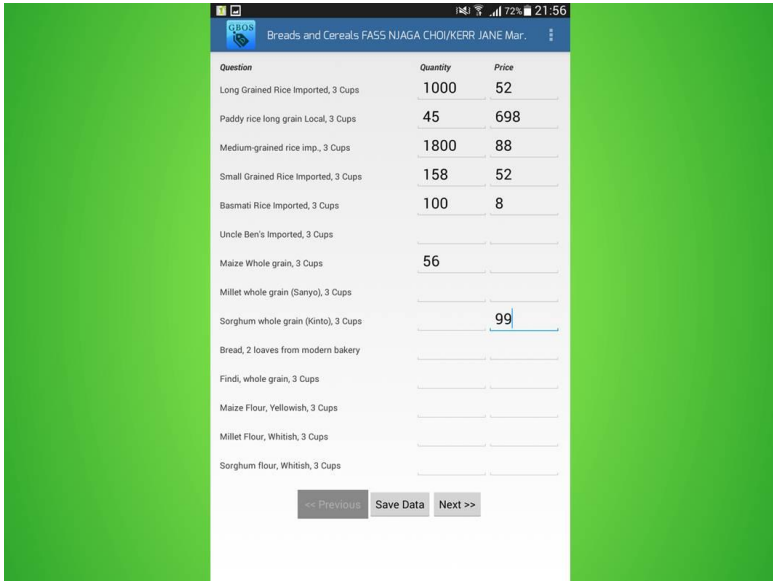
Breads and Cereals FASS NJAGA CHOI/KERR JANE Mar.
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Paddy rice long grain Local, 3 Cups 45 698
Medium-grained rice imp., 3 Cups 1800 88
Small Grained Rice Imported, 3 Cups 158 52
Basmati Rice Imported, 3 Cups 100 8
Uncle Ben's Imported, 3 Cups
Maize Whole grain, 3 Cups 56
Millet whole grain (Sanyo), 3 Cups
Sorghum whole grain (Kinto), 3 Cups 99
Bread, 2 loaves from modern bakery
Findi, whole grain, 3 Cups
Maize Flour, Yellowish, 3 Cups
Millet Flour, Whitish, 3 Cups
Sorghum flour, Whitish, 3 Cups
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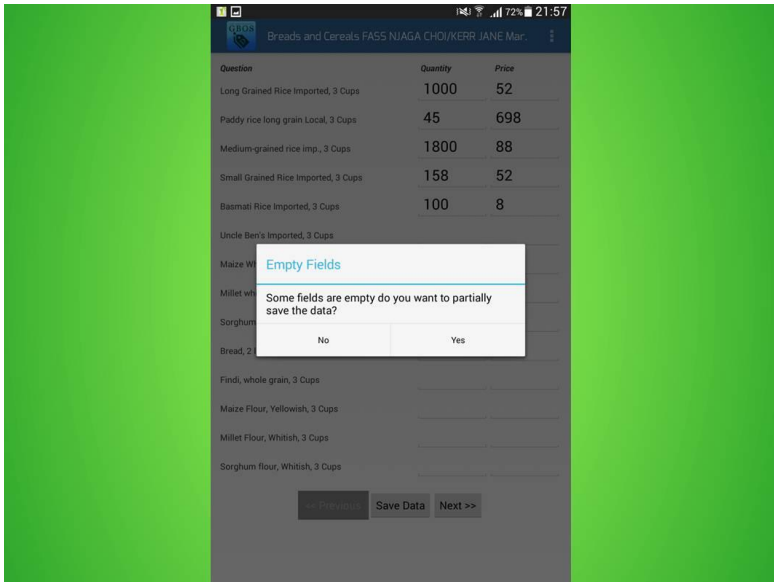
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Breads and Cereals FASS NJAGA CHOI/KERR JANE Mar.
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Basmati Rice Imported, 3 Cups
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Uncle Ben's Imported, 3 Cups
Empty Fields
Some fields are empty do you want to partially save the data?
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Maize Flour, Yellowish, 3 Cups
Millet Flour, Whitish, 3 Cups
Sorghum flour, Whitish, 3 Cups
Save Data
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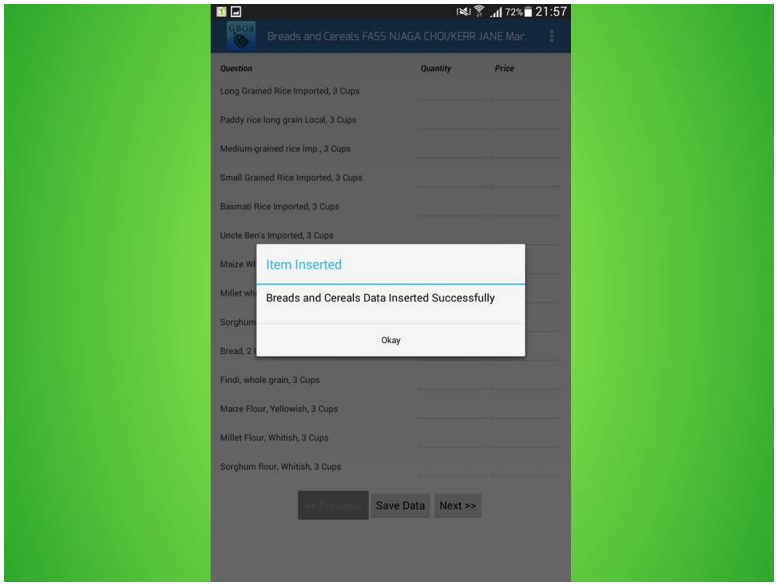
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Breads and Cereals Data Inserted Successfully
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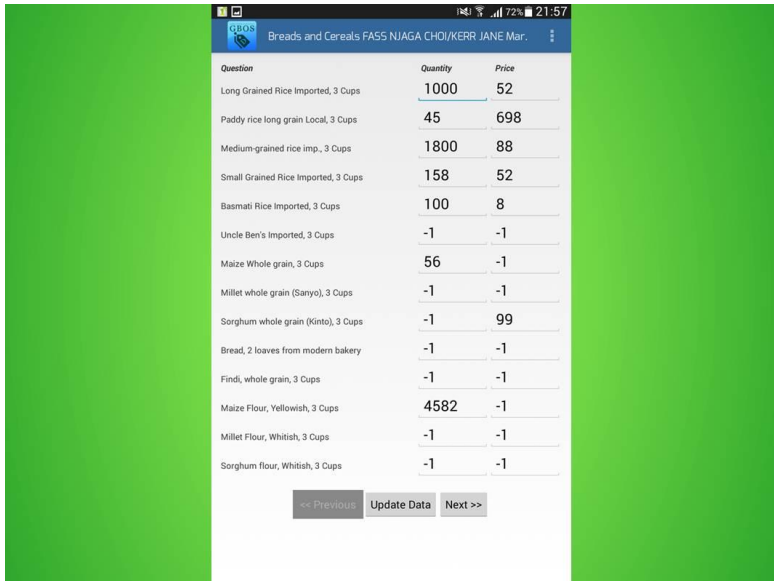
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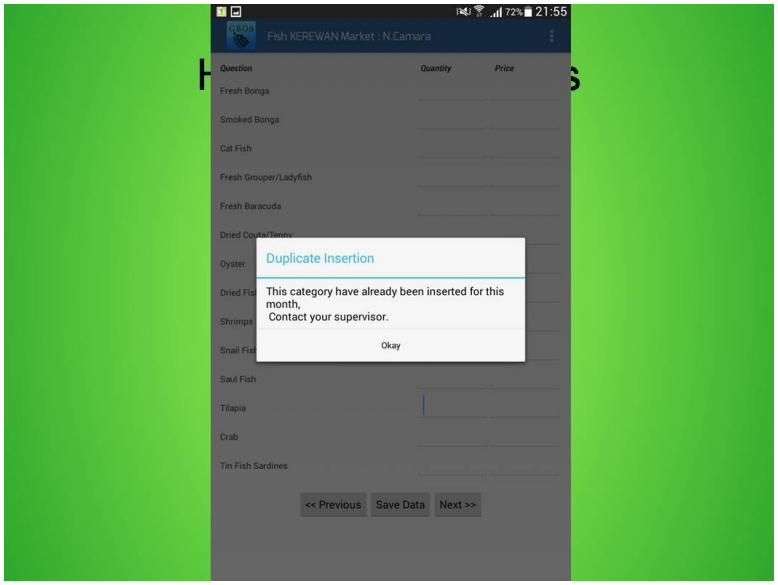
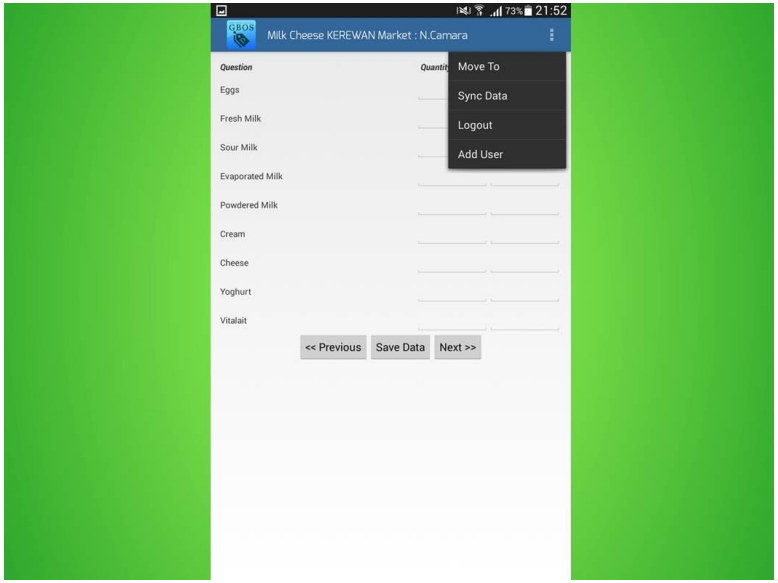
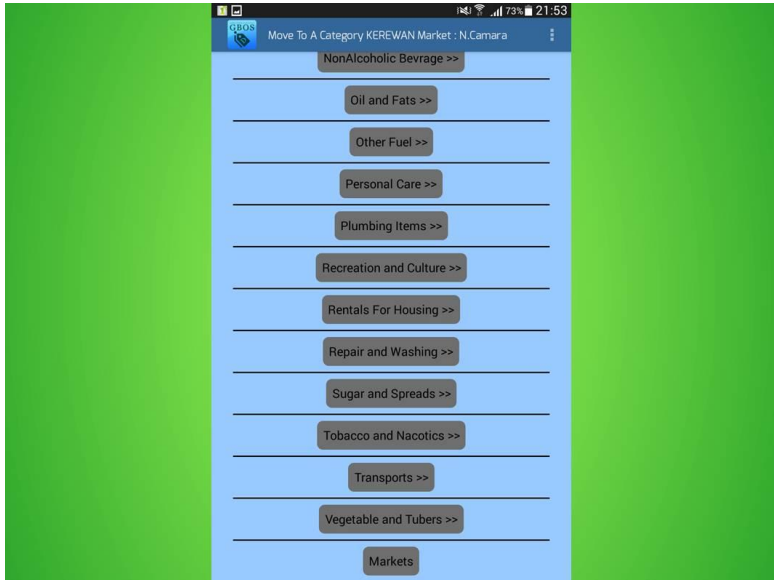
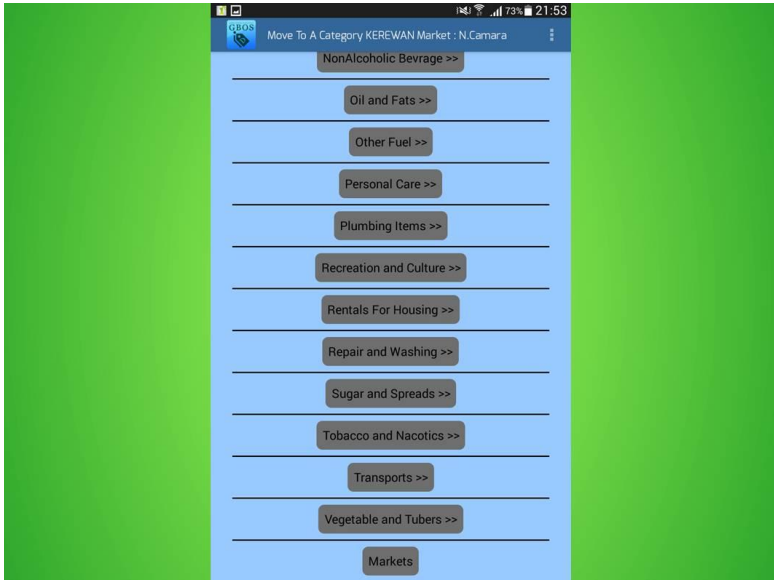
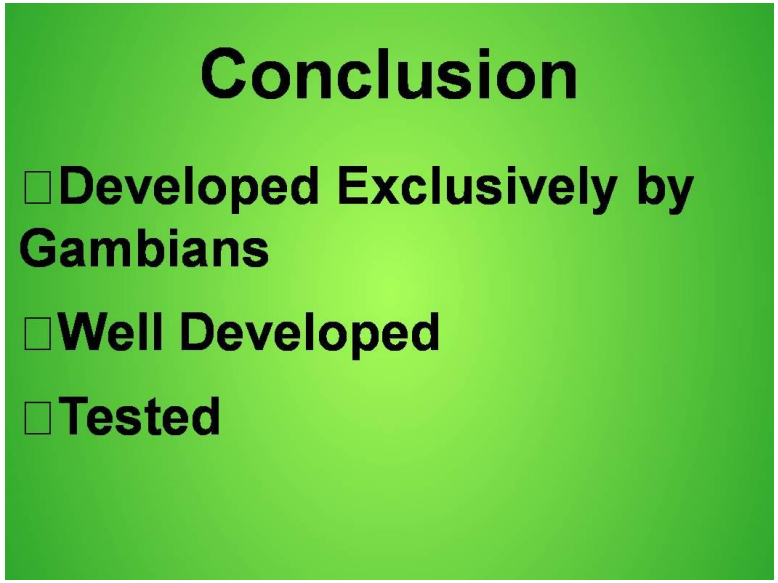
100
8
Uncle Ben's Imported, 3 Cups
-1
-1
Maize Whole grain, 3 Cups
56
-1
Millet whole grain (Sanyo), 3 Cups
-1
-1
Sorghum whole grain (Kinto), 3 Cups
-1
99
Bread, 2 loaves from modern bakery
-1
-1
Findi, whole grain, 3 Cups
-1
-1
Maize Flour, Yellowish, 3 Cups
4582
-1
Millet Flour, Whitish, 3 Cups
-1
-1
Sorghum flour, Whitish, 3 Cups
-1
-1
<< Previous
Update Data
Next >>


21:55
Fish KEREWAN Market : N.Camara
Question
Quantity
Price
Fresh Bonga
Smoked Bonga
Cat Fish
Fresh Grouper/Ladyfish
Fresh Baracuda
Oyster
Duplicate Insertion
This category have already been inserted for this month,
Contact your supervisor.
Okay
Saul Fish
Tilapia
Crab
Tin Fish Sardines
<< Previous
Save Data
Next >>


21:52
Milk Cheese KEREWAN Market : N.Camara
Question
Move To
Sync Data
Logout
Add User
Eggs
Fresh Milk
Sour Milk
Evaporated Milk
Powdered Milk
Cream
Cheese
Yoghurt
Vitalait
<< Previous
Save Data
Next >>


21:53
Move To A Category KEREWAN Market : N.Camara
NonAlcoholic Bevrage >>
Oil and Fats >>
Other Fuel >>
Personal Care >>
Plumbing Items >>
Recreation and Culture >>
Rentals For Housing >>
Repair and Washing >>
Sugar and Spreads >>
Tobacco and Nacotics >>
Transports >>
Vegetable and Tubers >>
Markets


21:53
Move To A Category KEREWAN Market : N.Camara
NonAlcoholic Bevrage >>
Oil and Fats >>
Other Fuel >>
Personal Care >>
Plumbing Items >>
Recreation and Culture >>
Rentals For Housing >>
Repair and Washing >>
Sugar and Spreads >>
Tobacco and Nacotics >>
Transports >>
Vegetable and Tubers >>
Markets


Conclusion
Developed Exclusively by Gambians
Well Developed
Tested

APPENDIX D: Presentation by Mbemba Hydara

Pilot Project on the use of Mobile Technology for data Collection in The Gambia

Presentation
by
Mr. Mbemba Hydara
Project Research Analyst

Introduction

- **Project Approach**
- **Accomplishments**
- **Challenges**
- **Way Forward**

Project Objectives

- Improve the capacity of National Statistic Bureau (GBoS)
- Utilize developed mobile data collection software application to generate quality and reliable data.
- Document experiences of enumerators on consumer (CPI) and producer (PPI) price data collection for statistical production.
- Determine the suitability of such data for the compilation of price and production statistics;

Literature Review
Africa Experience on mobile Technology use for Data

Country	Activity	Technology	Outcome
Cape Verde	Population and Housing Census (PHC)	Personal data Assistants (PDAs)	successful
Malawi	Household Surveys	Personal data Assistants (PDAs)	Successful
Sao tome and Principe	Population and Housing Census (PHC)	Personal data Assistants (PDAs)	Successful
Senegal	Census	Personal data Assistants (PDAs)	Work in progress
Kenya	Monitoring MDG's Achievements	Software Application	Successful

Project Approach

Systematic Development Approach

Project Approach

Phase	Gates	Status
Project Initiation	Phase # 1	Completed
Project Planning	Phase 2	Completed
Project Execution	Phase 3	In Progress
Project Closure	Phase 4	Pending

Systematic Approach

- Concept
- Feasibility Analysis
- Design
- Implementation
- Testing
- Deployment
- Maintenance

Detail Approach

- Project scoping, options, and technology
- Data generation and Analysis
- Detailed design and planning
- Development and Documentation
- Configuration and Testing
- Deployment - Field testing
- Project Closure

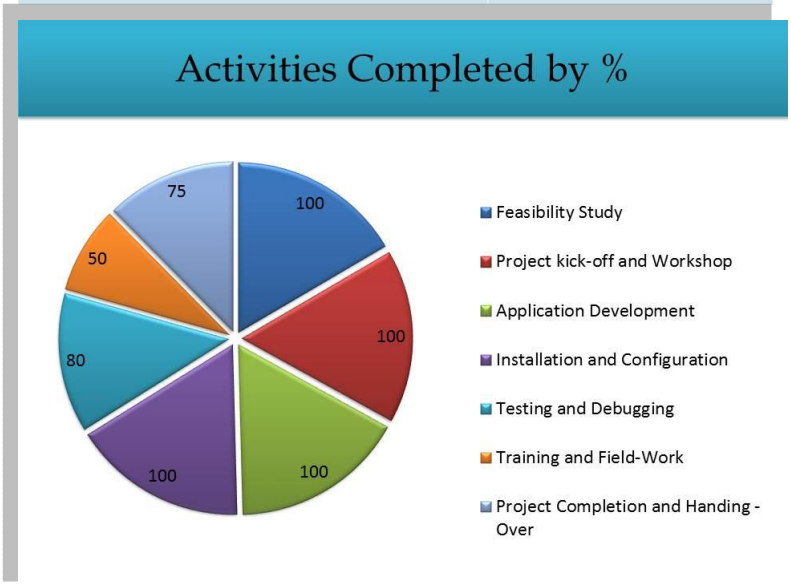
Survey on the Gambia Experience

Organisation	Activity	Technology	Challenges
Catholic Relieve Service (CRS)	Bed Net Distribution exercise	Android on Apple Platform	Electricity
NaNa and Health Ministry Gambia	Health impact baseline survey	Android	Network down time
World Food Programme (WFP)	Protracted Relieve and Recovery operation assessment	Device PDA	Network downtime and Electricity
Agriculture Planning and other Agencies	Online Farmer registration	RIG Mobile Phones	Network connectivity

Key Accomplishments to date

- Study on the feasibility of project completed
- Project kick-off workshop completed
- Software application developed within timeline
- Installation and configuration of hard and software completed
- Testing of developed Application completed
- Issues escalated successfully fixed
- Fieldwork to test application live into the markets due

Activity	Status (%)
Feasibility Study	Completed 100%
Project kick-off workshop	Completed 100%
Application Development	Completed 100%
Installation and Configuration	Completed 100%
Testing and Debugging	Completed 80%
National Training workshop and Field work Due	Completed 50%
Project completion and Handing-over	Completed 75%



Challenges

- Due to limited time and budget the following s are the challenges;
  - Timely mobilisation of required resources
  - Scope of work more than expected
  - Completing functional testing of developed Application within the timeline
  - Managing operational risks

Way Forward

- We therefore provide recommendations on solutions for any future work. These includes,
- Recommended Strategies for enhanced connectivity
- Robust security and disaster recovery
- Scalability for the developed application

Details will be covered on the Technology part of the next Presentation

Conclusion

- In spite of the challenges, the Pilot project has been successfully implemented.
- All major deliverables accomplished within timeline.
- The developed price application met project requirements and standard.
- Hopefully the pending deliverable will be completed by project deadline.

Thank You ?

APPENDIX E: Presentation by Pa Saffiong Kebbeh

Pilot Project on the use of Mobile Technologies for Statistical Data Collection in The Gambia

The Technology Platform & Configuration

Pa Saffiong Kebbeh

Research Consultant

INTRODUCTION

WHAT IS ANDROID?

- A Software platform and operating system for mobile.
- Based on the Linux kernel.
- Android was found way back in 2003.
- It was developed in Palo Alto, California.
- Android was developed by the Andy Rubin, Rich Miner, Nick Sears and Chris White.
- Android was purchased by GOOGLE in AUGUST,2005 for 50 million $. & incorporated in 2005

Introduction Cont.

- Anroid is a software cluster for mobile devices that includes an operating system OS, key application and middleware.
- About the design, the kernel of Anroid is based on Linux kernel and further enhanced by Google

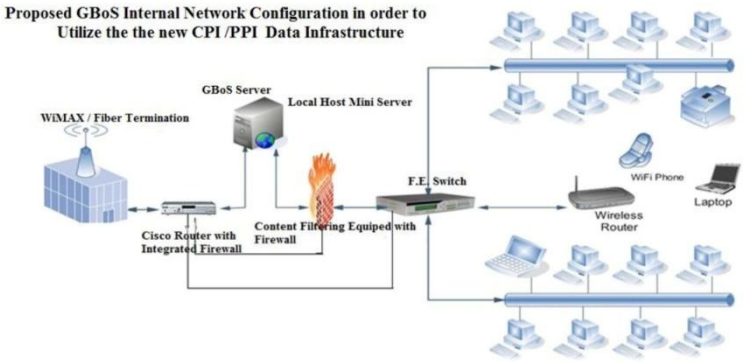
Platform

- Anroid is not a single piece of hardware, it's a complete end – to - end software platform that can be adapted to work on any number or hardware configuration.
- Everything is there, from the boot loader all the way to the application.

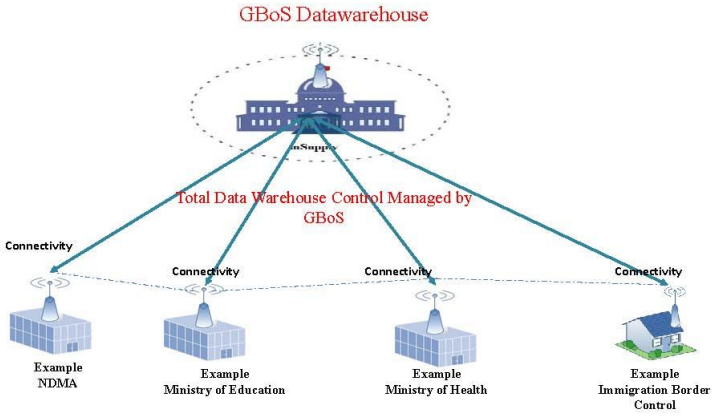
THE APPLICATION

- The application supports wireless communication using:-
  - 3G Networks
  - 4G Networks
  - 802.11 Wi-Fi Networks
  - Bluetooth Connectivity
- Android is a multi-process system, in which each application (and parts of the system) runs in its own process.

Proposed GBoS Data Infrastructure Setup



Possible Future Extension of Mobile Data Collection for other Sectors



Critical Functions Considered in Deploying the APP / Data Infrastructure

- Authentication – validates that the data was sent from the sender.
- Access control – limiting unauthorized users from accessing the network.
- Confidentiality – preventing the data to be read or copied as the data is being transported.
- Data Integrity – ensuring that the data has not been altered

Quality of Service

- We guarantee that the application we developed will provide facilities to monitor, control data collection errors with minimum impact to the quality of your services
- The system we deployed is of high capacity and fault-tolerant, and will have efficient management functions that can deliver quality service for the purpose inteded.
- Your application is designed for 99.99% availability and a grade of service (GOS) of 99%.
- We plan to provide the most reliable and efficient network solution for the application by minimizing outages due to either equipment failures or unavailability of network resources.

Thank You

APPENDIX F: MINUTES OF PROJECT TEAM PROCEEDING

SUMMARY OF MINUTES OF ITC RESEARCH GROUP MEETINGS ON THE PILOT PROJECT FROM 03 DEC 2014 TO 17 MARCH 2015

PROJECT INITIATION AND PLANING PHASE
01st Meeting

ITC/UTG Research Steering Committee held the above meeting on Wednesday 03rd of December 2014 at UTG –MDI Campus Kanifing. The meeting convened at 5.00pm chaired by project coordinator Dr Momodou Jain.

1. PRESENT AT MEETING: Steering Committee Members

Dr. Momodou Jain, Seffiong Kebbeh, Mbemba Hydara and Sheriffo Ceesay

MEETING AGENDA: ***Pilot Project Planning and Management***

2. ISSUES TABLED:

- Funds transfer from GBoS to ITC/UTG Research group
- Project Budget
- Project Organisation
- Office space
- Recruitment of financial consultant

3. ISSUES/DECISIONS:

- Project focal point Sheriffo Ceesay briefed steering committee about project preparations. He urged the committee to begin discussion with the budget. This was adopted.
- Saffiong raised a motion on the opening of TRI project account. The motion was supported by members and adopted.
- Mbemba raised the need to secure office space to administer project activities. This was considered but kept in view for further discussion in the next meeting.
- In order to ensure quality and standard of the Project, appointing a financial consultant was recommended and detail discussion on the matter was scheduled for the next meeting.
- Following discussions on the matter, the Committee agreed on the initial budget estimates and project organisation.
- It was agreed that the oversight management of the entire project shall be the responsibility of the four (4) man steering committee.

4. ACTION TO BE TAKEN:

The committee tasked Saffiong and Mbemba to finalise Account opening with the Bank.

5. ADJOURMENT:

The next meeting was scheduled to take place on December 04, 2014 at the University of the Gambia Faculty of Business - Kanifing 5.00pm.

6. **CLOSED:** The meeting closed at 7.45 pm

02nd Meeting

ITC Research Steering Committee meeting was held on 04 of December 2014 at UTG Faculty of Business - Kanifing. The meeting convened at 5.00pm chaired by Saffiong kebbeh.

7. PRESENT AT MEETING: Steering Committee Members

Coordinator Dr Momodou Jain, Saffiong Kebbeh, Mbemba Hydara and Sheriffo Ceesay

MINUTES COPIES SENT TO: Steering Committee members

- Apologies : Sheriffo apologised for being late
- Minutes of the last meeting: Approved as correct records of proceedings.

- **MEETING AGENDA:** Continuation of previous meeting agenda items and feed-back on assigned tasks.

8. ISSUES TABLED:

- Briefs on project account opening with the Bank
- Conference visit to Tunis by Dr. Jain and Sheriffo
- Identification of office space and Financial Accountant
- Budget on the Baseline survey
- Detail budget review

ISSUES/DECISIONS:

- Saffiong gave detail briefs on account opening confirming completion of all required transaction with the bank including signatories.
- Sheriffo announced a conference on pilot project he is to attend with Dr Jain in Tunis.
- The Project steering Committee assigned Saffiong and Mbemba to proceed with project activities.
- Sheriffo raise discussion on the budget preparation for the pre-workshop survey.
- Decision on the matter was to focus on the following;
    - Purchase of data cards for the software engineers
    - Contacts should be established with relevant institutions that have use mobile technology for data collections in the Gambia.
    - Training budget for the enumerators
    - Fuel and transportation arrangement
- Sheriffo raised a second motion to review the general budget so as to streamline additional projections. Discussion on this matter was slated for Saturday the 06th December 2014, 5:00pm at MDI Campus.
    - Identification of office space to run project activities was approved
    - Dr. Jain expressed appreciation and optimism in the way and manner project preparations are being done.

9. ACTION TO BE TAKEN:

Steering Committee assigned Seffiong and Mbemba to continue with project activities

10. ADJOURMENT:

The meeting adjourned until Dr. Jain and Sheriffo's return from Tunis.

- **CLOSED:** The meeting closed at 7.35 pm

03rd Meeting

ITC Research Steering Committee meeting was held on Saturday 06th of December 2014 at MDI Campus. The meeting convened at 3.00pm chaired by Saffiong Kebbeh.

11. PRESENT AT MEETING: Steering Committee Members

- Saffiong Kebbeh, Mbemba Hydara and Sheriffo Ceesay

- **MINUTES COPIES SENT TO:** Steering Committee members
  - Apologies for absence: Dr. Jain apologised for absence
  - Minutes of the last meeting: Approved as correct records of proceedings.

- **MEETING AGENDA: General Review of the Budget**

12. ISSUES / DECISIONS:

- Having thoroughly reviewed the budget, the steering committee observed the need to change and adjust some sections of the budget. This was carried out without delay.

ACTION TO BE TAKEN:

- The committee tasked Saffiong and Mbemba to oversee all pending issues regarding project kick-off workshop.

13. ADJOURMENT:

The meeting adjourned for December 12th 2014, 5.00pm at MDI campus,

CLOSED: The meeting closed at 5.00 pm

4th Meeting

ITC Research Steering Committee meeting was held on December 12th 2014 at MDI Campus. The meeting convened at 5.00pm chaired by project coordinator Dr Momodou Jain.

14. PRESENT AT MEETING: Steering Committee Members

- Dr Momodou Jain, Saffiong Kebbeh, Mbemba Hydara and Sheriffo Ceesay

- **MINUTES COPIES SENT TO:** Steering Committee members
  - Apologies for absence: no apologies
  - Minutes of the last meeting: Approved as correct records of proceedings.

- **MEETING AGENDA: Briefs on the conduct of the survey**

15. ISSUES TABLED:

- Introduction of enumerators to Dr. Jain and Sheriffo Ceesay
- Briefs on Training of enumerators
- Briefs on contacts with organisations using mobile technologies in the Gambia
- Briefs on enumerator payments for the baseline survey
- Briefs on Office space search
- Briefs on the Identified Financial consultant
- Feedback from Sheriffo and Dr. Jain on the Tunis trip

16. DECISIONS:

- Saffiong call the meeting to order followed by introduction of the baseline survey enumerators to the steering committee. Dr. Jain thanked enumerators for their good work.
- Mbemba briefed the committee on the conduct of the training and the baseline survey. Arrangements to facilitate smooth reception of the enumerator by relevant organisations were arranged in advance.
- Saffiong informed the committee that the tasked assigned to him and Mbemba to search for office space and suitable financial accountant was on-going and hopes are that it would be resolve soon.

17. ACTION TO BE TAKEN:

- The committee tasked Saffiong and Mbemba to continue to look for the office space and Accountant so as to effectively kick-start the project activities.
- Commence work on the report on the *status of the use of mobile technologies for data collection in the Gambia.*
- The steering committee assigned Sheriffo to work with GBoS on the final list of workshop participants and the necessary arrangement.
- Sheriffo also assigned to extend workshop invitation to the stake holders including UTG/ITC Research team

18. ADJOURMENT:

- The meeting adjourned for December 15, 2014 at 5.00pm at MDI Campus.

- **CLOSED:** The meeting closed at 7.45 pm

5th Meeting

ITC Research Steering Committee meeting was held on December 15, 2014 at the MDI Campus. The meeting convened at 5.00pm chaired by project coordinator Dr Momodou Jain.

19. PRESENT AT MEETING: Steering Committee Members

- Dr Momodou Jain, Pa Saffiong Kebbeh, Mbemba Hydara and Sheriffo Ceesay

- **MINUTES COPIES SENT TO:** Steering Committee members
  - Apologies for absence: No apologies
  - Minutes of the last meeting: Approved as correct records of proceedings.

- **MEETING AGENDA:** Administrative , Budget review, and workshop preparation

20. ISSUES TABLED:

- Briefs on Project office space
- Announcement of workshop date
- Raptors to cover proceedings
- Review of remuneration of project participants
- Briefs on the recruitment status of the financial accountant

21. DECISIONS:

- Steering Committee accepted office space negotiated at WARCIP building including utilities for the duration of the project.
- National baseline workshop scheduled to hold on Friday, December 19th 2014 at Baobab resort at 11:00 am.
- To outsource 2 raptors to cover workshop proceedings was recommended
- A thorough review of the budget on remuneration of all project participants was done and all issues therein addressed.
- The financial accountant identified Mr. Ebrima Darboe was accepted by the steering committee based on his credential and professional experience in Finance and Accounting.
- On the nationwide field survey to be held after the workshop, the committee agreed as follows;
    - Budget allocation for 15 days survey period be further discussed with GBoS.
    - Transport arrangement be projected in the allocation

22. ACTION TO BE TAKEN:

- Steering Committee assigned Sheriffo to work with GBoS on workshop arrangements.
- Saffiong and Mbemba assigned to outsource two raptors to cover the proceeding

23. ADJOURMENT:

- The meeting adjourned until further notice.

24. **CLOSED:** Meeting closed at 7:50 pm

6th Meeting

MINUTES OF HANDING-OVER OF FIRST REPORTS OF THE PILOT PROJECT

ITC Research Steering Committee formally presented the Reports *on the use of mobile technologies for data collection in the Gambia and Workshop proceeding*s to Statistician General Nyakassi Sanyang at GBOs Head Office in knifing on 07th of January 2015.

PRESENT AT MEETING:

- Nyakassi Sanyang - Statistician General
- Momodou Lamin Fadia : GBoS Director of IT
- Dr Momodou Jain - ITC/UTG Pilot project coordinator
- Sheriffo Ceesay - Focal Point GBoS
- Saffiong Kebbeh Research team member
- Mbemba Hydara Research team member

AGENDA: FORMAL HANDING-OVER OF PROJECT REPORTS

25. ISSUES TABLED:

- Presentation of the reports to the Statistician General

AOB: Review of Budget allocation for the nationwide field Survey

26. OPENING REMARKS:

The meeting convened with formal introduction of ITC/UTG research team and detail briefing on the progress of the Project.

Dr, Jain who chaired the meeting introduced the purpose of the meeting; that he called on the SG to formally hand-over reports on the first component of the project deliverables for onward delivery to project sponsor as specified in the contract agreement.

The *Status Report on the use of Mobile Technologies in The Gambia and Workshop proceeding in triplicate copies together with a CD* were handed to the statistician General Mr. Nyakassi Sanyang for review and onward delivery to UNECA.

On his part, SG Sanyang, thanked ITC-UTG Research team for the effort and expressed satisfaction on the quality of the reports.

AOB:

- On the issue of tablet procurement, SG Sanyang informed the team about the delay and error on their procurement forms. However, he gave optimism that the problem will be resolve soon.
- Dr. Jain commented on the survey budget with a gentle request for a review.
- Saffiong Kebbeh and Mbemba Hydara supported Dr. Jain's proposal and requested same on the survey budget.

27. DECISIONS

After a quick discussion and review on the budget, both parties agreed on the final projections.

CLOSED: The meeting started at 10:00 am and closed at 11.45 am

Project Execution phase

7th Meeting

ITC Research Steering Committee meeting was held on January 27 2015 chaired by project coordinator Dr. Momodou Jain at project office WACIIP Building on Kairaba Avenue.

PRESENT AT MEETING:

- Dr Momodou Jain - ITC/UTG Pilot project coordinator
- Sheriffo Ceesay - Focal Point GBoS
- Saffiong Kebbeh
- Mbemba Hydara
- Buba Bojang - Software Engineer
- Lamin Saidy - Developer
- Wuday Colley - Testing team member
- Malick Jobe - Testing team member
- Abubacarr Jallow - Testing team member

AGENDA: Pre-Testing Demo and Training workshop

28. ISSUES/DECISION

- Meeting with the Testing team at project office for the internal application testing.
- Briefs on the meeting held with Statistician General on GBoS readiness on the testing tools such as tablets and the training workshop.
- Delivery of tablets expected on the 31st January 2015 but yet to be finalised.
- Given potential delay in delivery of tablets, the steering committee decided that 30th be the internal testing, 03rd January be the application demo for GBoS and the schedule training date be move to 05th of January 2015.

29. **CLOSED:** The meeting was adjourned for the 30th January 2015

8th Meeting

ITC Research Steering Committee meeting was held on January 30, 2015 at the project office on Kairaba Avenue chaired by Dr. Momodou Jain.

PRESENT AT MEETING:

- Dr Momodou Jain - ITC/UTG Pilot project coordinator
- Saffiong Kebbeh
- Mbemba Hydara
- Buba Bojang - Software Engineer
- Lamin Saidy - Developer
- Wuday Colley - Testing team member
- Malick Jobe - Testing team member

AGENDA: Meeting on the Internal Testing Exercise

30. ISSUES/DECISIONS

- Decision reached on payments of the testing team
- The manner to conduct the testing exercise was agreed with the team
- Logistics requirement for the internal testing concluded
- Given the delay in the delivery of GBoS tablets, the steering committee decided to purchase four (4) tablets to carry out internal testing of the developed application to avoid further delay on the Training deadline.

31. CLOSED: The meeting was adjourned for 05 February 2015.

9th Meeting

ITC Research Steering Committee held an application Demo with GBoS on 05 February 2015 at. GBoS head Office Kanifing Estate.

PRESENT AT MEETING:

- Statistician General - Nyakassi Sanyang
- Director ICT GBoS - Momodou Lamin Fadia
- Focal Point GBoS - Sheriffo Ceesay
- Director GBoS Price Research - Ousman Dibba
- GBoS Price researcher - Fatou Darboe
- ITC-UTG Pilot Project Coordinator - Dr. Momodou Jain
- ITC-UTG Research Team - Saffiong Kebbeh
- ITC-UTG Research Team - Mbemba Hydara
- ITC-UTG Software Engineer - Buba Bojang
- ITC-UTG Developer - Lamin Saidy

AGENDA: DEMO OF THE DEVELOPED APPLICATION WITH GBoS

32. ISSUES/DECISIONS

- Dr. Jain called the meeting to order and gave an introductory statement on the purpose of the meeting.
- That his team call on GBoS to present a demo of the developed application and to identify gaps before the Training workshop and live field survey.
- A detail demo on the Consumer Price Index (CPI) was presented by Sheriffo Ceesay while Producer Price Index (PPI) by Buba Bojang.
- Observation and suggestions from the price director and staff were noted for further work.
- On the margin of the demo, a brief consultative meeting was convened with GBoS with a view to sound modalities on the Training Workshop.

33. CLOSED: The meeting was adjourned until after Training and Field Survey.

PROJECT CLOSE-OUT AND REVIEW PHASES

10th Meeting

ITC Research Steering Committee meeting was held at the project office Kairaba Avenue on 17th of March 2015 at 3.00 pm.

PRESENT AT MEETING:

- ITC-UTG Pilot Project Coordinator - Dr. Momodou Jain
- ITC-UTG Research Team - Saffiong Kebbeh

- ITC-UTG Lead Engineer - Sheriffo Ceesay-
- ITC-UTG Research Team - Mbemba Hydara
- ITC-UTG Software Engineer - Buba Bojang
- ITC-UTG Developer - Lamin Saidy

AGENDA: Project Completion

34. ISSUES/ DECISIONS

- Review on the nationwide field survey
- Assessment on Lessons learnt
- Review of all deliverables
- Review of project completion and close-out

CLOSED: The meeting closed at 6.00 pm until further notice.

APPENDIX G: EXCERPT OF PROGRAM TESTING AND DEBUGGING

Sample illustration of a bug/suggestion logged by one of the testers and response by a developer is illustrated below.

[#26] suggestion

Client: ICT-UTG
Project: Price Testing Phase One
Task Type: Task
Severity: Normal
Priority: Normal
Due: Sunday, 08 February 2015
Assigned To: Buba Bojang, Lamin Saidy, Sheriffo Ceesay, Wuday Colley
Created By: Wuday Colley

Description:

If it is possible for you to implement a onetime sinking whereby you enter all the data and save then do the sinking at once, before having to sink category after category. It is a whole lot of work really

Message automatically generated by Clocking IT

http://ictutg.clockingit.com/tasks/view/26

Response From: Sheriffo Ceesay

Wuday you don't need to sync each time you save the data. You are doing this because we want to check if it is going to work on every activity.

What you said is equally possible. Since it is possible to sync at any activity you could collect the whole data then sync it when you are done. This will sync all the unsync data. The above method was very effective and it helped eliminate lot of bugs