



Development of a framework for the strengthening of market information systems in Rwanda

Part of the One UN Funded Project:
*Enhancing National Market's Potential and linkages to EAC and CEPGL
frameworks*

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1. Introduction.

1. 1 Background.

In many respects the Government of Rwanda (GoR) is dedicated to the development of agriculture. In the medium and long-term, the Development Strategy, as enshrined in Economic Development and Poverty Reduction Strategy (EDPRS), National Agriculture Policy (NAP), the Strategic Plan for Agriculture Transformation (SPAT/PSTA) and Vision 2020, aims to transform “agriculture into a productive, high value, market oriented sector.”¹

eSoko is a tool designed to increase accessibility of market prices for government, farmers and traders. The tool enables electronic market prices collection via web, SMS, and a call-in feature called Interactive Voice Recognition. Either by calling in, sending SMS or visiting the esoko website, information consumer whether be a farmer, a trader, a researcher, or member of the public can access the commodity prices for a given market.

The eSoko fundamentally transforms the agribusiness by alleviating the information gaps existing between markets and farmers. Since a typical farmer lives far from the consumer markets and relies on middlemen for delivering his/her produce to the markets, the negotiations between the farmer and the middlemen are skewed in favour of the middlemen because of price information asymmetry. The eSoko Market Information System by making market prices accessible empowers the market-oriented farmer to make informed decisions in the transaction s/he is involved in.

Since its launch earlier this year, eSoko has received recognizable interest from the public despite limited efforts towards public awareness of its existence. In October alone, there were reported over 30,000 price information requests using eSoko' SMS function. Although this number is minimal given the magnitude of the sector, it is noteworthy nonetheless given that no public awareness campaigns have been created.

1. 2 Policy and Data Context

One of the key components of GoR's National Agricultural policy include intensification, regional trade and fair and equitable distribution of benefits. These policy objectives will be achieved through application of modern agricultural technologies, commercialization of agriculture through increased access to markets, and others. eSoko is such a technology developed to ensure equitable distribution by empowering farmers with real up-to-date market price information. Agricultural Market Information System is also another technology employed to ensure exchange of quality data on key parameters such as price of agricultural commodities, volume of production, quality of products, access to market centers (infrastructure, means of transportation, processing capacity, etc).

Intensification being at the center of the agricultural policy, monitoring and evaluation of its performance is critical. The most important measure of agricultural intensification is productivity or yield, which is the measure of quantity of produce per unit area (Mt/ha). A hectare being a spatial measure, one cannot ignore the centrality of spatial data to the national policy. Spatial data requires special treatment mostly explored in the Geographic Information Science (GIS), a hybrid branch of statistics and geography that cares for the nature of spatial data.

As regional trade is also an important component of the national agricultural policy and strategy, its measures also require in-depth review of currency. In the region, there tends to be two parallel exchange rates – the official exchange rate set by the Central Banks and the informal market

¹ Vision 2020. Page 6.

exchange rates. Trends in official exchange rates are much easier to obtain; however, they are not as commonly used in regional trade as their unofficial counterparts. Hence, market dynamics and price trends would not be captured accurately without clear measures of this currency dynamics.

Measuring agriculture intensification entails harnessing the volume of production per given area, referred to as yield or productivity. The unit area in the case of yield is a hectare (ha) and production volume is metric ton (MT). Assuming that production levels can be captured by surveying farmers' harvest, then it would be necessary to know the area harvested. Such measures are not so easy to obtain. Even if the exact area owned by a given farmer from the digitalized National Land Registry is known, inferring such denominator would be counter-productive. Assume a farmer has two hectares of land, upon harvest, an enumerator comes and collects the volume of production, which is 5 MT. An inference is made and the results show that the farmers had 2.5 MT/ha. What may have not been captured in this supposed yield is the possibility that the farmer only planted 1.8 hectares of his field. As a consequence, the yield as per inference is 10% lower than the reality, which is 2.77 MT/ha. Other customs, such as land leasing (*kwatisha*), make yield data spatially complicated.

In Rwanda, there are two distinct market prices given the nature of the markets. At the market place, there is the **asking price** and the **selling price**. The asking price is the initial price stated by the trader to the customer. The selling price is the price the client and the seller agree to after bargaining. This price elasticity is central to the comprehension of market dynamics.

1.3. Objectives and Methodology of this Assessment.

This report provides findings of an intensive analysis of eSoko from the system's perspective and usability perspective. Foundational to the analysis is the understanding of eSoko as potentially future center piece for agricultural trade in Rwanda and the region. Key components are assessed focusing on the existing design and use of eSoko, ideals of eSoko, as well as its potential for growth. In term of growth, we evaluated the possibility of increasing the number of commodities, number of markets (nationally and regionally), and expanding beyond market price information. We also examined the usability of the system and feasibility of electronic trade. Each assessment also contains recommendations.

Our overall approach to the assessment was three-pronged. A survey of existing literature on eSoko and other existing market information systems was conducted. This was followed by a process of understanding the tool from a user-point of view. Various tests mimicking the actions of a user of the system were done and documented. Interviews with market traders and small businesses to gather information on their interactions with the system complimented the tests. Last but not least, interviews with the technical team involved in the development and maintenance of eSoko were conducted to provide technical insight into the tool as well as their plans and wishes for improvement of the system. Combined, all of these information gathering exercises provided us with a holistic picture of the eSoko as a system as well as tool for users.

The report is written with consideration that the majority of its audience are non-technical persons. The report begins with a user-friendly user guide describing the system feature and how they are used, a technical review of the system, as well as an analysis of the Strengths, Weaknesses, Opportunities and Threats. The second section of the report delves into system expansion wide range of commodities and more markets nationally and regionally and increasing the amount of information per commodity. Each component of the assessment is conducted with usability and system architecture in mind. The last two sections address the question of electronic trade and user interfaces. Since electronic trade would be a completely new function in the system, the reporting on it is more of a proposition on this goal can be achieved given local infrastructure and user

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limitations. The assessment of the user interfaces evaluates systematic factors that may be contributing the low use of eSoko. In this regard, instead of looking to increasing awareness of eSoko, we examine some of the practices that have been adopted to facilitate users' interaction with the market information system.

2. eSoko User Guide.

eSoko is a part of the eRwanda Project funded by the World Bank to bridge information gaps in Rwanda's agribusiness. Currently, the eSoko market information system in particular addresses the absence of consistent, reliable and accessible information on prices at the market. The project developers firmly believe that by putting quality market prices in hands of farmers and traders, the middlemen's cut can be curtailed to benefit farmers and traders.

Central to the success of eSoko is access to quality and reliable data. The eSoko system was designed to facilitate data gathering as well as dissemination. The underlying principle is that electronic means would increase timely and cost-effectiveness of access to market prices. One belief is that data collection using electronic means would reduce error and increase efficiency.

Below we provide a review of the eSoko's features, usability, and technical architecture. The report proceeds to provide an overarching Strength, Weakness, Opportunities and Threats. The combination provides a rich platform for a layman to understand the system and at the same time an in-depth assessment of it.

2.1 System Features.

The eSoko market information system is built with overall eight core functions. Together these functions work to ease data collection and dissemination. Noting that data collection and dissemination are the central functions of the system, we will focus on the use of those. However, we will also briefly mention the ancillary modules.

The eSoko contains a *data submission module* designed to facilitate data entry using a web-based interface, a mobile phone application or interactive voice recognition. With the web-based interface, market agents collect data using paper forms, and enter into it the system using a computer. With the mobile phone application, the agent enters the data directly into the system using his/her cell phone via mobile internet, which covers most of Rwanda. The interactive voice recognition system requires calling the automated system which guides the market agent through data collection. Data collection agents visit each market once a week and collect five sample prices per commodity. These prices are aggregate and approved by the market coordinator.

The eSoko also provides a function that enables members of the public to query the market prices. For this, there is a mobile SMS interface, interactive voice recognition and a web interface. For the mobile interface, any user sends a Short Message Service (SMS) to 7656 containing the keyword, "eSoko" plus the name of the market, e.g. "Kimironko" and then the commodity in Kinyarwanda. Shortly after sending the SMS, the sender receives a response with the latest aggregate price or an error saying that s/he has made a mistake. With the interactive voice recognition tool, the user calls the system which guides him/her through finding the market price. Unlike the SMS interface, the web interface requires the user to enter the market codes and the commodity codes. To find these, the user has to click "market and commodity codes" link on the home page.

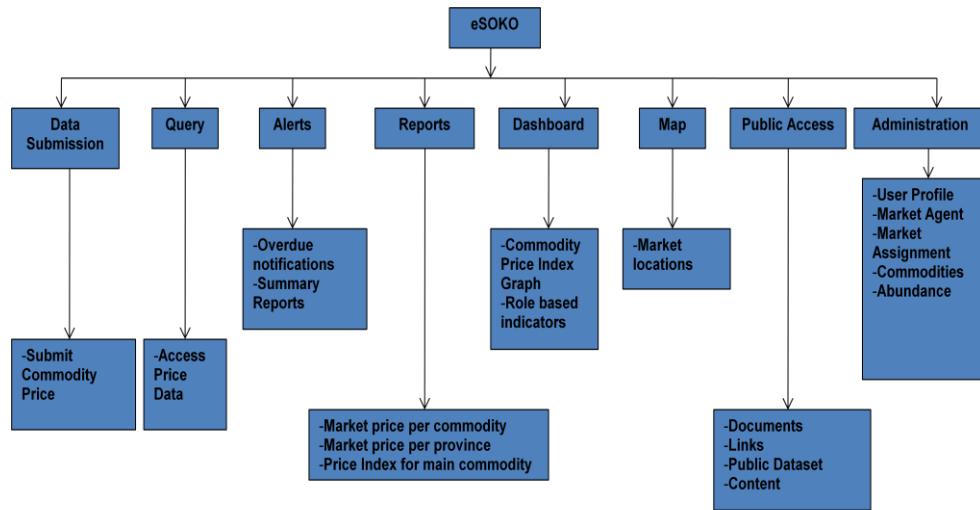


Figure 1: eSoko Modular Diagram²

2. 2 Usability.

The eSoko system was clearly designed for a Rwandan consumer in order to empower purchasing and selling decisions with timely and reliable market price information. Specifically, it was designed for the use of farmers and market traders. However, noting the importance of data collection in the success of the system as well as invaluable reports that it creates, government use of the system is noteworthy. From this point of view, we can assess the usability for the system from the price information consumer point of view as well as the price information provider.

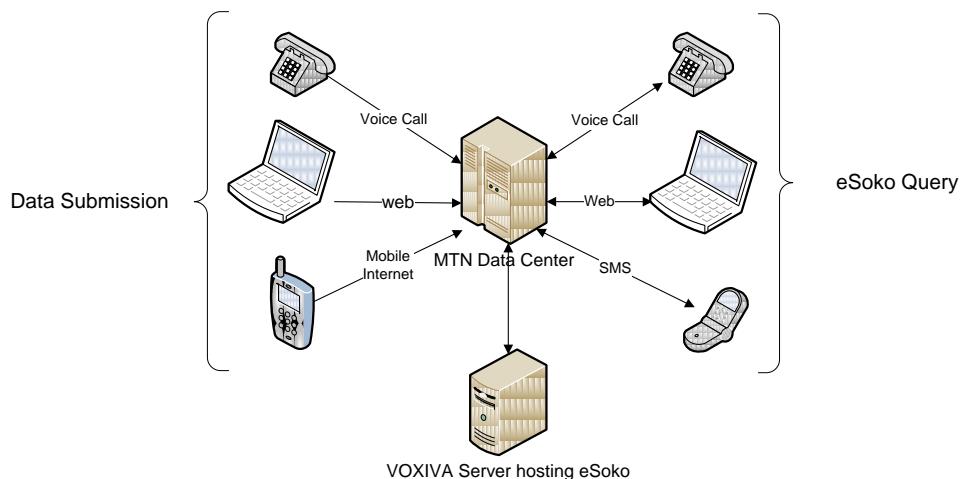


Figure 2: eSoko Information Flows

2.1 Market Information Consumer Usability

The three channels chosen by the system developers, namely SMS, Interactive Voice Recognition and Web sufficiently meet the needs of the Rwandan market. Other mediums that could have been considered are radio and newspapers, which we find not as up to task. The three choices provided by eSoko are almost universally cover Rwandan users and provide convenience of giving the consumers options on when and how often to check the information.

The uses of these channels are however not without challenges. Unlike radio, these channels

² Voxiva. eSoko Application Report. April 2009

require cost per consumption of information. As we all know, sending SMS costs money and so calling the interactive voice recognition tool or the website. There are also a limited number of commodities listed in the eSoko system as well as markets. Without handy information on which these products are, the user is required to guess and each trial is costly. More specifically, the user is required to type the query terms, market name/code and commodity name/code perfectly to avoid incurring extra charges. These shortcomings are discussed in more depth in the user interface section of this report and clear recommendations are made there.

2.2. Market Information Provider Usability.

To provide market information into the system for the purpose of consumption involves gathering the data, submitting the data, and analysing the information. Using electronic web based data entry, data collection and submission are kept as separate processes. However, with the mobile application and the interactive voice recognition tools, data gathering and submission are fused into one step.

While reducing the time lag and increasing the efficiency of the system, the interactive voice recognition and the mobile application are as dependent on the telecommunication penetration. Without mobile phone coverage, these data collection and transmission channels are not useful at all. On the other hand, relying on the market agent to collect on a piece of paper and then submit it to MINAGRI for input creates risk for loss of data and relevance of it, and makes the task more labour intensive.

The eSoko data collection functions are also designed to schedule market visits for market agents as a part of quality assurance. Where markets gather once a week, it makes sense for the agents to make one visit. On the other hand, where the markets gather twice a week or everyday of the week, system flexibility is needed to assure reliability of information on a day to day basis. This is especially important since it is through these markets the largest variety and quantities of commodities are sold.

3. Technical Review.

The eSoko system was designed with multiple data entry and dissemination in mind. The overall architecture of the system is built with a Microsoft SQL 2005 Database and a Java-based middleware built on Voxiva's Mobile Solution Framework to handle J2ME for mobile application for data gathering, .NET for web interface, an Interactive Voice Recognition technology and an SMS handling application. Below are general diagram on the architecture of the system with system user access as well as user profiles.

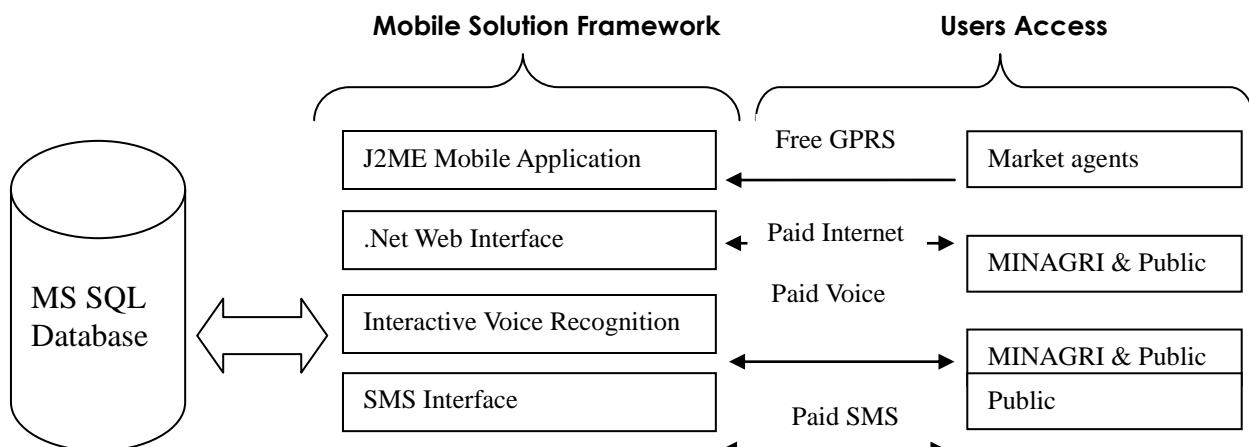


Figure 2: eSoko System Architecture

Actor	Role	Authentication	Access Level	Access Mode	Main Use Case
Public	Guest	No	•Public Dataset •Price Information	Web, IVR, SMS	•Access price information
Farmer	Guest	No	•Public Dataset •Price Information	Web, IVR, SMS	•Access price information
Trader	Guest	No	•Public Dataset •Price Information	Web, IVR, SMS	•Access Price Information
Market Agent	Market Agent	Yes	•Designated Markets	Web, IVR, J2ME	•Report Price Information
Market Coordinator	Market Coordinator	Yes	•All Market Data	Web	•Review agent submissions •Review market data •Publish Price Information
Project Partner/ Collaborator	Partner	Yes	•Custom Dataset •Custom Report	Web	•Access market data for organizational needs
Central Administrator	Administrator	Yes	•Administration	Web	•Manage all system & technical administration activities

Figure 3: Users and Goals³

The overall system is hosted in the MTN Datacenter on Voxiva servers. Voxiva declined to provide server specifications as well as information related to the bandwidth dedication for the system. A formal request for that information will have to be made, which will be reviewed by Voxiva USA, in order to obtain it. The government of Rwanda plans to move the application to the National Data Center once complete. Latest news suggests that the National Data Center will be complete in mid 2011. However it is not clear how soon eSoko will be able to migrate.

³ Voxiva. eSoko Application Report. April 2009

Overall the Mobile Solution Framework provides a varying and easy access to the system. Users do not have to directly interact with the server in its raw form. J2ME is a flexible platform for mobile device applications enabling easy deployment. Almost every Java-enable devices are able to handle such applications. Built by Microsoft and widely adopted, the .Net framework is also a standard for web applications. Both SMS and Interactive Voice Recognition capabilities of the Mobile Solution provide diverse means for on-request dissemination of market price information.

4. SWOT Analysis.

4.1 Strengths.

Overall the strength of eSoko as a concept is its pioneering, support and demand in the market place. Government initiatives to increase the use of it via distribution of mobile devices, as well as MTN's willing to eliminate the data cost of using the mobile application for data collection are strong indications of support both in the private and public sector

The eSoko is built on good fundamentals. The price information is in high demand in Rwanda and the infrastructure is in good position to support the demand. Even with recognized very little public awareness campaigns, last month the system generated over 30,000 price information requests via SMS. Recognizing the continental demand for price information, eSoko in Rwanda was replicated in various countries by Tradenet, including Benin, Burkina Faso, Cameroon, Ghana, Ivory Coast, Madagascar, Mali, Togo and Sudan. The infrastructure in Rwanda is particularly in good position to support this type of tool. The mobile coverage is reported to be exceeding 90% and mobile usership is growing at an unprecedented rate.

Another key strengths of eSoko is its integration into regional agricultural data flows. Data collected for eSoko is also important for the functioning of regional Market Information Systems (see Appendix 6 for more information on Regional MIS). Regional Agriculture Trade Network, a market information system of East African Grain Council, uses the information collected for the use of eSoko. The same applies for COMESA Food and Agricultural Marketing Information System (FAMIS). The data collected by market agents are transmitted to RATIN and FAMIS via an online data submission forms.

2.2 Weaknesses.

Although demonstrating a lot of potential for growth, there remains systematic concerns with eSoko's growth at the market place. Without built-in self-evaluation mechanisms and/or use of them, it is not clear that the system is agile enough to adapt to user needs. For instance the notion of that the price of using eSoko is problematic has come to the attention of the project after its implementation. However, such information as perception of the public on the reliability of the price information as well as proportion of successful numbers of queries to total number of queries remains uncaptured. These are major concerns to do with self-evaluation for the purpose of improvement.

In spite of the system developers' view of the value of the data currently present in eSoko, in our survey of the pricing we found opposing views. In our meeting with the system developers, we were told that the data collected was accurate and reliable. According to the developers, the market agents often reported the same prices for each commodity from the sample of three vendors they surveyed. Our assessment found it rare that prices were consistent at all. In fact, we found that pricing varied based on the vendors' produce supplier and freshness, as well as placement of the vendor in the market and various bargaining factors. With a little bargaining, almost every vendor was willing to lower the initial asking price. As a source of pricing information, when we asked the market traders of eSoko, they told us that their ability to get good margins from buyers would diminish if people came to the market with knowledge of the prices.

The unreliability of aggregated market prices is not helped by low frequency of data collection. It is appropriate to collect data once a week in a market that only gather once a week. On the other hand in markets where the frequency of market days are more than once a week, the overall

accuracy and reliability of the price information diminishes. In Kigali, we found prices listed to be at times a week old. In these instances, the listed prices could not be treated as reliable for consumers, which may cause it to be a deterrent.

In our assessment of the system, we followed the example query provided by eSoko brochure. The example clearly illustrated using a cell phone to SMS "Igiciro Kimironko umuceri" [price Kimironko market rice] to 7656. That message returned an error that the commodity we were seeking did not exist in the system. We repeated the same attempt three times to realize that that brochure had incorrectly spelled the commodity, "umuceri," for which the right spellings were, "Umuceli-RW," "Umuceli-Tz" or "Umuceli-Asia." It is not clear whether these erroneous attempts contributed to the figure of 33,000 SMS queries per month, which has been interpreted as "33,000 users." Failure to distinguish failed and successful queries are loss of opportunities to improve the system and its establishment in the market place.

In summary, we consider the key weakness of eSoko to be absence of feedback mechanisms that inform decision-making with regards to the systems successes and opportunities for growth. Although impressive at the early stages of the project, it is unclear whether the price information in eSoko is reflective of the reality in the market and whether the intended consumers find it reliable. We were not able to gain access to the system in order to conduct analysis on its use patterns; however, the fact that it is not readily available to the decision makers demonstrates lack of strategic information in decision making.

4.3 Opportunities.

At such a nascent stage of the system and with its achievements thus far, it is without saying that there are still many opportunities to explore. In particular, we can consider expansion of the eSoko to a larger audience and to provide price information on larger breadth of commodities and markets. Although we explore these opportunities in this section, in-depth reviews of them occur in the expansion of commodities section, farm gate pricing section, user interface section and online trading section.

Our survey found a lot of opportunities for vertical and horizontal growth for eSoko. In terms of vertical growth, we found that existing services could be expanded gathering and disseminating of more information on current commodities and markets. In addition to market prices, farm-gate prices could be incorporated as per commodity, as well as commodity production levels and marketable supply, commodity import and export levels, and market demand.

The lack of adequate data on agricultural commodity market information at both the domestic and sub-regional levels, remains one of the key limitations to the envisaged regional market integration process. The significance of the availability of timely, reliable and up-to-date information/data regarding agricultural commodities that reach or are available for the market has been well recognized by a cross-section of stakeholders including farmers, traders, processors, exporters, transporters, consumers such as restaurant & hotel operators, big consumers (prisons, schools, health facilities), on the one hand, and decision makers including Government ministries (MINAGRI, MINEAC, MINICOM, MINECOFIN, MINALOC) and associated public institutions such as RADA, RHODA, RRA, Customs, and others, as well as development partners (DPs), on the other.

Therefore, expansion in terms of coverage relating to a wider range of commodities at the market, coupled with a wider geographical coverage of the markets within national boundaries and beyond within the EAC and CEPGL sub regions would be a major opportunity. Currently, only 26

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commodities are covered, whereas, a lot more commodities are brought to the existing markets served by eSoko. Similarly, only 33 markets are covered country-wide, whereas, there are significantly more markets in the country.⁴

Increasing the number of commodities, and inclusion of other farm inputs besides the inorganic fertilizers, would be highly beneficial, would add value, and would mean the expansion of eSoko consumer base and change of its profile. The eSoko could look beyond the borders of Rwanda and empower cross-border trade with market information on a whole range of parameters including available quantities by location, quality in terms of harmonized quality standards and other regulatory measures that have influence on marketing. There are wealth of data/information regarding staple and horticulture commodities that are available but are scattered and are not systematically exploited to address the needs of the beneficiaries. These include among others, staple and horticulture commodities production and yield data across districts and provinces, and some cases as lower down as the sector level.

A lot more useful data that would feed into the market information data for development planning, would be derived from such basic data, and these include nutrient coverage both in terms of quality and quantity, as a way of assessing the food security situation within the different parts of the country, and give indication of the surplus that would be available for the domestic as well as the sub-regional markets.

Currently, there is no harmonized Agricultural Market Information System (AMIS) that is geared towards addressing the needs of EAC, CEPGL, other regional economic communities (RECs) such as COMESA, SADC, ECOWAS, etc. that would foster a healthy and well-informed cross-border trade. This calls for the need for establishing a standardized and harmonized MIS with specific emphasis on eSoko beyond Rwanda. The move is indicated by the recent concerted efforts amongst EAC and CEPGL partner states through a series of IT experts meetings held in the different capitals of these countries, with the aim of deliberating on the establishment of MIS for the sub-regions. The results are clearly indicative that eSoko be modified to cater for the sub-regional MIS requirements.

Beyond the current target audience, farmers and traders, it appears that there is a wide audience that is still to be served. Market price information is so much of value to the hospitality industry that a number of restaurant owners informed us that they would be willing to pay for such information. Such a revenue generating model would be of such great importance for the sustainability of eSoko that we recommend further examination. Considering adding information on agricultural inputs, especially supply levels, naturally would also entail adding new actors that are outside the current profile of farmer and market traders. By enabling online trading, dynamics between all these actors and existing ones would be enhanced at a regional level increasing the efficiency, and likely production, in this sector.

The GoR policy and strategy emphasis on increasing market information access to all key stakeholders within Rwanda and within the sub-regions and beyond as enunciated in all medium and long term planning framework documents including the Vision 2020, Economic Development and Poverty Reduction Strategy (EDPRS), National Agricultural Policy (NAP) and Strategic Plan for Agriculture Transformation (SPAT/PSTA), is a big opportunity.

⁴ In our interviews we heard varying numbers of markets and commodities covered by eSoko. MINAGRI reported 46 markets, but we were able to identify fewer in the system.

The inclusion of MIS with specific emphasis on eSoko in most of the rural agricultural development projects and programs, and MINAGRI with the support of the DPs, including World Bank financed Land Husbandry, Water Harvesting & Hillside Irrigation (LWH), Kirehe Community-based Watershed Management Project (KWAMP), "Appui à la Filière Horticole (APFH)", and Project D'appui au Plan Stratégique Pour la Transformation de L'agriculture (PAPSTA)

The WFP's Purchase for Progress (P4P) program is actively using the eSoko market price survey results in setting purchase prices within the Rwandan Maize farmers' cooperatives and unions that have gone into contract agreements for purchase of their maize and beans.

Geographic Information Systems and Remote Sensing could also be adopted to ensure continuous and accurate measures of intensification as per National Policy. Remote sensing, using satellites, permits frequent crop identification over a given area unit. Remote sensing is widely used to identify objects from their unique spectral signature. Such techniques as Cluster Analysis used in Geographic Information Science enable identification of plants over a given area. While it would not provide precise production information, especially with regards to marketable surplus, remote sensing would provide accurate and timely agricultural surveys with plant species over a given area. With this data and geo-coded production data, Geographic Information Systems would automate calculation of yield information enabling timely decision making.

4.4 Threats.

External factors are foundational to the functioning of eSoko. Both data collection and dissemination strongly rests on adequate functioning of mobile operators. There also needs to be a project management team and sufficient resources to ensure successful implementation and long-term success. The departure of eRwanda team from the eSoko project starting the end of December 2010 will create a vacuum for coordinating external actors, such as mobile operators and the eSoko hosting provider.

Currently eSoko is running under the eRwanda project, which is coming to an end at the end of this year. At this stage, the eRwanda team was considering initiating the second phase of eSoko development that would address some of the systematic concerns with eSoko that came into the limelight during launch. These initiatives would include developing a multilingual interface, an online trading platform, enhancing the user experience via SMS interaction, finding means to reduce cost of SMS sent by users from other mobile operators and creating richer mobile interface for mobile consumers. As these initiatives are to correct some of the current shortcomings of eSoko and to expand the platform, transferring them to another agency may slow down or impend the rollout of the service to the public, which began earlier this year. The impact of this on the momentum of adopting the system may be significant.

Thus far the eRwanda team has initiated talks with MTN and Rwandatel towards providing lowering the costs of using eSoko for users. If the system were to be extended to the region, similar talks would have to be had with every mobile operator in the region. These negotiations are not by any means simple and they require adamant leadership. It is similar with the transfer of the application from Voxiva's servers in MTN's data center to the National Data Center. Without clear and dedicated project leadership, the remaining work of increasing public awareness and fine-tuning of the system may be in jeopardy.

Increasing of number of commodities and markets will also require a larger workforce and/or systematic adjustments to the data collection models. Expanding the depth of information gathered per commodity beyond price information and the frequency of data collection will also have similar effects. These increases in coordination costs for eSoko is also likely to be compounded

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by the increase of the total cost of SMS sent driven by larger number of people querying the eSoko.

There is also a need for continuous systematic evaluation for propagated data. In our interviews, we have observed an non-amicable relationship among data providers (market traders) and data collectors. Since this data is recorded and reported in eSoko and then disseminated to other regional systems, including RATIN and FAMIS, data quality has to be qualitatively guaranteed. Linking eSoko to its regional counterparts would guarantee timely dataflow, omissions of human error, and better use of available human resources.

5. Expansion of Market Information Systems

Currently, eSoko contains twenty six (26) commodities, four (4) of which are non-food items. The system also covers 33 markets around the country. Among the many opportunities available with eSOKO, expansion of its listed commodities and markets is key. It is also worth considering expanding the service to the region especially given the potential of trade among member nations.

5.1 Expanding the Service to the Region.

Expanding eSoko to the region would be a principle step in recognizing the emergence of the East Africa Community in agricultural trade. As research has shown, there are already high levels of formal and informal agricultural trade among member states of the East African Community as well as CEPGL. The expansion would facilitate these trades and strengthen them. The expansion, however, will also have major impacts on the current models employed by eSoko.

Expansion of the eSoko to the regional level will mean increasing the number of markets listed on eSoko, which means increasing the number of data enumerators as well as management. Since the data collection and dissemination will involve more telecommunication companies, further strategies will have to be employed on how to reduce the cost of using the system for the user. Some of these changes will have significant implication on the architecture of eSoko as well as its operations.

a. Adding New Markets.

eSoko is built with ability to ease the addition of a new market to the system. The system administrator or market coordinator logs into the web interface where s/he will find a form to create a new market. The mock-up of the form for adding a new market looks like the figure below. Since the system was conceptualized for Rwanda, the form does not ask about the country in which the market is found. This would be a very important addition to be made in addition to ensuring that is reflected in the database.

Form ESOKO E02-MRF		Name of Form: Market Registration Form																																																																															
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Prior to adding a new market, sufficient research will have to be done to ensure that that market meets a certain set of criteria. Such criteria may include, market accessibility, demand levels, production levels, etc. This is particularly important since not every market can be included into the system. One approach for facilitating prioritization process is by relying on users to recommend markets. This in a way is a crowd-sourcing approach which would help the system managers better predict which markets are important to system users. Users may also be asked to provide some of the basic information, such as those displayed above.

As it stands, market codes are numerical and hence obscure to an average user. For instance, why "Base" is 301 is not self-explanatory. A different approach can be adopted to facilitate the coding of these markets. For instance, country, district, and markets name can be taken into consideration. Consider Kimironko as an example, "RW-KC-KICU" could be the code. "RW" would refer to the country, "KC" the district, and the rest being the first four letters of the market's name. While allowing the user look at the code and deduce certain things about the market, this nomenclature would allow for identifying the market's location as in Rwanda and distinction between "Kimisagara" market in Nyarugenge and "Kimironko" market in Kicukiro district.

b. Data Collection.

With increase in the number of markets, the data collection process will become more intensive. The number of markets agents would have to increase and so is their coordination. Provided that they are deemed sufficient and appropriate, existing models and channels for data collection may be continued. Having said that, it is clear that the cost of running eSoko would grow heavily although it may be spread among member states.

It may be worth it to revise the data collection models since the supplier of market information and consumers would significantly change by expanding eSoko to the region. The increase of market agents will require more efficiency and reliability to be incorporated in that process. There will have to be guarantee use of the mobile application platform for data entry as timely data will be more imperative. In our studies, we found it questionable whether currently collected prices are as relevant to consumers because of the frequency of data collection in comparison to the frequency of price adjustments. This will have to be mitigated.

Crowd-sourcing has been recognised as an effective model for mass data collection. Without employing staff to conduct data collection and entry, the crowd-sourcing model amasses public to do data gathering. By creating interest in the data, such as letting vendors know that this is affordable means to let buyers know of their prices, more vendors publish their prices making the aggregate data more accurate and reliable. It goes without saying that such models often tend to also be cheaper to operate and more sustainable as they garner buy-in from all players.

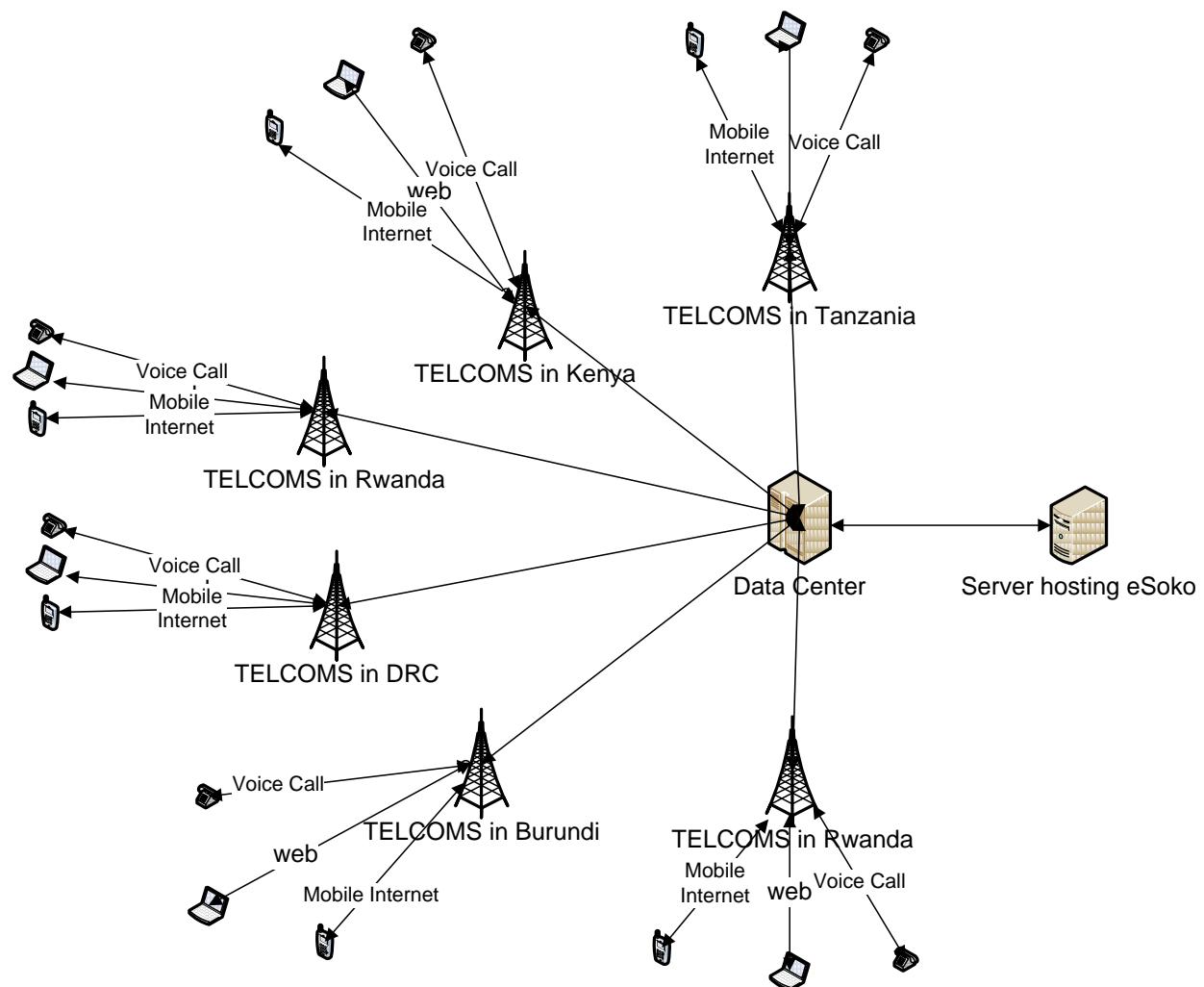
For instance, with a functioning electronic trading price, farmers and market traders (sellers) could place asking prices for their commodities on the system using the mobile application. Buyers would query the system for the commodities and place offers via the same application. Using the mobile application that uses GPRS or 3G internet, the cost of placing or receiving an offer would be around 80% cheaper than SMS. With appropriate public awareness campaigns helping sellers to understand the potential of this free marketing and buyers of this virtual convenient market place, sellers and buyers would begin using the system to select who to buy from or sell to. This marketing incentive and diminishing of cost of using the system would drive buyers and sellers to publish their prices frequently making market data in the system become more reflective of the real market prices. Since factors such as the age of commodity also influence purchase decision, these too

would have to somehow be included.

c. Usability for Data Dissemination.

Expanding the use of eSoko to the general public of East and Central Africa will require in-depth review of the needs of this audience. Currently, the eSoko SMS and Interactive Voice Recognition interfaces are in Kinyarwanda while the website is in English. The understanding is that the common user of market prices using SMS will likely be a common Rwandan farmers or traders who share the lingua franca of Kinyarwanda and the currency, the Rwandan franc. These assumption will have to be revised by regional expansion of eSoko.

Luckily, the value of eSoko is market information, which appears as Roman numerals not text. The importance of text is evoked in the process of querying and data dissemination. This is imperative, however, since the user interacts with the system via text. In other words, commodity names would have to be in multiple languages just as error messages would have to be. As there may also be markets in different countries or regions with the same names, it may also be useful to consider adding district or location of the market in the query terms.



User locations will also have to be reconsidered in the layout of the system. Currently as the system is hosted in Rwanda, the prices of querying 7656 from any networks are not that different although still a concern for the users. On the other hand, sending SMS to a number in Rwanda from other countries in the region would be much more expensive - at times almost three times what the

highest paying Rwandan users are paying now. To mitigate this will require obtaining short numbers in every country where eSoko is, finding a way for all telecommunication companies to treat that number as one operating in their network, and linking that number to wherever the application will be hosted. The importance of this task cannot be overlooked, nor its magnitude. The diagram below illustrates the overall architecture of the network.

Prior to the adoption of the East African common currency, eSoko spread across East Africa member states as well as CEPEGL will involve multiple currencies. A farmer or trader in Uganda will want to see the prices in Ugandan Shillings just as a user in Burundi will want to see the prices in Burundian francs. Although these may be operational currencies in the user's country, there are not necessarily going to be the currency in the country of the seller. To be user-friendly, the system will have to perform the currency conversions. Keeping in mind that there are official currency exchange rates often publicized by the Central Banks, there are also unofficial exchange rates that are likely to be what the traders and farmers use. Finding a reliable mechanism to obtain the unofficial exchange rates for currency conversions given currency fluctuations will require systematic review on how to capture that data and make it useful in the realm of eSoko. Not doing so may drive the users to this that eSoko provides unuseful and unreliable market information.

5.2 Increasing the Number of Commodities.

Currently eSoko permits addition of a new commodity into the system via the web form below. As a user with right privileges logs into the systems, s/he can add a new commodity to the system. The commodity code is manually entered by the system administrator. The user entering the new commodity is required to enter the commodity's name in the three official languages of Rwanda as illustrated the in the mock screen below. This form can be used to enter any commodities, including non-food items.

Form ESOKO E03-CRF <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Data Type</td></tr> <tr><td>Form Title</td></tr> <tr><td>Section Header</td></tr> <tr><td>NUMBER (3)</td></tr> <tr><td>TEXT (40)</td></tr> <tr><td>TEXT (40)</td></tr> <tr><td>TEXT (40)</td></tr> <tr><td>TEXT (40)</td></tr> <tr><td>Section Header</td></tr> <tr><td>LIST</td></tr> <tr><td>TEXT (40)</td></tr> <tr><td>TEXT (80)</td></tr> </table>	Data Type	Form Title	Section Header	NUMBER (3)	TEXT (40)	TEXT (40)	TEXT (40)	TEXT (40)	Section Header	LIST	TEXT (40)	TEXT (80)	<p style="text-align: center;">Name of Form: Commodity Registration Form</p> <div style="border: 1px solid #ccc; padding: 10px; margin-bottom: 10px;"> <p style="text-align: center;">New Commodity Registration Form</p> <p>* Indicates a required field</p> </div> <div style="background-color: #336699; color: white; padding: 5px; margin-bottom: 10px;"> Commodity Information </div> <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">* Q1</td> <td style="width: 85%;">Commodity Code</td> <td style="width: 30%;"><input type="text"/></td> </tr> <tr> <td>* Q2</td> <td>Commodity Name</td> <td><input type="text"/></td> </tr> <tr> <td>* Q3</td> <td>Commodity Short Name</td> <td><input type="text"/></td> </tr> <tr> <td>* Q4</td> <td>Commodity Name in French</td> <td><input type="text"/></td> </tr> <tr> <td>* Q5</td> <td>Commodity Name in Kinyarwanda</td> <td><input type="text"/></td> </tr> </table> <div style="background-color: #336699; color: white; padding: 5px; margin-bottom: 10px;"> Commodity Details </div> <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">* Q5</td> <td style="width: 85%;">Unit Type</td> <td style="width: 30%;"><input type="text"/> Select</td> </tr> <tr> <td>Q6</td> <td>Origin</td> <td><input type="text"/></td> </tr> <tr> <td>Q7</td> <td>Commodity Description</td> <td><input type="text"/></td> </tr> </table> <div style="text-align: center; margin-top: 20px;"> <input type="button" value="Reset"/> <input type="button" value="Cancel"/> <input type="button" value="Submit"/> </div>	* Q1	Commodity Code	<input type="text"/>	* Q2	Commodity Name	<input type="text"/>	* Q3	Commodity Short Name	<input type="text"/>	* Q4	Commodity Name in French	<input type="text"/>	* Q5	Commodity Name in Kinyarwanda	<input type="text"/>	* Q5	Unit Type	<input type="text"/> Select	Q6	Origin	<input type="text"/>	Q7	Commodity Description	<input type="text"/>
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The lack of standardisation in the commodity codes is of a concern with regards to the system use. Currently the codes appear in numerically although they are clearly not set in any order. As numbers, commodity codes are obscure and do not tell the user anything about the commodity. A more user-friendly code for say "igitoke," may have been "IGTK."

Having more systematized commodity codes and names would add more value to the system. These can be entered even before the commodities are active in the system and be set as inactive for the time being. As there are a finite list of commodities commonly produced and/or traded in the region, this would ensure more quality information. As it currently stands, listed commodities like "ifu-imyumbati," (cassava flour) are obscure to the user because the common terms are "ifu y'imbyumbati" or "ifu y'ubugari."

As the system prepares for regional launch, the commodity codes and names will have to be standardised across the board. A user in Uganda entering a new commodity will not be able to determine all the names in all languages to be available for the system's users. This will require collaborative work on behalf of the system administrators and/or market coordinators. Other possible names will also have to be documented for query purposes. The system should enable the user to query green peas with "amashaza" or "amageri" they are called in various parts of the Rwanda. The same principle would apply for non-Kinyarwanda, French or English names. The same applies for instance of singular and plural names of commodities e.g. "igitoke" and "ibitoke."

5.3 Increasing Information Regarding Each Commodity.

As a tool to enhance regional trade, eSoko would greatly benefit from increasing the amount of information available per commodity. At this moment, only market prices are available and nothing else. Additional information such as farm-gate prices, production levels, marketable surplus, levels of import and export, and supply and demand per market are not available. Such information would significantly transform the lives of farmers and traders, and the general public if it were to be made available.

It is impossible to image an online trading platform being functional in the least if no more than pricing information is available. For the online trading to work, a farmer or supplier has to announce that s/he has certain amounts of commodities and s/he is selling for a certain fee. The information would entice a potential buyer seeking certain amount good for a certain price to respond. Price alone would not be sufficient to render the trading efficient.

From a system point of view, the hypothetical situation provided above achieves a number of systematic goals. If the seller is a farmer, farm-gate prices would be collected as well as marketable supply levels. If the seller is a market trader, the supply at that specific market would be collected just as are the market prices. Such information is not only useful for the buyer seeking supply, but it is useful for policy makers and agricultural analysts. Supposing that a buyer from Uganda responds to the offer of a buyer in Rwanda, the levels of import and export could be measured in real time.

5.4 System Architecture.

Thinking beyond the borders of Rwanda for eSoko is essential, especially as East African Community takes hold. Adapting the eSoko Market Information System to regional level will, however, require specific changes to the overall system architecture although these changes are not fundamentals. Overall, the changes will have to do with infrastructure changes, database structure, user role redefinition and SMS handling. The level of complexity in implementing these changes will depend

Development of Framework for the Strengthening of Market Information Systems in Rwanda

on the depth of revision of eSoko data collection and dissemination given a wider and more diverse audience.

Provided that data collection by means of crowd-sourcing is accepted as more reliable and effective, the overall definition of user roles will have to be revamped as are the processes associated with data collection. The market agents' role may have to be removed or altered to a more quality assurance role. Algorithms to aggregate incoming data will have to be devised and implemented to ensure that information appearing in the system is in real-time and reflective of the reality on the ground. There are likely to be multiple coordinators of data collection at national and sub-national levels given the larger nature of neighbouring countries and the increase of the number of data collection points.

Placing eSoko in the hands of traders and farmers to supply their own prices, these users will have to be registered into the system. Such information as names, contact information, location and exact activity in the agri-business will have to be defined. This information will be useful in defining user-roles. For example, an offer from a farmer Pierre Karangwa will have to be considered as a farm-gate price. If Mr Karangwa was a registered trader at the Base Market, his listing would be considered as a "market price." With registration, authentication will be enabled ensuring that posted prices are done so by the registered users. Since SMS will not be as effective in enabling these functions, the mobile application will have to be extended to these users.

While price variation of eSoko replying to an SMS query from MTN, Tigo or Rwandatel may not be that bit at this point, Maximum FRW10, going regional would expose this cost. The cost of sending SMS to multiple countries in East Africa and CEPGL greatly vary in comparison to sending SMS within Rwanda. In addition, the more SMS will be sent out will mean this variation will have to be taken into consideration. To mitigate this, the function in eSoko application that handles receiving and sending SMS will have to be adapted to sending SMS using the most convenient and affordable channel to multiple available option.

If the suggestions we recommend were to be adopted, eSoko's database would have to undergo a significant amount changes. Commodity codes and market codes would have to be revised. Structures to support a larger number of commodity names would developed and permit their querying for more diverse users. More information regarding commodities will have to be catered for just as room for a wider range of registered users will have to be created. As it stands, whole different component of the system dedicated to online trading will have to be developed.

The synergy between eSoko and other regional agricultural information systems, such as RATIN and FAMIS will have to be revised. Currently data exchanges between these systems are manual. Linking these databases for rapid updates is ideal. However, it also means some standardisations with regards to codes and protocols of data exchanges. Overall this initiative would make for stronger regional agricultural trade integration. However, it will also require some level of revamping all systems involved.

All of these changes will have significant impacts on the nature of the available resources to accessing the eSoko system. The increase of usership in form of expansion of the system's market base may require for the database to optimized for performance as well as increasing the performance capacity of the servers that host the application. As it stands, Voxiva Rwanda hosting the application was not at liberty to disclose neither server specifications nor bandwidth dedicated to the functioning of eSoko. Without this information it is impossible to determine whether the

existing infrastructure will suffice or require overhauling. This, however, is important to put into consideration as plans of expansion are reviewed.

6. Improving Outreach through User Interface.

As a principle point of interaction between machine and user, it is essential to look at user interface when inquiring about the levels of use of an application or system. Traditionally, one may begin by asking how much effort was put to creating awareness of such system as eSoko in evaluating its reach and the results of those efforts. In this section of our analysis, we go beyond that and ask: what are the factors that may limit the user, specifically the public, from taking the initiative to use the system and what may impede the user from incorporating the system into their daily lives?

For a system that is publicly accessible, it is essential to consider factors that may or may not be contributing to the desired level of use. Accessibility to the user interface is a key component of this interrogation. Using Short Messaging Service (SMS), Interactive Voice Recognition and the World Wide Web, eSoko is ubiquitous with over three million mobile subscriber and a growing number that has access to the internet. However, these protocols are not without impediments for the user. In this section we will assess those impediments.

Our analysis would be incomplete without consideration of the factors contributing the “bounce rate,” i.e. the amount of people not able to find what they seek in the system. While legitimate that the user may be seeking something the system is not able to provide, it is also possible that the user stops interacting with the system simply because s/he does not know how. An effective user interface guides the user to what s/he may be seeking. It is in this light that we assess eSoko’s user interface in order to understand the effectiveness of its use of opportunities it has with users.

After evaluating some of the challenges facing eSoko’s user interface, we will proceed to provide recommendations on how it can be used. Again, we will separate our recommendations for the mobile user interface and the web user interface. Our focus here will be design factors that would reduce impediments to the user’s experience with eSoko.

6.1 eSoko’s User Interface.

A user interface is the point of contact between a human user and a machine system. That point of contact is two way. The user interacts with the user interface to give instructions to a machine. It is also through the user interface that the machine delivers specific information to the users. Such information from the machine may be the information the user was seeking, a request for further instructions, or an error message indicating failure to retrieve the requested information.

In the case of eSoko, there are three distinct interfaces enabling the user to interact with the Agricultural Market Information Systems. The first and most commonly used is the SMS mobile interface. Using his/her mobile device, the user is able to query the market information system for specific price information via the Short Message Service (SMS) sent to 7656. In these instances, the machine also responds to the user’s query via SMS.

Another point for a user to retrieve price information from the market information system is through the interactive voice recognition and web. Since the interactive voice recognition interface is used so little due to price impediments, we do not delve into analysing it. Reachable through a web browser at www.esoko.gov.rw, the web interface has similar functions to the mobile interface. The user can query the database of prices of goods per market. The results are displayed instantaneously to the user in a tabular format.

Although performing the same functions, there distinct differences between the two interface. For one, the mobile interface using SMS is restricted to 160 characters per message while there are no limits for the web interface. From a requirements point of view, the web interface requires a computer or internet enable device with access to the internet while the mobile interface requires a cell phone with airtime. Obviously from a capital cost of opportunity point of view, the web interface is less accessible for users. From a usage point of view, a report filed by the East African Business quoted users appealing that the cost of SMS and Internet were still an impediment to the adoption of the tool.⁵ We agree that the cost of use need to be mitigated.

6.2 Limits of Current SMS Mobile User Interface.

Even though cheaper for the user, it has on various occasions been noted that the cost of the mobile interface is a challenge to the popularity of eSoko. Earlier in 2010, the government and the mobile operator MTN pledged to provide subsidized mobile devices to help farmers with the cost of using the mobile interface.⁶ Even with an emergence of a third mobile operator in the country suppressing the prices of SMS, the East African Business Week cited above suggests that the price challenge has not been overcome.

The findings of the East African Business Week do not contradict our own findings. The opinions we found among many users showed that the price of using eSoko via SMS remained problematic particularly because of the price. The short number, 7656, used to access eSoko via SMS is an MTN number. This means that users trying to access the eSoko from other networks pay either FRW15 with Rwandatel or FRW25 with Tigo whereas MTN users pay just FRW10.

The SMS interface, while still providing the most cost effective and location independent entry point to the market information, still does not guide the user on how to interact with the system. With more than two dozen commodities in eSoko and various markets, having a more guided interface would facilitate the adoption and use of eSoko. With a finite number of commodities and markets, it is very difficult for the user to remember exactly which ones are listed in eSoko and exactly how.

For instance, following the example in the brochure distributed by eSoko in the Kicukiro market verbatim, we sent an SMS to 7656 containing the string, "Igiciro Kimironko umuceri." The results of that query on three trials were, "izina ry'igicuruzwa wanditse sиро, ongera uryandike neza." While informing us that we had incorrectly written the commodity, we could not determine where we had gone wrong. It is foreseeable that at this juncture a user may give up. After several trials with "umuceri," "Umuceri," and "Umuceli," we consulted the commodities list on the website to discover that the right queries for rice were either "Umuceli-RW," "Umuceli-Tz" or "Umuceli-Asia." In this example, one can see that the user interface was useful in alerting me that I had made an error in querying the system; however, it did not help me whatsoever in trying to resolve it.

6.3 Limits of the Current Web Interface.

On the morning of November 9th, 2010 we visited www.esoko.gov.rw using multiple browsers and the interface looked fairly the same. The image below is a screenshot of that interface from Mozilla Firefox 3.6.10. Using this landing page and steps to reaching market prices, we are going to assess this interface from the following perspectives: who are the users and what are their needs?

⁵ The East African Business Week. 18 October 2010. High Internet, SMS Costs Slow Rural Project. <http://allafrica.com/stories/201010181374.html>.

⁶ Majyam bere, Gertrude. 4 February 2010. eSoko to Ease Farmers' Access to Market Information. New Times. <http://allafrica.com/stories/201002040063.html>

Development of Framework for the Strengthening of Market Information Systems in Rwanda

The screenshot shows the homepage of the e-Soko website. At the top left is the e-Soko logo with a green leaf icon. To its right is the Republic of Rwanda Ministry of Agriculture and Animal Resources logo. Further right is the RDB IT eRwanda Project logo. Below these are navigation links: About e-Soko, About MinAgri, About eRwanda, Our Partners, Latest Market Prices, Monthly Reports, Province & District Weekly News, and Market Name & Code. A sidebar on the left features a photo of a hand holding a smartphone displaying market data over a background of coffee beans. The main content area includes a paragraph about the government's investment in ICTs for agriculture, a photo of a field being irrigated, and a detailed description of the eRwanda Project's goals. On the right, there is a login form for 'Guest' users, a 'Forgot Password' link, and a map of Rwanda with provinces labeled. Below the map is a link to an interactive map.

About e-Soko

About MinAgri

About eRwanda

Our Partners

Latest Market Prices

Monthly Reports

Province & District Weekly News

Market Name & Code

Republic of Rwanda
Ministry of Agriculture and
Animal Resources

RDB IT
eRwanda Project

Login

User Name

Password

Language English

Guest

Forgot Password

MAP OF THE REPUBLIC OF RWANDA

[Click here to view an Interactive map](#)

B.P: 021 Kigali
Tel: 00 250 585008
Fax: + 00 250 585057
E-mail: info@minagri.gov.rw
Web: www.minagri.gov.rw

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Powered by

Reading from various documents related to eSoko, it is clear that the project is geared to an audience of Rwandan farmers and traders. On the home page of eSoko the text reads,

"The eRwanda Project, a World Bank funded ICT for Development project being implemented by the Rwanda Information Technology Authority (RITA) intends to remedy this critical information gap with the use of ICTs through its e-SOKO Project that seeks to empower farmers to enable them make more informed market pricing decisions and ultimately more successful farming. This Agricultural Market Pricing Information System will also significantly enhance the Ministry of Agriculture – MINAGRI's interaction with the farmers and traders as well as the planning function."⁷

Understanding that the audience of the eSoko project are Rwandans seeking market price information, we can then deduce the basic nature of the form and function of the content of the eSoko web interface. From a function point of view, the content of the interface shall provide pricing information. On the landing page of eSoko, as you can see above, that information is not present and neither are sufficient instructions on how to reach it. This demonstrates that the website does not enforce the objectives of eSoko i.e. to provide market prices.

Like the entire website, the little instructions provided by the website are in English. Considering that the eSoko project is primarily designed to cater to the needs of Rwandan farmers and traders, it seems that using Kinyarwanda as the lingua franca of the website would be more useful. It is also paramount to note that most of these users are not avid computer users, hence instructions and a self-explanatory user interface are indispensable.

⁷ <http://www.esoko.gov.rw/esoko/Dashboard/Login.aspx?DashboardId=4&dash=true&Login=true>. Accessed on 8th November 2010

On the eSoko website and brochures handed out at the market we discovered text reading, "To access the eSoko system through the web, type the Url: <http://www.esoko.gov.rw/>. This will give you access to all the latest commodity prices in all the markets as well as monthly reports from all the markets regarding the commodities available. On the web latest market prices can be accessed using commodity codes."⁸ We found these instructions not sufficiently useful in helping use the eSoko web interface, especially because of the language and incomplete nature. Overall, we found there were five steps involving a total of three pages. To determine the prices, these are the steps we found most efficient:

1. Open browser and go to www.esoko.gov.rw;
2. Click the fifth button on the left navigation menu, "Latest Market Prices," which opens a new page;
3. Go back to the original page and click the eighth button on the left navigation menu, "Market Name and Code" which opens a new page with the codes;
4. Note the codes you want for market and commodity;
5. Go to the Latest Market Prices page and fill in market and commodity code and the system will return the price.

Best practices in web user interface recommend that the user shall be able to find what s/he is seeking in two clicks or less. As you can see above, there are well over four clicks to obtaining the market prices on the eSoko web interface. Further, functional buttons to accessing this information are the placed not in the most visible areas of the webpage. Below we discuss how these interface challenges can be addressed.

6.4 Suggestions for Expanding Reach through Improved User Interface

An affordable mobile interface is imperative to the success of eSoko. As demonstrated above, one of the key impediments to the price reduction is the monopoly granted to MTN. It has come to our attention that Rwanda Utility Regulatory Authority (RURA) can provide a short-number accessible through all mobile operators. In practice, RURA would provide SIM cards with the same short number from every mobile operator. Hence, when a user queries eSoko Market Price System, the prices would be as follows depending on the operator: FRW10 from Rwandatel, FRW10 from MTN and FRW25 for Tigo. Given that this is government initiative, RURA will charge no fee for processing the request.

Given the adoption of a mobile application for data collection, it is also feasible to consider a similar application for data dissemination. The major advantages of the mobile applications over SMS are two-fold. The mobile application can be created to be more interactive and user-friendly. Instead of typing the keywords and sending them to 7656 as it is with SMS, the user could choose a market from a list and then one or two commodities from the list, and receive results instantaneously. Most important about this approach is the reduction in cost for the user. Prior to MTN's waiver of the fee, it was estimated that transmitting market prices from the market agent to the system would have cost less than FRW3 per transmission. The information consumer mobile application can be developed to have the same cost efficiency. The only real impediment to the application since mobile internet is accessible wherever there is a voice signal in Rwanda is the

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<http://www.esoko.gov.rw/esoko/Dashboard/Login.aspx?DashboardId=14&sm=m402&save=true&home=true&dash=true&records=100¤tPage=&Float=2&viewDash=&myDashboards=true,true&Menu=&breadC=true&DisplayMenu=false>. Accessed on 8th November 2010.

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mobile devices. For the application to work on a mobile device, the device has to be Java enabled. Currently there are no data on the prevalence of these devices in Rwanda, although world-wide the technology is becoming mainstream and standard for mobile devices.

An *interactive SMS Interface* would facilitate the user in his/her requests. Instead of just returning an error message, the user would also receive guidance on how to improve their query. For instance, the message returned for a query, such as "umuceri," which does not match any commodities would suggest the closest resemblance e.g. "umuceli-RW." It is also possible to have simple applications, similar to the ones currently installed on SIM cards to query news, sports, FOREX, Courier Tracking, and flights. These applications would enable rapid and guided deployment of queries without the user having to type in the short code number or the query term "igiciro."

A *purpose-driven Web Interface* would be built to respond to the needs of a specific audience. In this regard, as we have identified Rwandan farmers and traders as the primary audience and their needs to be finding market prices, the interface could made in a more appropriate language with the simplest method for accessing the desired information. In other words, the primary language of the interface could be Kinyarwanda (perhaps other official languages could also be made available) and the steps for finding price information could be reduced.

With a finite number of commodities and markets, it is feasible to use drop-down menus on the website. These menus and the results of the query could be placed directly on the home page putting the functions of eSoko in the limelight. While not following the model of Google home page of excessive minimalism and hundred percent dedication of the homepage's real-estate to the purpose of search, there is still a lesson to be learnt from the successes of that model.

Advent of internet-ready mobile devices also provides justification for creating a mobile-optimized website. These websites, often as accompaniments to the proper websites, are designed for small screens and slow internet available on mobile internet. Towards this end, the overall layout of the website is set in tighter boundaries; text is limited; and the use of image is set to fewer images optimised for smaller screen resolutions. Such interface would provide another access point for the public, which may be cheaper and more effective than SMS if well developed.

7. Implementing Online Trading.

The online trading component of eSoko was requested as part of the second phase in the implementation of eSoko. Noting that there are currently limited means to facilitate the financial transactions that are a part of agricultural trade, the vision is to provide a platform for information exchanges. These exchanges may be created in such a way that their content generates the information needed by management of eSoko.

7.1 Available Means for Online Trading.

As it stands, there is no complete means for facilitating financial transactions in eSoko. Virtual money, such as credit cards, has not taken strong hold in Rwanda and infrastructure to support is yet to be seen. While there are plans to harmonize electronic cash transfers between banks, the viable alternative at the moment is MTN's Mobile Money or customized eSoko credit system.

The eSoko credit system would require substantial infrastructure and organization development to support it. The system itself would have to be built with sufficient security for financial transactions and points for converting virtual cash to currency would have to be created in parts of the country accessible to farmers and traders alike. The feat of creating such an infrastructure would incur more impediments as the system is exported to bigger neighbouring countries

While MTN' Mobile Money meets those infrastructure requirements, its limited penetration at this stage would not serve a large proportion of the intended audience. At this stage, MTN Mobile Money while growing rapidly continues to provide limited opportunities for transforming the virtual money into real cash. The monetary transaction using MTN Mobile Money would also encounter significant hindrances once exported to neighbouring countries, where in most cases MTN does not operate.

7.2 Seizing the Opportunity.

Information exchange may be a more appropriate model to continue with for now. Such supply questions as price, quantity, and location are valuable information that can be provided by eSoko. In this regard, we can envision a buyer, whether a middlemen, a market trader, or member of the public seeking to determine who from s/he can find a specific commodity at the best price and/or in certain quantities. Of course, it may be wise to consider making sure that a household is not directed to a farmer for buying commodities, which would yield much frustration. This factor will have to be negotiated with the desire to provide market prices to farmers and farm-gate prices to market traders.

To make online trading in market information work, as mentioned earlier, a broader spectrum of commodity information would have to be posted into the system at a higher frequency than it is happening now. In other words, the entire system would have to be revamped to accommodate more commodities and information per commodity to include such variables as quantity. Instead of using market agents, posting of information would be done by those participating in the trade. To entice them to do so, these users would have to find value in doing so, namely marketing their products.

The value of using eSoko would be more than finding market prices. It would also be finding the best deal. Once the user has identified the best price and who is offering it, s/he can get access to the contacts of that individual and begin trying to reach them. All "traders" in the system would be required to have accounts into the system, which are linked to their contacts. To avoid privacy

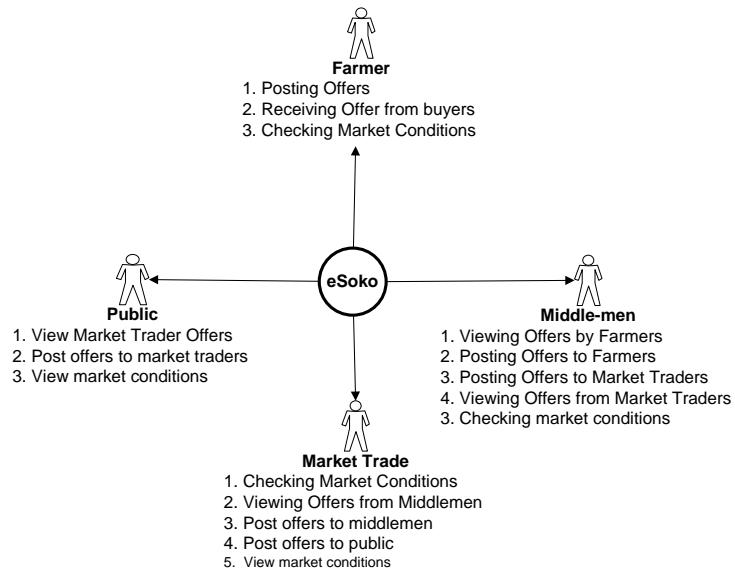
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concerns, the traders would be required to post offers and counter offers publicly until they agree to exchange contact information to close the deal.

The use of eSoko for farmers, middlemen and market traders for online trading will completely transform these user's interactions with it. It is in this regard that simple, intuitive and option-rich interface will have to be created. The current SMS interface may not suffice in the long term. Hence, the mobile application interface may be more appropriate. Aside from being more affordable per transaction than SMS, the mobile application provides an on-the-go richer interface that would enable trading.

To enable online trading, eSoko would require expanding the current profile of users. For instance, the current profile "public" would have to be segmented into functional actors, such as input suppliers, farmers, cooperatives, traders, transporters, processors, exporters/importers, consumers etc. These users will have defined roles and limited capabilities in the system. It would also be more holistic into include the general public i.e. the market trader's clients into online trading.

Enabling market patrons to have accounts in eSoko would essentially provide means for cost-effective marketing for market traders. In doing so, it would be giving market traders incentive to post information with regards to the commodities they trade enriching the central database with real-time accurate data at low over-head cost. Permitting members of the public to obtain accounts would also add even more value as outliers and consumer habits can be profiled more easily. Below is an example of the actors and their goals in the system.



Given the importance of the hospitality industry and other businesses in agribusiness, this system would be half complete if these actors were not given a prominent role. In our interviews with hotel and restaurant owners, they all expressed interest in eSoko and some even pledged to pay membership fees. Services demanded by the consumers included being able to find the seller offering the best price, placing orders online, and possibility to monitor trends. Other than helping agriculturalists determine the profile of consumption among these consumers, these users could provide immensely valuable market information if they were given incentive to enter it. For example, if eSoko would provide small business means of monitoring their consumption of agricultural products, they may be given incentive to enter how much they purchased of a given commodity and at what price. This information would be the backbone of demand data.

8. Conclusions & Key Recommendations.

8.1 Conclusion.

As shown in the remarks of this report, although widely unknown to the public, eSoko is built on strong principles and architecture designed to serve an audience with diverse needs. The overall three-pronged approach to the user interface is wide-reaching although not consistent in its servitude. The initiatives by Rwanda Development Board (RDB), eRwanda, to improve the current infrastructure of eSoko demonstrate that there is a lot of room to grow. The need to include other useful market parameters such as available quantity of a given commodity within a given location, the quality attributes of the commodity, etc is key in order to fully exploit such a feature. Also, it would be useful to keep it open for ease of accommodating new entrants to the market. Resorting to an architecture that would facilitate integration of multiple mobile operators is an important part of that growth.

Whereas, the current report does not permit delving into the organizational and business model recommendations, this will be an important factor in how much and how fast eSoko can grow. Evidently, there is still a lot of room for growth the areas of usership, usability, functionality, organization and architecture. All of these are interconnected and considering one without the other is not advisable.

8.2 Key Recommendations.

(i) Need to reinforce sensitization of the key players within the value chains.

As observed all the way, the lack of awareness on eSoko and how it functions and on the benefits associated with it is a common feature all along the value chain (input suppliers, producers, traders, processors, exporters, consumers). Need to incentivize the beneficiaries has to be taken into serious consideration, if it has to attain the desired popularity, and wider adoption amongst potential users.

(ii) Need for a systematic data collection methodology.

The aspect of data collection methodology with respect to reliability of data obtained needs to be emphasized. In order to come up with comparable data on market behaviour, the need for a standardized and systematic methodology is highly critical. It becomes even more important, when the coverage is extended to cover different territories, with supposedly different ways of doing business. This includes ensuring application of standardized terminology & codes, as well as systematic and documented methods for data verification and aggregation.

(iii) Need for a sustainable data collection model.

If eSoko is to remain within Rwanda, its overheads will grow at significant pace as data collection and dissemination intensifies. The same will apply if the system is to reach the regional users. Either the government of Rwanda or governments of the member states will have to bear the brunt of these costs. Specific costs associated with data collections are labour and logistics. With growth in popularity, the cost of transmitting data whether by SMS or web will start being noticeable.

(iv) Need for Establishing and Maintaining a Strong Link Between eSoko And GIS Data.

As mentioned, issues to do with crop yields and overall production need to be accurately measured, and easy to predict so as to be able to assess the market behaviour with a fair level of accuracy. Remote sensing and GIS could be used to increase the frequency, reliability and efficiency of agricultural surveys. Whereas, the use of GIS would be useful in predicting production/productivity parameters, an efficient MIS e.g. eSoko will assist in disseminating market-

related info to different players at the marketplace.

(v) Need to Consider a Public private partnership (PPP) Model.

Tradenet's eSoko.com has been implemented in multiple countries under the PPP model. Tradenet has a complete market information system, which is tailored to every country they work with. Instead of the government running eSoko as a programme in a ministry, Tradenet's eSoko is shared with public as a non-paid and paid service. Certain premium service in eSoko.com such as alerts, distribution of offers, etc are charged. User registration and querying of the system are free.

Tradenet's model affords a chance for public sector to offer high quality service at low cost to the government or whichever agency wishing to provide the service. As the service provider is concerned with customer satisfaction and retention for making money, the provider has extra incentives to ensure the application as working optimally.

Even if the PPP model is not to be adopted, the government can also study possibilities of running eSoko as a tax-neutral service. The indication of the business community towards paying a membership fee for getting access to the system is a strong indicator towards this direction. In the same vein, previous research for the Agriculture Knowledge Information Market Place provided strong evidence that Agriculture Professionals would be willing to pay for access to market information.

8.3 Seminar Recommendations.

During the seminars of the 8th, 9th and 10th of December 2010, participants worked to produce a comprehensive list of recommendations. These include:

(i) Standardization and improvement of user experience:

- Use graphics and drop-down menus to improve querying;
- Use keywords in the SMS querying and provide suggestions for failed queries;
- Standardize naming and codes in similar manner as Common External Tariffs; and
- Organize regional consultations for creating uniform information.

(ii) Data collection and data accuracy:

- Build capacity of data collectors;
- Harmonize data collection;
- Employ actors in the market, such as market leaders and tax collectors, to collect data;
- Provide incentives, e.g. profit calculation, for market traders to supply price data including buying and selling prices.

(iii) Regional MIS Opportunities:

- Single MIS as oppose to integration of country systems;
- Commitment to common currency;
- Enhance eSoko with additional trade information, transport costs, supply and demand data, etc;
- Availability of funds for such initiatives.

(iv) Sustainability:

- MIS shall provide valuable information to ensure governments' continuous support;
- Increase MIS's value to the private sector in order to generate revenue;
- Explore revenue sharing opportunities between MIS and mobile operators;
- Create public awareness of the value of MIS;
- Provide free MIS until mature and then begin charging for service

7. Appendix

Appendix 1: Listed Markets & Codes

Code	Market Name
301	Base
508	Bugarama
509	Bushenge
203	Butare
302	Byumba
503	Congo Nil
303	Gaseke
207	Gikongoro
504	Gisenyi
502	Kabaya
507	Kamembe
408	Karenge
201	Kayenzi
506	Kibirizi
406	Kibungo
101	Kicukiro
103	Kimironko
505	Mahoko
202	Muhanga
501	Mukamira
404	Mukarange
306	Musanze
206	Musha
205	Ndago
102	Nyabugogo
401	Nyagatare
405	Nyakarambi
204	Nyanza
305	Rugarama
407	Ruhuha
403	Rukomo
304	Rushashi
402	Rwagitima

Appendix 2: Listed Commodities and Codes

Code	Commodity Name in Kinyarwanda
13	DAP
14	Ditane
26	Ifu-ingano
23	Ifu-ibigori
21	ibitunguru-bitukura
59	Uree
58	Umuceli-Tz
57	Umuceli-RW
56	Umuceli-Asia
55	Ubunyobwa
53	Soya
48	NPK
44	Inyanya
40	inshyushyu
38	Ingano
33	Imyumbati
30	Imineke
27	Igitoki
25	Ifu-imyumbati
20	Ibisyimbo
19	Ibirayi
17	Ibijumba
16	Ibigori
10	Amatunda
9	Amashu
8	Amashaza
7	Amasaka

Appendix 3: Market Field Report (Data Consumption)

The field visit was carried out by Mr. Mike R. Kananura between the 25th and 29th of October 2010. The objective of the visit was to acquire usage information on eSoko from the perspective of the traders. Mr. Kananura was provided an interview schedule that guided his interactions. The interview schedule is designed to be loose enabling open-discussions that may diverge to topics not previously considered.

Mr Kananura recorded the interviews using a voice recorder where interviewees permitted. This is an analysis of the interviews on the assessment of e-soko usage in markets i.e. by sellers/markets vendors. 23 people were interviewed, among the interviewed are market authorities and sellers in Biryogo, Kicukiro, Kimironko, Kimisagara, Nyabugogo markets and one enumerator of MINAGRI. The interviewed are between the ages of 21-60, 6 are males and 17 are females.

a. Market Traders and Authorities' views:

Ten of Twenty two people interviewed in the markets have heard about e-soko. The sources of knowledge are adverts through the media (radio broadcasters and TV), adverts on vehicles, RDB/MINAGRI e-soko campaign in Kicukiro market, and through conversations with friends. The knowledge of eSoko the interviewees had was not useful for them to be able to use e-soko. Most of the interviewees expressed having heard of eSoko but had not taken initiative to use it. Two who attempted using the system reported finding inaccurate information including lower prices than those present at the market. They reported to have never used eSoko since then.

After demonstrations of eSoko, all interviewees expressed appreciation and enthusiasm for the system. They also requested more information about the usage and benefits of eSoko. At the time of the demonstration twelve of the twenty participants believed that eSoko would benefit them. A larger majority expressed that the system would benefit consumers even more. Traders of perishable commodities particularly lamented that fluctuation of prices, which is not reflected in eSoko, would put them at disadvantage.

Observations:

While at the market, we noted that prices in the system were not the same as the prices in the markets. Traders and market authorities confirmed that perishable commodities like cooking bananas, Irish potatoes, fresh vegetables were most susceptible to price fluctuation due to quality that diminishes with time and poor means of preservation in the market. These price adjustments may occur as often as per hour basis. Frequent price fluctuation that is not parallel to data collection appeared to be the cause of this problem.

Other factors that may impact price variation include, place of origin of the commodities, demand and traders' location in the market. Placement in the market has a strong impact on demand for individual traders. Disorganization in some markets also contributes much in price fluctuation. For example, in Kicukiro Market where taxes pay daily, weekly or monthly, the nature of the traders' overheads vary greatly having impact on their pricing.

Appendix 3: Market Agent Interview Report (Data Collection)

Through reference we were able to identify a market agent for MINAGRI. The purpose of this interview was to gather understanding on the process of data collection from a data enumerator point of view. This would help us understand the sticky points in the process, which may or may not affect quality of data.

Interview Highlights

- Market Agents are in charge of data collection.
- 4 field surveys are carried out every week by one enumerator in charge of 3 markets, i.e. one of the three is surveyed twice in a week.
- Lists of different commodities in markets are used; the current list has 67 items. The enumerator fills the list due to commodities in that very market.
- The data report is thereafter submitted at MINAGRI and where it is entered into the system.
- Some market agents use phones that have software that displayed the list and the report is sent electronically to the coordinator at MINAGRI.
- 5 inquiries are made on each commodity and an average is calculated which is the one used in the MIS (market information system).
- Availability of that specific commodity is also reported for a record. [Scarce, available, normal]
- Most of the commodities have a constant price for a certain period, though some fluctuate from time to time.
- The database is updated on a weekly basis.
- In general people are not familiar with using e-soko.

Challenges According to the Enumerator:

- The people are not easily approachable because of little knowledge on what the survey is about.
- The cell phones used by enumerators have a list of only three options of inquiry on each commodity.

General recommendations:

- There should be public awareness on e-soko so that the public understands the market information system.
- Market traders need to be more organized.
- There should be daily update of data in the system due to price fluctuation on a timely basis.
- The number of enumerators should increase.
- Provide the mobile software to all enumerators.

Appendix 4: Survey of Business Consumer of eSoko (Data Consumption)

The field survey was carried out by Mr. Mike R. Kananura between the 1st and 4th of October 2010. Mr Kananura was tasked to interview managers of hotels and restaurants in order to determine their use and interest of eSoko. This analysis was done using these interviews.

In total, four hotels /restaurants were interviewed. These are Bloom hotel, Michael's Den hotel, Hotel-tech, and Hilltop hotel. Initially, we had approached Bloom hotel, Papyrus Restaurant, Chez Lando Hotel, La Planete Resto-bar, Michael's Den hotel, Hotel-tech, Hilltop Hotel and Alpha palace. We were unable to establish a time for the remainder of the interviewees.

BLOOM HOTEL (MALE) 40-50YRS:

Views:

- No knowledge of e-soko but read an article in the New Times on it about a month ago.
- No usage of e-soko because of lack of awareness about the service.
- Shopping of commodities is done by purchasing officers, though before they had suppliers but because of lack of trust they had to maneuver to a different strategy.
- They use Nyabugogo market as the source of commodities after Kimironko market hiked prices.
- After explanation of the service, he said that it would boost competition in the industry and markets if there were thorough usage.

Recommendations:

- There should be campaign on awareness and sensitization of e-soko to the consumers/ users of the service industry.
- Since there is still a big limitation on the usage of internet and less reliability, cell phones can be the target of the service provider and offer a subscription service that could be paid monthly.

HILLTOP HOTEL (FEMALE) 40-45 YRS:

Views:

- No knowledge of e-soko but willing to know.
- Their opinion was that the usage of e-soko would boost their business by saving time and being consistent.
- They have suppliers for the commodities they need but also send staff to the market.

Recommendations:

- There should be sensitization most especially through the media like newspapers.
- The internet is preferable for the market information system in case offered as a service to be paid monthly.
- The information can be received once per week at the time of choice.
- eSoko should be evaluated on a regular basis to ensure relevance to the consumers.

HOTEL-TECH (MALE) 45-50YRS:

Views:

- No knowledge of e-soko but once saw it on T.V in the MINICOM program.
- Once he has a clear understanding of the service there can be a big benefit for us from it.
- Hotel-Tech uses purchasing officers who move around in markets inspecting for the best price.

Recommendations:

- A bulk message containing market information can be forwarded to the people working in the industry through the hotel association, because it is the best way to reach every business in the industry.
- Unless the monthly paid MIS (market information system) service is cheap, otherwise they cannot use it.
- The information should be sent quarterly because prices at the market fluctuate in about three months.
- There should be a campaign of awareness and sensitization, most especially through the media.

MICHAEL'S DEN HOTEL (FEMALE) 30-40YRS:

Views:

- No knowledge of eSoko but once saw it on a banner.
- The hotel buys depending on the consumers they have. There is no specific time for purchasing. They don't use suppliers instead go to the market.
- Hotel staff move around the markets seeking the best price.
- She says that if there is a good awareness of the service it would be very beneficial to their business by saving time.

Recommendations:

- Information should be free for people to access it, so they are not comfortable to use the monthly paid MIS service.
- There should be sensitization so that the service is used.
- It would be better if the service providers carry out the campaign door to door i.e. focus on business locations.
- Advertisement through the media.

Appendix 5: Project Managers Interview Report (System Design & Plans)

At RDB eRwanda we met the eSoko Project Manager and at Voxiva we met the person in charge of managing the system. The objective of the interviews was together higher level vision for eSoko as well as the specifics on the system design. For the specifics on the system design, we were given an electronic copy of the system design document. The interview was fairly structured.

eRwanda Interview:

- Vision for eSoko: to provide easy access to market prices
- Current level of use: 3,661 web users and 30,000+ SMS users in October
- Future Plans:
 - Create a multilingual interface
 - Devise a trading platform that would handle posting of supply and supply requests;
 - Improve the SMS error-handling mechanism facilitate ease of use;
 - Create a more rich mobile interface perhaps with graphics;
 - Create more public awareness of the system
- Challenges:
 - The end of eRwanda this coming December
 - Lack of public awareness

Voxiva Interview:

- Vision of eSoko:
 - to automate market information collection and dissemination
 - Data disseminated to Government through web and public through SMS and Interactive Voice Recognition
- Current levels of use:
 - 33 commodities and 42 markets are active in the system
 - Data Collection is done by market agents who use mobile application although Interactive Voice and Web interface are also available
- Challenges:
 - Missing an aggregator to facilitate use of multiple mobile carriers
 - Change of behavior at MINAGRI has been difficult
- Future Plans:
 - Improve analytics of the data
 - Create online trading platform
 - Double the amount of market agents
 - Increase frequency of visits
 - Increase capacity in the Ministry to take over eSoko

Appendix 6: Application of MIS in the Region

SN	State/REC	MIS applied presently	Deficiencies	Remarks
1	Rwanda (EAC/CEPGL)	e-Soko (SMS)/ Radio/TV	Lack key market components /parameters such as product volumes, product quality standards, delivery details etc.	Phase 1 of e-Soko ending December, 2010, but MINAGRI will continue to support the program; As of today, about 30,000 people have sent SMSs inquiries through e-Soko, mainly about prices of different agricultural commodities (Pers comm., Arthur Byabagamba, RDB)
2	Burundi (EAC/CEPGL)	Radio/TV		Carrying out feasibility study on installation and use of e-Soko with VOXIVA company.
3	Kenya (EAC)	SMS/ Radio/TV	Mainly in the grain value chain	Making full use of RATIN services (based in Nairobi) through EAGC, slowly covering other member states within EAC sub-region; Membership 67 organizations within Eastern Africa; USAID-COMPETE support to smallholders to access markets; RATIN has also initiated AMITSA – information system on input (fertilizer) information system
4	Uganda (EAC)	SMS/ Radio/TV	Using private MIS service providers (several)	Started making use of RATIN services
5	Tanzania (EAC)	Newspapers/Radio/ TV		MIS used in few locations, and this might be attributed to issue of many tribal languages used.
6	DR Congo (CEPGL)	Radio/TV	Negotiating on use of Rwanda e-Soko within North and Southern Kivu	Yet to install the system.
7	RATIN (Regional Agriculture Trade Intelligence), Nairobi, Kenya.	SMS/Monthly Bulletins/Internet	Covers only six commodities – Maize, beans, rice, wheat, sorghum & millet. Countries covered – Kenya, Uganda, Tanzania & Rwanda.	Yet to be adopted fully across member states