PineApple Project

Operational Concept Description

1 December 2012

1. Scope.

1.1 Identification.

This version of the Operational Concept Description (OCD) was created for the December 2012 Global Random Hacks of Kindness (RHoK) event.

1.2 System overview.

The PineApple Project aims to bring an aggregation of public data sources and crowd-sourced data to subsistence farmers in the equatorial regions of the world to assist them with making planting decisions for their location using readily available technologies (for example, flip phones and feature phones).

1.3 Document overview.

The OCD describes the problem being addressed, justification for the proposed solution, a high-level description of the solution, some typical use cases, and an analysis of the proposed solution.

2. Referenced documents.

(Clause, 2012) Victoria Clause. “GSMA mAgri publishes new infographic: Agricultural productivity gap & the opportunity for mobile.” GSMA. 2012. Online: http://www.gsma.com/mobilefordevelopment/gsma-magri-publishes-new-infographic-agricultural-productivity-gap-the-opportunity-for-mobile/

(Crouse, 2012) Ron Crouse. “Climate and the Ocean.” *Water Encyclopedia.* Advameg. 2012. Online: http://www.waterencyclopedia.com/Ce-Cr/Climate-and-the-Ocean.html#b

(World Bank, 2008) The World Bank. *World Development Report 2008: Agriculture for Development.* The World Bank: Washington, DC. 2007.

3. Current system or situation.

3.1 Background, objectives, and scope.

Forty percent of the developing world's population is engaged in small-scale farming (World Bank, 2008). These farmers are at a significant disadvantage, compared to farmers in the developed world: they have less access to information (many farmers in the developed world have agricultural extensions to support them and they have far better access to the Internet), they have less information about market conditions, and they have less clout when selling their goods.

The objective of the PineApple Project is to help correct this imbalance through a system that can provide information to support planting decisions and improve outcomes when taking the crop to market. The system must be capable of being used in a variety of environments, including the costly, low-bandwidth access available in much of the developing world.

The PineApple Project is targeted at farmers in the equatorial region, at present, although there is no reason it couldn't also be used in the rest of the world with an expansion of the crop database. The growing conditions data does cover most of the arable landmass of the Earth. The pilot effort is also focused on use with prepaid, standard cellphones; but future expansion will take advantage of smart phones and web browsers.

3.2 Operational policies and constraints.

Some of the significant constraints faced by this project are the high cost of data access in much of the developing world where even a text message usually has an associated fee, lack of consistent growing conditions data throughout the targeted geographic areas, sparse geocoding facilities for remote areas in the developing world, and the possibility of intentional sabotage of the data (especially crowd-sourced pricing data) by entrenched interests or competing farmers.

3.3 Description of current system or situation.

Figure 3-1 shows the comparison between agriculture in the developing and developed worlds and the opportunity the use of mobile technologies presents to provide information to farmers in the developing world to help them improve their productivity.

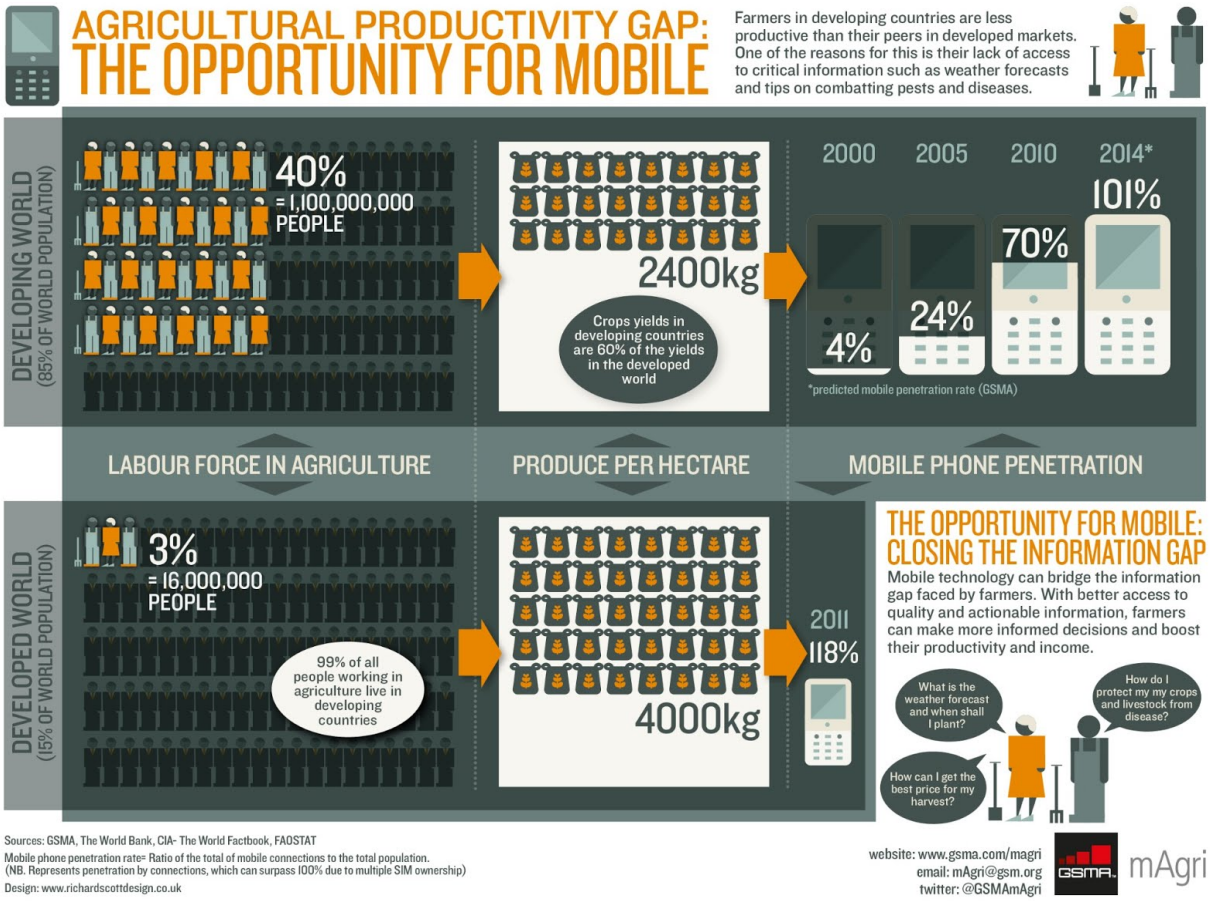

Figure 3-1. An infographic comparing the number of people involved in agriculture in the developing and developed worlds, their relative productivity, and projected mobile phone penetration in the developing world (GSMA, 2012).

While farmers in the developed world have access to many resources to improve their yields and their profitability, the same is not true in the developing world. And, while there are a number of advantages (mechanization, high-yield seed, targeted fertilizers, etc.) that farmers in industrialized agriculture have that help them achieve high yields with less effort, there are also a number of advantages in information accessibility that farmers in the developed world enjoy that those in the developing world don't have as much access to - things like agricultural research findings, market condition reports, and focused growing conditions data. This project aims to address this information gap by providing tools based on open source data and crowd-sourced data.

The information needs are not necessarily great. Just simple recommendations about which crops to plant in a given location at a given time of year can be very helpful. Add in crowd-sourced data about localized growing conditions and market demand and the recommendations become even more useful. Add market projections, crop rotations, pest and disease data, and a peer exchange for goods and you have a very powerful tool.

There have been other tools that have tried to satisfy this need, but they often require broadband data access or smart phones, capabilities that are improving in the developing world, but that have not reached the point of being widely accessible to the majority of subsistence farmers. For most of the citizens of the developing world, a cell phone is an essential, but very expensive, tool. When even sending a text message can cost up to 10% of your daily income, you are not likely to make widespread use of web-based or smart phone apps. That's why the PineApple Project is trying to do as much of the data aggregation, processing, and recommendation generation on the server side as possible. A farmer should be able to make one query and get a useful recommendation.

3.4 Users or involved personnel.

The PineApple Project is intended for use by subsistence farmers in equatorial and tropical regions, as shown in Figure 3-2. It may also be a useful tool for Non-Governmental Organization (NGO) personnel working in the region.

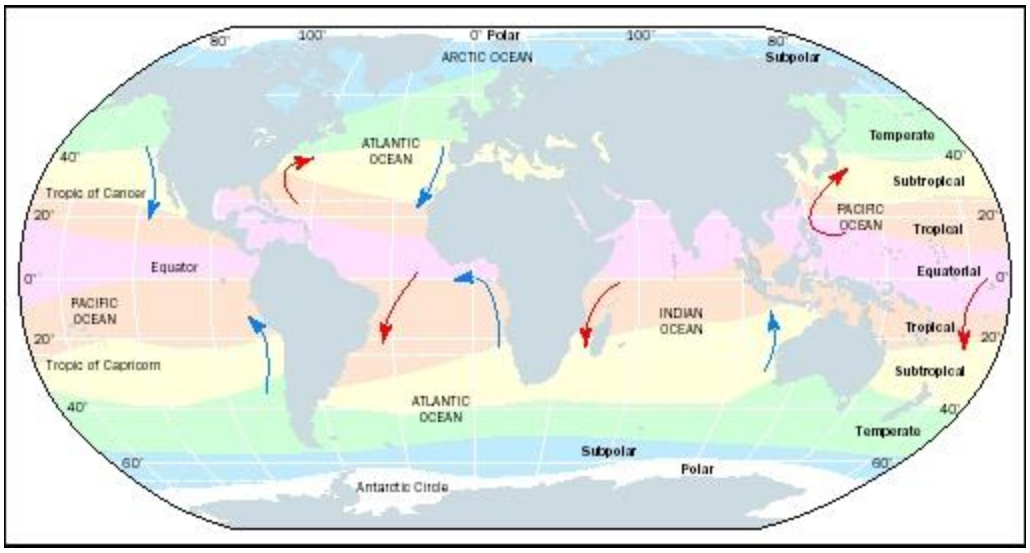

Figure 3-2. Map of the global climate regions. This project is focused on the equatorial and tropical regions (Crouse, 2012)

3.5 Support concept.

There is not an existing system that serves the information needs of subsistence farmers.

4. Justification for and nature of changes.

4.1 Justification for change.

As noted by the World Bank, the increasing number of handsets and area of coverage in developing nations serves two vital functions in improving the livelihood of subsistence farmers:

1. Access to market and pricing data to maximize monetary returns and
2. Using handsets and low-cost laptops to provide the educational function typically performed by extension services in developed nations.

The PineApple Project intends to address both of these needs for subsistence farmers.

4.2 Description of needed changes.

The PineApple Project will have server-side databases and processing to make the recommendations to the users of the system and will support three types of client, depending on the availability of data for the farmer:

1. A low-bandwidth mobile solution (typically a prepaid flip phone or feature phone).
2. A higher-bandwidth mobile solution (i.e., a smart phone ot tablet).
3. A broadband solution that may or may not be mobile (laptop or desktop).

The system will also provide recommendations based on data obtained through different levels of user interaction:

1. A recommendation based solely on matching growing condition data obtained from open data sources, selected by geolocation, and matched to a simple crop database.
2. A recommendation that includes open-source market data.
3. A recommendation that includes issues such as crop rotation and biogenetic diversity.
4. A recommendation that includes crowd-sourced pricing data.
5. A recommendation that includes crowd-sourced and/or localized growing condition and crop data.
6. Supplements to the recommendation, such as growing tips and pest/disease information.

In all cases, the system should minimize the number of interactions required and minimize data transmission costs.

4.3 Priorities among the changes.

The priorities for the PineApple Project are:

1. Implement the low-bandwidth solution and the first level of recommendations, as described in section 4.2.
2. Add the second level of recommendation.
3. Add the third level of recommendation.
4. Add the fourth level of recommendation.
5. Implement the higher-bandwidth mobile solution.
6. Implement the broadband client.
7. Add the fifth level of recommendation.
8. Add the sixth level of recommendation.

4.4 Changes considered but not included.

Assuming that the growth of broadband access is going to continue at a fast pace in the developing world and skipping the low-bandwidth solution. This approach did not seem prudent at this time.

4.5 Assumptions and constraints.

The assumptions for the project are that field testing will be possible after each implementation of functionality and that data access will continue to be the critical technical limitation for the foreseeable future.

5. Concept for a new or modified system.

5.1 Description of the new system.

Figure 5-1 shows a block diagram for the system as described in section 4.

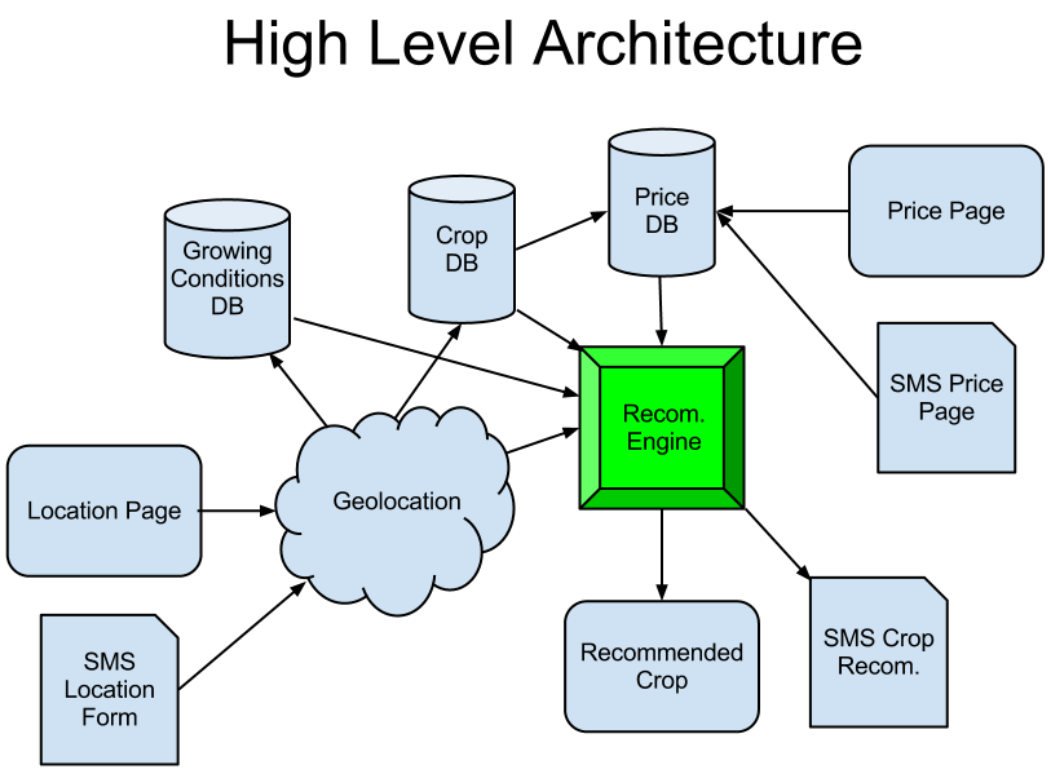

Figure 5-1. Block diagram of PineApple Project.

The recommendation engine is the heart of the system. It takes a geolocation from either the device or the output of a geocoding service, finds the location in a grid cell of the growing conditions database, compares the retrieved growing conditions to find matching crops in the crop database, finds pricing data for that crop and region in the price database, and makes a recommendation or recommendations for the crop to grow in the location at the current time.

The interface to the system can be Short Message Service (SMS), mobile apps, or a web browser. On the server side, the processing is the same.

5.2 Users/affected personnel.

The PineApple Project is expected to be used by subsistence farmers in equatorial and tropical regions and by NGO personnel.

5.3 Support concept.

The system needs to operate on the existing infrastructure in the target regions.

6. Operational scenarios.

The following use cases describe typical usage scenarios for the PineApple Project.

7. Summary of impacts.

7.1 Operational impacts.

To be useful to the subsistence farmers the PineApple Project is attempting to assist, the system should provide valuable information without additional costs or equipment. This can be a challenge in many areas of the developing world where SMS costs, while trivial to us, can be prohibitive for a user in these areas and where ubiquitous Internet connectivity doesn't exist.

7.2 Organizational impacts.

Hosting arrangements need to be made to serve the clients in the equatorial regions, service agreements need to be made with service providers in the targeted area, and relationships with people on the ground in these areas need to be established.

7.3 Impacts during development.

The primary issues for the development of the system are related to the distributed and inconsistent development schedule for the project. Much of the development has been done at hackathons, which means that many of the assets are spread around a number of hosting sites and cloud stores. A centralized repository needs to be established and a single host for the system set up.

8. Analysis of the proposed system.

8.1 Summary of advantages.

The primary advantage of the system is that it can help to address the information imbalance for subsistence farmers and improve their livelihoods through improved utilization of land and better revenue from their crops.

8.2 Summary of disadvantages/limitations.

The primary disadvantages for the system are the technological limitations and publicizing the data in the developing world. Getting good quality, timely data for the databases is also a challenge.

9. Notes.

9.1 Acronyms

Acronym	Meaning
DB	Database
NGO	Non-Governmental Organization
OCD	Operational Concept Description
SMS	Short Message Service