IE 482 – Humanitarian Logistics

The Broccoli Project Case Study

Persistent Access to Food Security Through the Use of Biometrics, Low-Cost Computing and Logistics

by

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1. Introduction

In developing countries, high unemployment rates can lead to high levels of crime and life decisions that can have adverse long-term effects. Controlled life decisions such as keeping a child at home to work rather than sending them to school because of the opportunity costs and also uncontrolled decisions such as food insecurity - the long-term effects of malnutrition in children - can cause a lifelong problem with learning[1].

The Broccoli Project [http://broccoliproject.org] is „a rewards program for the poor" that provides rewards in the form of vouchers to its participants. It is similar to the successful Latin American Conditional Cash Transfer [CCT] Programs that reward the participants with cash for activities such as keeping children in school and preventative healthcare. The reader is directed to the web references from the World Bank[2] and Wikipedia[3] for an in-depth discussion on the implementation of such programs.

The Broccoli Project takes the idea of a typical rewards program where certain behaviors are linked to the accumulation of a stored value that can at a later stage be redeemed for a reward – it attempts to change purchasing behavior and reward this appropriately.

A typical commercially based rewards program can be described[4] as having the following components:

§ *A storage of value accrued by the purchases and behavior of the subscriber*

§ *Hard benefits, which include monetary, product or service rewards that can be acquired by the subscriber in exchange for the accrual.*

§ *Soft benefits, which include non-financial advantages that program members receive that, are not available to the general public.*

§ *Surprise and delights, such as promotional opportunities like coupons or double points, or unannounced benefits.*

[1] http://www.unicef.org/sowc98/silent.htm
[2] http://go.worldbank.org/DQDGRMU2W0
[3] http://en.wikipedia.org/wiki/Conditional_Cash_Transfer
[4] http://www.docstoc.com/docs/1744637/DMGuideto-MultichanelMkt077506

The Broccoli Project puts a value on social behavior change as a valuable activity for both the individual and the community they live in. By promoting positive social change, the cycle of poverty can be broken.

It is often because basic needs are not met such as food, shelter and clothing that the poor might resort to petty crime – this can lead to a reinforcement of such behavior which results in a life of crime, poverty that perpetuates the poverty cycle.

The Broccoli Project aims to break this cycle by providing a framework that provides an alternative to crime giving in effect a safety net that will provide essentials, such as food, shelter and clothing.

The Broccoli Project has developed a set of technologies and processes that enable the impoverished to perform socially beneficial actions such as taking an HIV/AIDS test, cleaning up communities, collecting certain types of plastics and in return for these deeds, the participants will receive vouchers that can be exchanged for food, clothing and other basic needs.

Fig 1.1 Biometric Registration

Fig 1.2 Vouchers for Food

Participants perform activities to accumulate points that can be converted to vouchers that in turn can be used for basic needs such as food, shelter & clothing. The selection of products is based[5] on Maslow's hierarchy of needs shown below in Fig 1.3.

[5] http://en.wikipedia.org/wiki/Abraham_Maslow

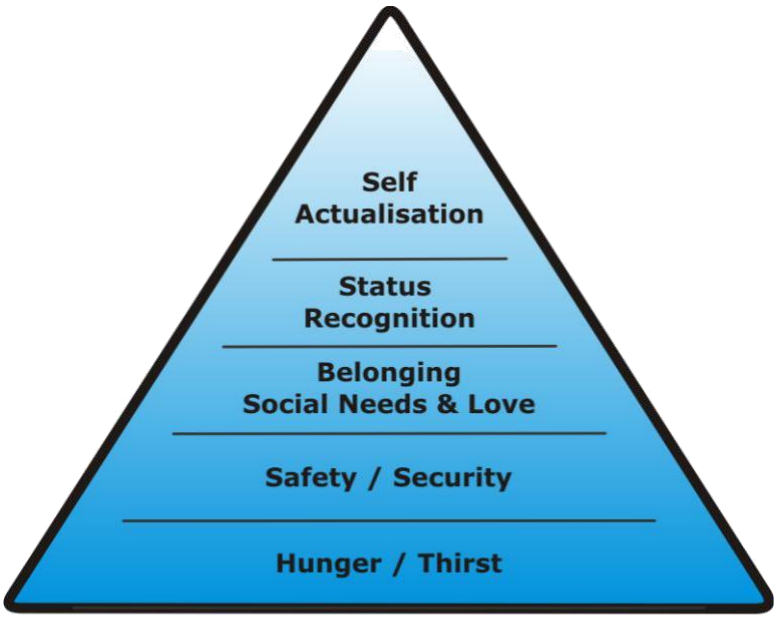

Fig 1.3 Maslow's Hierarchy of Needs

There are many ways to accumulate points: getting an HIV test, attending skills development programs, keeping children in school, and attending preventative healthcare workshops – learning how disease is controlled and managed.

The main objective of these programs is to help people to break the cycle of poverty.

2. Problem Definition

To gain traction in rural areas, we will require the development of an outdoor, rugged system (called a Broccoli Point) that will address the maximum amount of people for the lowest number of devices deployed. Efficiently utilizing scarce resources is critically important and applying operations research tools will be beneficial in the service network design and distribution logistics decisions.

Fig 2.1 A Broccoli Point

With this project we aim to develop a plan of action to deploy an effective network of hardware that will enable participants to register and provide access to food security, and will also provide education about HIV, employment opportunities, and in working with local government will look to replicate the learning nationally and ultimately globally.

The main concept that we will pursue is the optimal placement of ***Broccoli Points***. A Broccoli Point is a point of access for vouchers of any sort that will be accessed by biometric sign-in. In this case, biometrics refers to a fingerprint-scanning device that authenticates the identity of the individual presenting him/herself. For a deeper discussion on biometrics, the reader is directed to online resources on the subject[6].

[6] http://en.wikipedia.org/wiki/Fingerprint_recognition

With the help of biometrics, a person can have access to vouchers at any time (as long as s/he reaches a Broccoli Point).

A central idea of a Broccoli Point is that it will be persistently available at any time and in cases of emergency when no other support structure is available -a food voucher can be accessed by using his/her fingerprint (provided s/he has accumulated points through a Broccoli Project based activity).

3. Logistics Constraints

Each Broccoli Point should satisfy the following requirements:

1. The Broccoli Point should be within the coverage of a cellular signal.
2. The Broccoli Point should be at a spot that could be maintained.
3. The Broccoli Point should be "*nearby*" to clinics so that HIV-positive people will be inclined to go and get a test as an incentive to gather points for food vouchers.
4. The Broccoli Point should also be "*close enough*" to a redemption point such as Pick n Pay[7] so that people can easily redeem their vouchers they have printed from the Broccoli Point.

Based on these limitations, we aim to find the *best* locations for the Broccoli Point. The *best* location will depend on the criteria defined. We will develop different solutions for different criteria and compare the alternatives.

4. Case Questions

The base scenario represents the current situation in Cape Town, South Africa. One of the main ways that people get food vouchers is by getting HIV tests. Transportation is difficult and costly in Cape Town. Thus, we plan to design a system so that people can reach the clinics to get HIV tests so that they get food vouchers that can be redeemed at a redemption point such as Pick n Pay. The

[7] http://www.pnp.co.za

base scenario will aim to locate Broccoli Point which are:

- "*near*" to people"s houses, so that people can reach those points
- "*near*" to clinics so that people can go and take a test in case they do not have any points gathered when they need a food voucher
- "*near*" to redemption points so that people can go and redeem the printed food vouchers.

To this end, the three distances of interest are:

1. District-to-Clinics (How far from home to where I can get healthcare)
2. Clinics-to-Redemption (How far after I get care can I get food)
3. District-to-Redemption (How far from my home to get food)

Fig 4.1 depicts the locations from Google Maps.

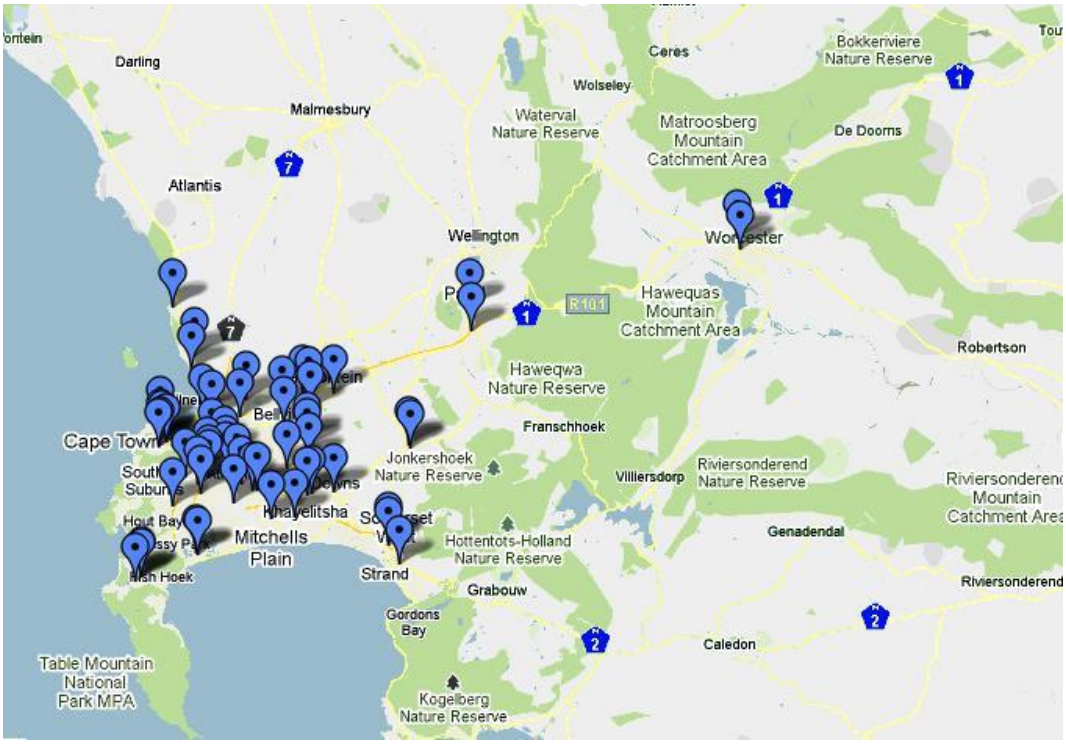

Fig 4.1 Google Map of locations, districts, clinics, and redemption points

Considering the problem description, you need to answer three questions:

A) Try to cover all districts while minimizing the number of Broccoli points required to do so. Where do you place your BP's?

B) The decision-makers want to see how coverage changes based on the number of installed Broccoli points. Make a systematic sensitivity analysis to demonstrate how many people can be covered with fewer Broccoli points than the number you found in part A.

C) Try to minimize the maximum distance between the districts & the Broccoli points while covering all districts.