

FACILITATING AND PROMOTING URBAN AGRICULTURE THROUGH MOBILE PHONES

Victoria Foing

SUSTAINABLE DEVELOPMENT

What Is Sustainable Development?

According to the Brundtland Report in 1987, sustainable development:

- “Meets the needs of the present without compromising the ability of future generations to meet their own needs”
- Prioritizes the needs of the poorest individuals
- Recognizes the limitations imposed by technology and society

It is a multi-dimensional concept that encompasses:

- Environmental sustainability, “the ability to maintain rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely”
- Social sustainability, “the ability of a social system... to function at a defined level of social well being indefinitely”
- Economic sustainability, “the ability to support a defined level of economic production indefinitely”
 (“Sustainability”, 2014)

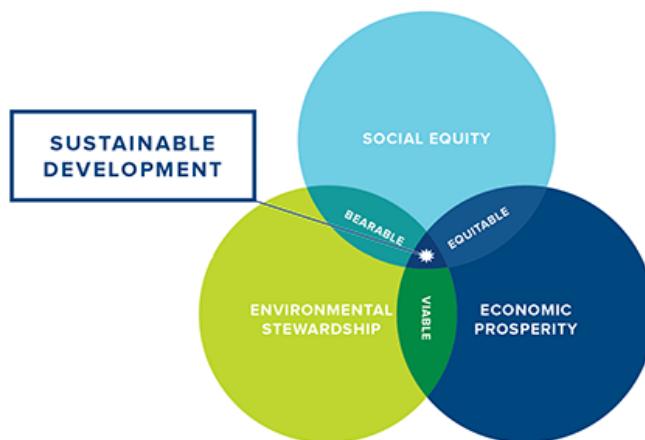


Fig. 1. A Venn diagram of Sustainable Development

Why is Sustainable Development Important?

Sustainable development is comprehensive and addresses multiple issues such as poverty, food insecurity, and climate change.



Fig. 2. The 2030 Agenda for Sustainable Development

According to the United Nation's *World Economic and Social Survey* of 2013,

- Poverty still affects more than one billion people
- Hunger and malnourishment affects nearly all of these people
- Greenhouse gas emissions and biodiversity loss have increased and threaten the environment

Sustainable development is crucial in developing countries because they are the major victims of poverty and food insecurity and are subject to dangerous urbanization rates. In the last two decades, rural-urban migrations have doubled the proportion of the urban population in developing countries and contributed to the rise of megacities (Mougeot, 2006). These rates are predicted to accelerate in the future. Many of the migrants arrive in these cities empty-handed, struggle finding jobs, and end up living in "slums and squatter settlements, without adequate clean water, sanitation... health care" or food (Mougeot, 2006). Due to the unplanned growth of these cities, the United Nations predicts that by 2020:

- The "global level of urban poverty" will grow from 30 to 50 per cent
- Food will continue to be a "basic luxury" for the urban poor
- Consumption and waste production levels will rise and pose greater harm to the environment

Sustainable development is less urgent in developed countries but still valuable as cities of the North have high ecological footprints. Climate change

is a global problem and requires global action so these countries cannot be excluded from the agenda. Secretary-General Ban Ki-Moon refers to sustainable development as “the major issue of our time” (UN/DESA, 2013). It is a task that must be addressed worldwide and indefinitely.

URBAN AGRICULTURE

Urban agriculture is “the growing, processing, and distribution of food and nonfood plant and tree crops and the raising of livestock, directly for the urban market, both within and on the fringe of an urban area.” It differs from rural agriculture because it involves a “close connection in space... with the ecology and economy of cities” (Mougeot, 2006).

Where?

Urban agriculture can be carried out in various unused spaces:

- “backyards... rooftops... window boxes”
 - “on roadsides, beside railroads, beneath high tension lines”
 - “in vacant lots of industrial estates”
 - “on steep slopes and banks of rivers”
 - “on the grounds of schools, hospitals, prisons, and other institutions”
 - “tanks, ponds, and pens in rivers”
 - “small plots of land” on the periphery of cities
- (Mougeot, 2006)

What?

Urban agriculture is flexible and adapts to local demands and supplies, and thus involves a variety of innovative farming systems:

- Animal husbandry (cattle, pigs, poultry)
- Aquaculture (seaweed, fish, shrimp, oysters)
- Agroforestry (trees, shrubs)
- Beekeeping (bees, honey)
- Horticulture (fruits, vegetables, herbs, medicinal plants, flowers)
- Social services (catering, recreation, education, therapy)

How?

In order to implement these farming systems, urban farmers need:

- Land
 - Training and education
 - Inputs (organic wastes, fertilizers, water, labor, technologies)
- (Mougeot, 2006).



Fig. 3. Urban Agriculture at McGill's Edible Campus

A tool for Sustainable Development

When the United Nations report defined sustainable development, it immediately recognized that urban agriculture could be used as a “tool for sustainable urban development” (Brundtland, 1987). This is because it can provide economic, social, and environmental benefits for all cities.

In developing countries, urban agriculture can contribute to:

- Economic empowerment, by enabling urban farmers to sell surplus products thus providing them with jobs and income
- Food security, by enabling urban farmers to self-provision thus providing them with reliable sources of food

In developed and developing countries, urban agriculture can contribute to:

- Environmental sustainability, by reducing pollution and food miles, recycling waste products and wastewater, and improving air quality
- Citizen and community well-being, by improving diets, health, lifestyles, social cohesion, and education

Evidence suggests that the benefits of urban agriculture can cascade into other development goals such as lowering child mortality and improving maternal health. Thus it is appearing more frequently on the “international agenda” as an essential component “of a comprehensive solution” (Mougeot, 2006). However, it is important to note that urban agriculture is not a total solution. Cities cannot “become self-sufficient in food” because they rely on “cereal crops” that can only be properly cultivated in rural areas and their ecological problems cannot be solved by urban farming systems alone (Mougeot, 2006).

Challenges for Urban Agriculture

There are health risks posed by polluted urban environments:

- Urban soils may be contaminated with “lead, arsenic, and other toxins”
- Air quality is poor due to car, factory, and power plant emissions
- Rivers may be polluted with urban runoff, sewer outflows, and garbage
- Pathogens and zoonotic diseases spread faster in dense urban areas

In developed countries, the main challenges are:

- Lack of space
- High cost of land and labor
- Lack of incentive, as there is food security and urban agriculture is often too expensive to be a “viable alternative to the supermarket”
(Corbould, 2013)

In developing countries, the main challenges are:

- Political opposition in the form of bans, fines, and harassment “due to public health, administrative, and social concerns” about urban farming
- Urban sprawl, leading to the destruction of urban and peri-urban farms for new buildings
(Corbould, 2013)

Governmental support and enabling policies are necessary in order to “maximize” the sustainable contributions of urban agriculture and “minimize” the political, financial, and health-related challenges (Mougeot, 2006).

MOBILE APPLICATIONS IN THE DEVELOPED WORLD

Mobile phones are ubiquitous in the developed world and are used for social, work and leisure purposes. “App culture” is prominent and many designers have taken advantage of this trend to create services for the greater good (e.g. apps donating to charity via the participation of users). Some believe that fusing digital technology and urban agriculture is counterintuitive because farming requires one to get away from a screen, go outside, and get their hands dirty. However, several design companies have managed to embrace digital technology as a strategy for facilitating and promoting urban agriculture. (Wiebes, 2013)

Sprout It

Sprout It is a Lifestyle application that teaches its user how to grow their own vegetables. It was released in 2013, designed in Ohio by Vaxa Design Group, and funded by Miracle-Gro. Its main features include:

- Processing the user’s ZIP code
- Giving the user customized growing and cultivation tips
- Updating the user with weather notifications and other alerts (Summers, 2013)

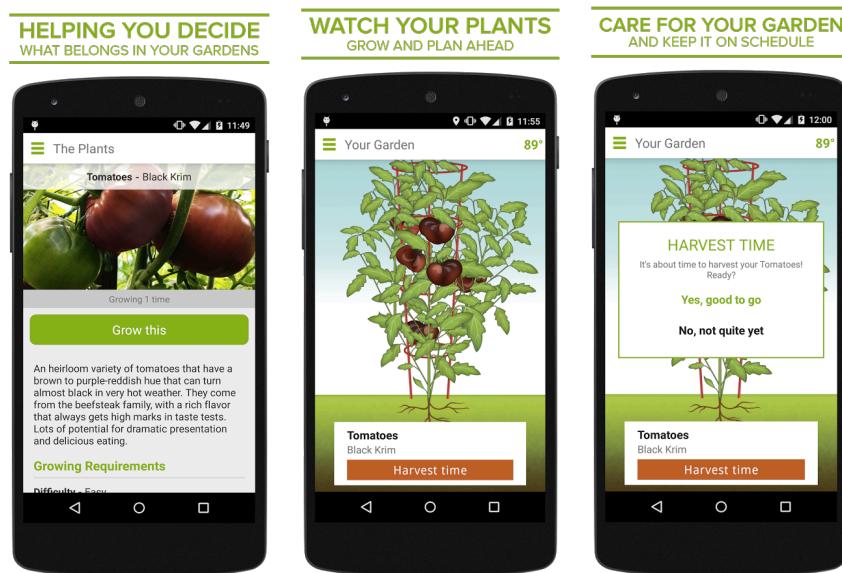


Fig. 5. Sprout It App

Stadseboeren

Stadseboeren is a Social Networking application that was released in 2013. It was designed in Den Bosch, the southern part of the Netherlands, by Concepten Bouwers and is funded by the province as well as a Creative Industries Fund. It seeks to:

- Connect users with other city farmers
- Notify users about related events
- Let users trade their crops with a barter section
(Wiebes, 2013)



Fig. 6. Stadseboeren App

Urb.ag

Urb.ag is a Web application recently developed in Boston by Fathom Information Design and the Mayor's Office of Food Initiatives and is sponsored by the Knight Foundation. In 2013, the city of Boston adopted a framework for citywide urban agriculture but the legal jargon was hard to understand. This application solves that by:

- Translating complicated zoning laws into useable information
- Guiding Bostonians through the process of starting their own commercial farms
(Ducharme, 2014)

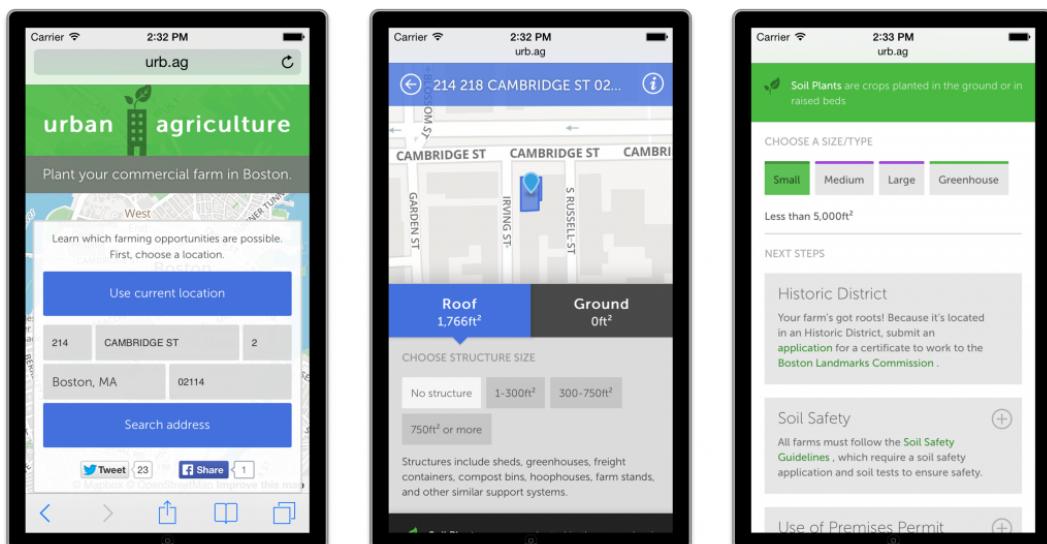


Fig. 7. Urb.ag App

Achievements and Challenges

How well did these apps seize the opportunities and address the challenges of urban agriculture in developed areas?

- All three applications educated users about sustainable farming methods and encouraged them grow and eat local vegetables
- Sprout it urged users “to not garden alone, and to stay connected”, Stadseboeren connected urban farmers online and in real life, Urb.ag did not focus on community development
- Urb.ag and Stadseboeren were based in regions where policy towards urban agriculture was favorable
- None of the applications addressed financial challenges

Technological Difficulties, User Adoption, Accessibility

These are the three challenges that all mobile apps inevitably have to face.

- Sprout It uses a lot of data and constantly crashes
- All three applications are appealing, personal (allowing for individual profiles and location-specific services), fun to navigate, free, and compatible for iPhones and androids
- There are very few reviews of these applications and the majority of them are negative

Five Borough Farm Data Collection Toolkit

In New York City, city gardeners are tracking the value of urban farming with the Five Boroughs Data Collection Toolkit. This is a guide that helps urban farmers gather five categories of data on their farms:

- Food production (crop count, harvest count)
- Environmental (landfill waste diversion, compost production, rainwater harvesting)
- Social (participation, skills and knowledge, sharing with other gardens, reach of programs)
- Health (attitude changes, good moods, healthy eating, beauty)
- Economic (market sales, donations of food)

The urban farmers submit the data to the ‘Barn’ database so that it can be:

- Organized in a presentable format
- Presented to politicians, grant organizations, and developers
- Employed as a political tool for advocating urban agriculture (Farming Concrete, 2015)

Welcome to the Farming Concrete Barn, where you can store the data you collect with the Farming Concrete Data Collection Toolkit, developed by the Design Trust for Public Space in collaboration with Farming Concrete.

If you are a gardener and would like to start entering data, please [log in](#) first. If you don't yet have a login, you can [create one now](#) if you are just visiting, we will eventually have some public reports here for you to view.

If you have any problems or questions, please email us at [gardens \(at\) farmingconcrete \(dot\) org](mailto:gardens(at)farmingconcrete(dot)org).

Data © OpenStreetMap, Imagery © Mapbox

[REGISTER](#) [LOG IN](#)

Fig. 8. The Farming Concrete Barn that stores data from the toolkit

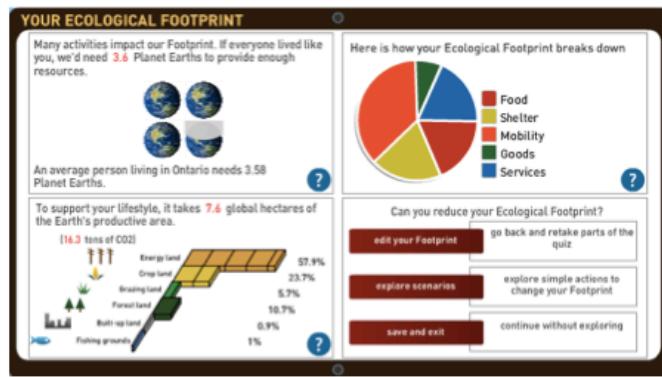
Suggested Improvements

In order to overcome political and financial obstacles and address issues of technological difficulty, user adoption, and accessibility, these applications should focus on:

- Building incentive
- Improving access to resources
- Encouraging users to stick and make progress with the application
- Sharing the urban farming phenomenon with non-farmers and marginalized groups

My recommendations for doing so are to incorporate:

- An ecological footprint profile, so that users can track their own achievements and positive contributions to the environment
- A map, that allows urban farmers to post notices if they are looking for space, training, organic waste, fertilizers, technologies, customers and volunteers, or partners for group-buying and group-selling purposes
- A point / award system, that enables friendly competition and personal goal-setting to motivate users to:
 - Collect data with the Toolkit and contribute to the Barn database
 - Share the application with others in their social networks
 - Reduce their ecological footprints



How much of the food that you eat is locally grown or produced?

How much of your diet is based on fresh, unpackaged foods?



Most of the food I eat is locally grown or produced



Fig. 9. Example of Ecological Footprint Profile from Footprint Network

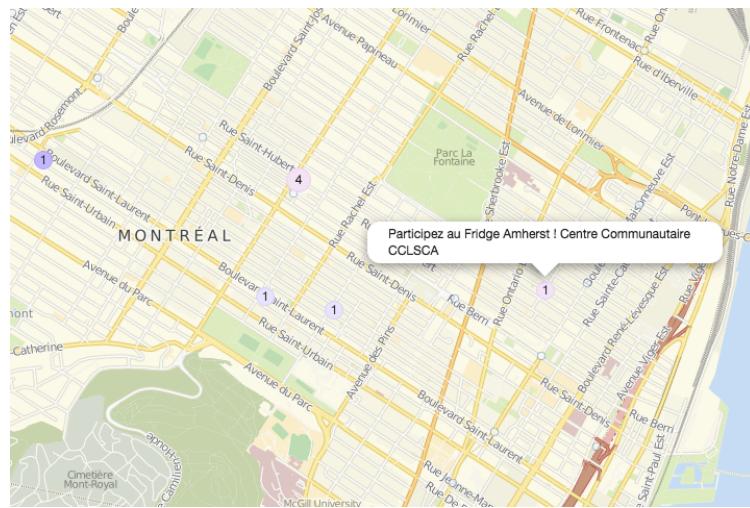


Fig. 10. Example of Map that markets various initiatives from Craigslist

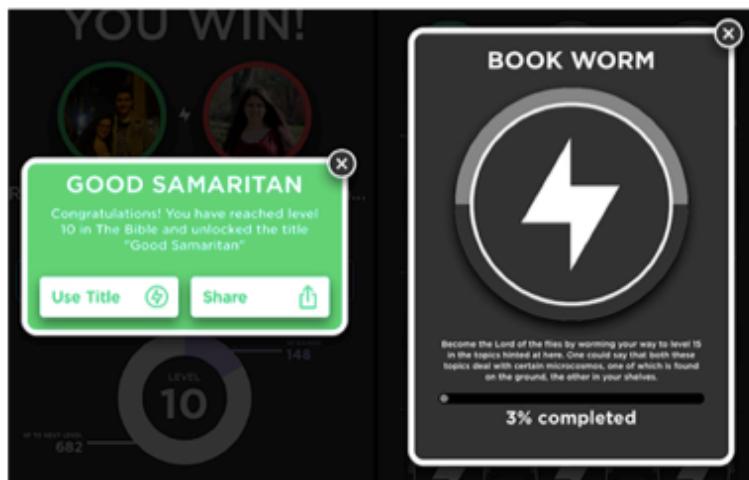


Fig. 11. Example of Award System from QuizUp, a Trivia application

Since simplicity addresses issues of technology, adoption, and reach, computer scientists and designers should make sure that these features do not require a lot of data and that the menu for navigating between them is straightforward.

MOBILE APPLICATIONS IN THE DEVELOPING WORLD

There has been a boom in mobile phone use in the developing world. In the last decade, the number of people with mobile phones has risen from 8 to 80 per cent (Alamenciak, 2015). The “mobile revolution” has been characterized by several limitations in order to remain affordable and pragmatic to its users. The most suitable phone for the developing world is a cheap rugged Android with long-lasting battery and simple SMS and voice features that use only little bandwidth. These limitations have nonetheless “[fuelled] tremendous creativity”: particularly, the invention of simple mobile applications that improve access to services in the agricultural sector (Kochi, 2012). For decades, rural farmers in the South have been disconnected from important sources of information that could help them improve their crop yields and economic transactions. Mobile applications that enabled access to these services have contributed to the food production and incomes of rural farmers.

Free Basics

Recently, Marc Zuckerberg announced a new application called Free Basics that gives everyone in India free access to Internet services. He cites the example of a farmer, Ganesh, who used the application to read about monsoon patterns on AccuWeather and commodity prices on Reuters Market Light. As result, Ganesh was able to “[double] his crop yield”, get rid of insects, and “invest in new crops and livestock” (Zuckerberg, 2015).



Fig. 12. Ganesh and his wife Bharati

M-Kilimo

In Kenya, a voice-based application called M-Kilimo allows farmers with mobile phones to speak with helpline experts who:

- Answer queries about agricultural practices, plant and animal diseases, weather forecasts and market prices
- Are available every day from 7am to 11pm
- Refer complicated problems to a second line of help
(Pshenichnaya and Westhead, 2012)



Fig. 13: M-Kilimo Flyer

Tigo Kilimo

A similar mobile application called Tigo Kilimo has been implemented in Tanzania which includes:

- Agronomic advice on 10 major crops, weather forecasts, market prices
 - Free USSD and SMS channels and charged interactive voice responses and calls
- (GSMA, 2015)



Fig. 14: Tigo Kilimo USSD Menu

myAgro

In Mali, a text-based application for farmers called myAgro partners with local village vendors to sell high-quality agricultural inputs to farmers on layaway so they do not have to spend all their money at once.

- Farmers can purchase scratch cards with a user ID from local vendors
- They text the code on the scratch card to the myAgro number
- Every time they buy a card and do this, they can top up their myAgro accounts and save up money for fertilizer and seeds so that they can gradually raise their incomes

(Tamargo, 2015)



Fig. 15: Topping Up myAgro Account

Technological Difficulties, User Adoption, and Accessibility

- It was difficult to communicate complex questions and answers through limited connections
- This lead to some instances of unsatisfactory problem-solving such as confusing or irrelevant advice (GSMA, 2015)
- A lack of “literacy skills and technological knowledge” prevented some users from understanding the advice and utilizing it
- Many users did not trust the new technologies, especially not the older demographic, and could only become accustomed to them by slowly upgrading from simple technologies to more complex ones
- The most marginalized groups, who needed these services the most, lacked the resources (e.g. income, education) to properly access, use, and benefit from them
- Social imbalances can make it harder for women to access these services

(Heike, 2013)

Applications for Urban Agriculture

Considering the contributions that these applications have made to the economic empowerment and food security of rural farmers, the question remains if similar applications could be used to facilitate and promote urban agriculture. These applications would have to consider the challenges of pollution, illegality, and urban sprawl in order to be effective.

SUGGESTED DESIGN CONCEPT: U-PRODUCE

U-Produce is a collective mobile application that is heavily inspired by the feats of Free Basics, M-Kilimo, Tigo Kilimo, and myAgro and offers the following three services: U-Information, U-Support, and U-Feedback. Every user registers by dialing ***101*10#** and is asked to create a profile including his or her name, age, gender, location, income, experience, and goals (self-provisioning or extra income). The application works in conjunction with:

- Local weather stations, to receive up-to-date weather forecasts
- The Ministry of Agriculture, to receive daily market prices
- Landowners, politicians, and developers, to create inventory of available and suitable land for urban farming in the city
- Research institutions, universities, NGOs, to compile research on the most prosperous urban farming systems in the city and provide knowledgeable workers for training and educating farmers
- Local vendors, waste recycling depots, and water treatment plants, to catalogue the available agricultural inputs and establish layaway systems
- Community-based organizations that increase the role of women and other marginalized groups in urban farming

U-Information

A voice-based helpline specifically tailored to urban farmers. Helpline experts offer information in the form of Urban Farming Advice, Market Prices, and Weather Forecasts.

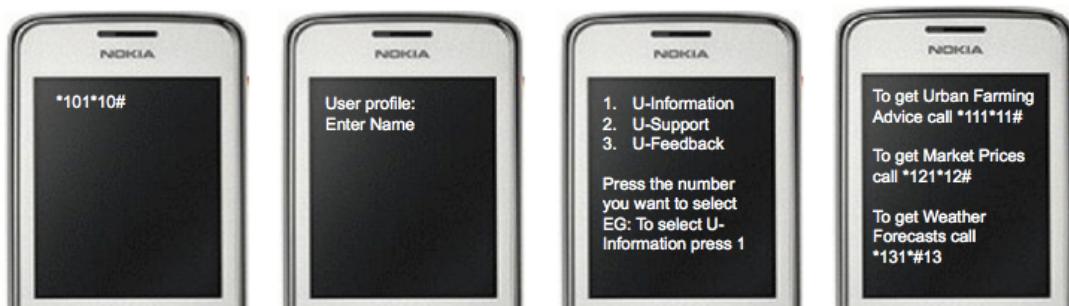


Fig. 16. Registration, User Profile, Home Menu, U-Information Menu

The Urban Farming Advice option consists of three specific categories.

Land, in which helpline experts will:

- Consult an inventory of available and suitable land
- Recommend land plots to users if they are accessible them (i.e. if they match the location, income, experience, goals in the user profile)
- Refer users that have trouble accessing these land plots to U-Support

Practices, in which helpline experts will:

- Consult a database of local and regional urban farming systems
- Recommend urban farming systems (e.g. horticulture, animal husbandry, aquaculture) to users if they match the land plot chosen and can be implemented by the user
- Provide advice on how to avoid pollution and health risks (e.g. using raised beds, using treated wastewater, using pesticides safely)
- Provide advice on starting and maintaining specific farming systems
- Refer users that do not have the resources to implement these farming systems to U-Support

Inputs, in which helpline experts:

- Consult a database of locally-available fertilizers, organic wastes, treated wastewater, and technologies
- Recommend inputs to users if they match the urban farming system chosen, the land plot chosen, and are accessible to them
- Refer users that have trouble accessing these inputs to U-Support

U-Support

U-Support is a text-based service that helps marginalized urban farmers gain access to land, training, and agricultural inputs by:

- Referring them to community-based organizations (e.g. female organizations) that will help them gain access to land
- Providing layaway systems (similar to myAgro) for training and agricultural inputs through scratch cards from local vendors



Fig. 17. U-Support Menu improving access to land, training, and inputs

U-Feedback

U-Feedback consists of an SMS-based and voice-based survey that tries to assess the impact of the application so that it can be tailored to its users. The first survey will collect “better”, “same”, or “worse” assessments regarding:

- Food security
- Income
- Health
- Happiness

The second survey will ask users about successful experiences, complaints, and suggestions and allow them to elaborate on their feedback verbally.

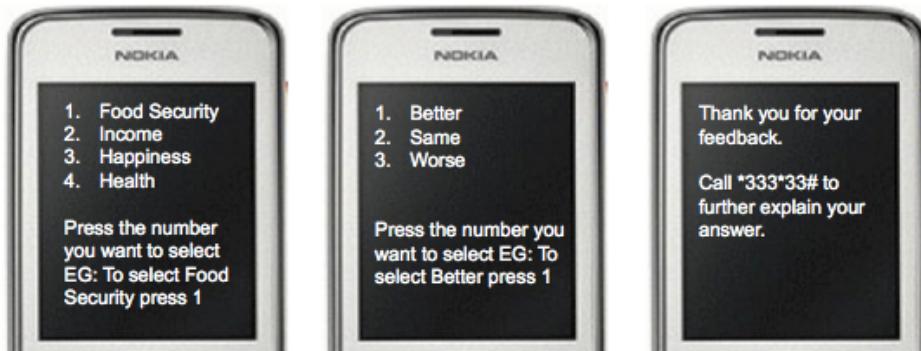


Fig. 18. The U-Feedback process

If responses are positive, this process can contribute to the case for urban agriculture and be used to influence policies that promote, facilitate, and protect it. All the feedback, including failures, will be logged so that it can be used in future scenarios and shared within regional networks. The application will be simple, malleable to its context and users, and well integrated into the political, educational, and scientific institutions of the city.

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Fig. 2: <https://sustainabledevelopment.un.org/?menu=1300>

Fig. 3: <https://www.mcgill.ca/redpath/channels/event/if-trees-could-talk-mcgills-edible-campus-226029>

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Fig. 5: <https://play.google.com/store/apps/details?id=com.vaxadesign.sprout>

Fig. 6: <http://www.conceptenbouwers.nl/?p=83>

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Fig. 8: <https://farmingconcrete.org/barn/>

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