

# Rooftop Gardens for Sustainable Livelihoods in Cape Town



## Abstract

High rates of unemployment afflict Cape Town, especially in the informal settlements surrounding the city. This project developed a rooftop gardening programme to create employment opportunities for unemployed and poor Cape Town residents. The rooftop gardening programme can promote job creation, entrepreneurship, and local food production, and if implemented at a large scale, could have a positive impact on dozens of low income households in Cape Town. Through GIS mapping, market research, and cost and revenue calculations, we have developed a programme to implement rooftop gardens in the Central Business District of Cape Town.

*This project summary is part of an ongoing research programme by students and faculty of the WPI Cape Town Project Centre to explore and develop with local partners options for sustainable community development in South Africa.*

*For our full project report: <http://wp.wpi.edu/capetown/homepage/projects/p2012/rooftop>*

*For more about the Cape Town Project Centre: <http://wp.wpi.edu/capetown/>*

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## Sponsors

The City of Cape Town's  
Office of Sustainable  
Livelihoods

Touching the Earth Lightly  
(TEL)

*An Interactive Qualifying Project to be submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor Science.*

## Problem Statement

Unemployment is a major issue in South Africa, rooted deep in the country's history. At the end of apartheid in 1994, over a third of the labour force was unemployed. High unemployment rates are partly due to rapid industrialization and urbanization in the mid-1970s, which caused a population shift to urban areas in search of opportunities that did not exist in the rural areas. High unemployment rates also stem from the social and economic structure of the country under apartheid. Businesses were given tax breaks on capital investments that adopted labour-saving practices. Instead of employing large numbers of unskilled workers at low wages, smaller numbers of skilled workers were hired at higher wages (Nattrass, 2004). The opportunities that so many had come to the cities to find were few and far between. Recent surveys show that there are continuing high levels of unemployment

and that the current economy of Cape Town favours skilled labour positions over unskilled positions, such as gardening (City, 2009).

A study done by Kingdon and Knight looked at unemployment rates among different groups showing that certain groups are more likely to enter into and remain unemployed than others. Their data showed that 41.2% of Africans were unemployed, compared to only 6.3% of whites. 38.7% of people with no formal education were unemployed, compared to 5.7% of people with higher than secondary level educations. This suggests that although employment opportunities may be available, many of the unemployed don't have the education or skills to fill the positions (Kingdon, 2005). According to a recent report, 74.7% of individuals in a Cape Town informal settlement, The Graveyard Pond, have not been able to find full-time jobs (Drivdal, 2011).

With high rates of unemployment and poverty in Cape Town, the City government has emphasised creating sustainable livelihoods for the disadvantaged. The City's Office of Sustainable Livelihoods has led this programme, which aligns with their mission to create jobs for the unemployed while stimulating the local economy and promoting environmentally friendly practices. Local gardeners grow high market value produce on rooftops in the Central Business District (CBD), creating jobs and developing entrepreneurship.

## Mission Statement and Objectives

The goal of this project was to stimulate discussion and reflection among stakeholders regarding the feasibility of creating jobs through growing high value produce on rooftops and selling the produce to local

restaurants. To achieve this goal, the following six objectives were created:

1. Outline the management and staffing of the programme.
2. Determine what plants will be grown and how they will be produced.
3. Determine the start-up costs, recurring costs, and projected revenue of the pilot garden and entire programme.
4. Develop a proposal to implement a pilot rooftop garden.
5. Investigate market interest in the programme.
6. Find sites for the rooftop gardens within the CBD.

## On the Ground in the Sky

Stephen Lamb, the founder of Touching the Earth Lightly (TEL), was appointed to construct a rooftop garden on the 44 Wale



Figure 1: Our area of study, the Cape Town city bowl





Figure 2: Street level view of the 44 Wale Street rooftop garden

Street government building. We had anticipated that this garden would be a source for concrete data, such as production levels and effects of uncontrollable variables. Once we were on the ground in Cape Town, we realised that the project was not as far along as we had thought. This rooftop garden was meant to be a showcase, rather than a test bed for micro greens and oyster mushrooms.

Our sponsors' goal for the project was to contribute to the improvement of the quality of life for the poor in Cape Town while promoting resource efficiency. They were looking for us to provide them with hard statistical data they were lacking, such as

how much rooftop space is available in the CBD and the economic viability of the project.

After initial meetings with our sponsors, our reflections left us with some major questions regarding the feasibility and sustainability of the programme.

- Since job creation is the purpose for the programme: How much rooftop gardening space and associated revenues from food production do you need to sustain one job? Where can we find workers and how will they be selected? How will the workers be trained?
- In regards to the management hierarchy of the programme: What positions are required for a sustainable programme? Who will supervise the workers? Who will manage the gardens once they are operational? What scale must the programme be started at to ensure the hierarchy can be sustained?
- From a financial standpoint: How much money is required to start-up the programme? How long will it be until the gardens generate revenue? Will this revenue be enough to cover costs? Can revenues support the expansion of the programme?

## Key Accomplishments

We developed the basic structure and rationale for a rooftop gardening programme. Our key accomplishments are:

1. Developed a framework for a sustainable multi-rooftop gardening programme
2. Developed revenue projections that suggest the programme could sustain jobs
3. Assessed market interest in the programme and produce
4. Identified potential rooftop gardening space
5. Stimulated discussion within city agencies and among key constituents
6. Generated interest among city agencies to fund a pilot garden on city property

7. Created a set of proposals to explain and market the programme

## Programme Framework

Stephen Lamb developed the idea to use unutilised space on rooftops in the CBD as venues for the production of oyster mushrooms and micro greens in order to create much needed jobs. Our team had the opportunity to transform this innovative idea into a feasible programme.

Valuable input from our sponsors was taken and developed into a framework for a sustainable multi-rooftop gardening programme. Multiple rooftop gardens are necessary for the start-up since one rooftop



Figure 3: Front cover of programme proposal

garden would not be able to support garden maintenance, worker training, and the incomes of its supervisor and gardeners. We established that the start-up rooftop gardening programme should be 1000m<sup>2</sup> of rooftop garden space tended by 10 full-time or 20 part-time gardeners, managed by one supervisor, and overseen by TEL. We developed a detailed proposal to find corporate funding for the programme. We also created a second proposal for a pilot rooftop

Table 1: Cost Capital and recurring cost

Capital Costs	
Cost Factors	Price (Rand)
Decking	500 000
Bolts and Fixings	291 667
Crates	62 500
Plants	13 858
Soils	55 491
Mushroom Cabinets	267 000
Construction Labour	148 692
<b>Total</b>	<b>1 339 208</b>
Recurring Costs	
Cost Factors	Annual Projection (Rand)
Training	100 000
Maintenance	150 000
Water	100 000
Seeds and Plants	110 000
Mushroom Growing Medium	7 700
Salaries for Gardeners and Supervisor	419 000
<b>Total (1 Year)</b>	<b>886 700</b>
<b>Total (2 Years)</b>	<b>1 773 400</b>
<b>Total Start-up Costs</b>	<b>3 112 608</b>

which will be used to generate concrete data, establish appropriate gardener training, and determine efficient gardening techniques.

## Monetary Inputs and Outputs

### Cost

Projecting the cost and revenue of the programme was crucial for the development of our proposal to both corporate funders and to city agencies. Our sponsors provided us with a cost breakdown for the rooftop garden at 44 Wale Street to supplement our research, which helped us to identify the necessary cost factors.

Once we refined the start-up cost, we determined the annual recurring cost, including salaries for two years and costs for training, maintenance, water, and seeds. In our proposal, we asked for funding to cover the recurring costs for the first two years, after which it is anticipated that the programme will generate enough revenue to pay the workers and cover its recurring costs.

Determining the start-up and recurring costs allowed the team to estimate the funding needed for the entire rooftop programme and a pilot rooftop garden on the Prestwich Memorial building. Initially, these costs were high and represented an ideal rooftop garden setup. Our sponsor saw the expense of the ideal rooftop and requested

Table 2: Revenue for the 1000 m<sup>2</sup> rooftop garden programme

Returns on Investment	Growing Space (m <sup>2</sup> )	Production levels (kg/yr)	Price per (Rand/kg)	Total Revenue (Rand/yr)	30% Revenue (Rand/yr)
Oyster Mushrooms	125	24 750	60	1 485 000	445 500
Alfalfa Sprouts	75	5 675	65	368 843	110 653
Mung Bean Sprouts	75	5 675	60	340 470	102 141
Brussel Sprout Micro Greens	75	5 675	29	162 291	48 687
Baby Butter Lettuce Sprouts	75	5 675	85	482 333	144 700
Baby Spinach Sprouts	75	5 675	48	780 244	234 073
<b>Total Revenue</b>				<b>3 619 181</b>	<b>1 085 754</b>

pricing for a less expensive pilot garden. We were able to significantly cut down our costs to make the rooftop programme and pilot garden feasible by finding cheaper ways to produce oyster mushrooms and taking out items like lattices that did not affect production.

### Revenue

At the beginning of the project, our sponsor stipulated that the rooftop gardens would

grow oyster mushrooms, alfalfa sprouts, mung bean sprouts, and brussel sprout micro greens. In order to calculate revenues, we researched the likely production levels and local wholesale prices. We had trouble finding these figures for the micro greens, so our sponsor suggested we extrapolate based on data of mung bean sprouts we could find at the grocery store. Based on this method, the estimated revenue numbers were extraordinarily high; according to

Table 3: Supervisor and gardeners' incomes

First Two Years Income (Salary Based)		After First Two Years (Percentage of Profit)		
Position	Salary (Rand)	Position	% Profit Allotted	Yearly Income (Rand)
<b>10 Full-Time Gardening Positions</b>	263,000	<b>10 Full-Time Gardening Positions</b>	45	286,089
<b>1 Supervisor</b>	156,000	<b>1 Supervisor</b>	25	158,939



our advisors, our revenues were overestimated by a factor of ten. We found a website which specialized in micro green production and gave production levels for micro greens based on weight and planting practices. Using these guidelines, we were able to generate more accurate revenue numbers. Since our calculations did not take into account several uncertainties, such as Cape Town's strong winds and hot summers, plant disease, variable germination rates, and the learning curve for the gardeners, we reduced our projected production volumes to 30% of the calculated value.

## Income

As part of the programme, we anticipate that for the first two years, the gardeners and supervisor will be paid a salary provided by the funding and the service provider will be paid based on profit. We plan for the gardeners to make the Cape Town minimum wage of R8.95 per hour and for the supervisor to make the average Cape Town salary for a manager in sales, which is R13 000 per month (Minimum, 2012; Salary, 2012). Salaries for two years at these rates have been incorporated into the funding request. 90% of any generated revenue during the first two years will go into the programme reserve and the remaining 10% will go to TEL.

After the first two years, the rooftop



Figure 4: Restaurant trifold pamphlet

gardens should be sustainable and the income of the gardeners and supervisor will be profit based, both of which need to be incorporated into the profit breakdown. To establish the profit breakdown, we first calculated 30% of our revenue that was projected assuming a perfect harvest which accounts for complications such as gardening mistakes, spoilage, plant disease, and weather damage. The adjusted revenue this generates is R1 085 754 (\$125 317). We subtracted the projected maintenance cost of R450 000, leaving a profit of

R635 754 (\$73 378). We determined that to match the incomes the workers received during the first two years, 45% of the adjusted profit will be divided amongst the gardeners and 25% will go to the supervisor. TEL will get 10% of the profit leaving 20% for the reserve. Table 3 shows the comparison of the incomes of the gardeners and supervisor for the first two years and for the years to follow. The incomes are nearly identical which will provide a smooth transition when incomes switch from salary to profit based.

## Market Investigation

In order for the rooftop gardening programme to be sustainable, an adequate market must be established. We generated a list of 99 restaurants in the CBD with addresses and contact information. Of these 99, we interviewed 11 to assess interest in the programme and found 5 restaurants

that would be willing to purchase the rooftop garden produce.

Through our interviews, we discovered crucial marketing strategies and ideas. During the start-up phase, the programme should market produce to small-scale, independent, and high-end restaurants. These restaurants require the type of high quality produce the programme is looking to grow at quantities matching projected production levels. We found that many restaurants require small quantities of a large variety of micro greens. Anticipating that there might not be sufficient demand for the produce, we decided to also produce baby butter lettuce and baby spinach, both of which are easily marketable. We developed an informational pamphlet (Figure 4) to be handed out to restaurants which can be found on the team's website.

## The Farm in the City

To address the question about potential rooftop garden venues, we used GIS map-



Figure 5: Available rooftop space in the Central Business District



Figure 6: Team at presentation

ping and Google Maps to determine all of the flat rooftop space in the CBD, allowing us to calculate the large scale potential for the programme. With Photoshop, we created images to highlight each available rooftop (Figure 5) and the congregate available space they formed. The team calculated that in the CBD there is approximately 162,000 m<sup>2</sup> of available rooftop space that could be utilised for gardening. We created a database with addresses of many of these buildings with their contact information which will be used by the City and TEL when moving forward with this project.

### Raising Awareness

An important aspect of our project was to develop a strategy to best represent the programme and market it to stakeholders. Over the course of our time in Cape Town, we had three presentations to city agencies and key constituents.

### Sustainable Livelihoods Network

We presented our programme during the Sustainable Livelihoods Network Meeting on November 1, 2012. Still in the early stages of the project, our primary goal was to inform the department of the project mission. The key discussion topics of our

presentation were the overall goals of the project, the major stakeholders, the job opportunities, and our plans for moving forward. After the presentation, the main concerns raised by attendees surrounded the workers: who they would be and where we would find them. They suggested that we hire workers who have already worked on governmental work projects which will allow the City to better assess their work ethic and dependability. They suggested we look into Voortrekker Corridor, a mayoral urban regeneration programme, and Straawerk, a Christian mission group. As a result, we included Voortrekker as a way to find employees in our proposal, but not Straawerk since this group is not focused specifically on finding jobs for the poor.

### Department of Economic and Human Development

We made a presentation to the managers of the Department of Economic and Human Development on November 26, 2012. In this presentation, we discussed our proposed programme, the pilot rooftop garden, and projected costs and revenues. The meeting attendees asked us more difficult and specific questions than the ones raised during our previous presentation. Once again it was stressed that we need to find dependable workers, and it was suggested that we strongly consider workers who have already been involved in governmental work programmes. In our proposal, the salaries for

our workers were revenue based but it was advised that we include a stipend for workers, which is now included for the gardeners and supervisor. One sceptical attendee asked us why we were planning to grow produce on a rooftop instead of spaces more conducive to production. We explained that this programme utilizes dead space in the city and is meant to create jobs, not necessarily optimise production. The response to this presentation was generally positive and led to negotiations for R200 000 (\$23 084) in funding for the pilot garden.

### Cape Town Design 2014

For our final presentation, we presented to city, Cape Town Design 2014, and World Design Capital representatives on December 13, 2012. The discussion topics of this presentation were similar to the last; we



Figure 7: Cape Town Design 2014 button





Figure 8: Measuring and sketching designs for Prestwich Memorial with Stephen Lamb

presented a complete programme plan and conveyed the importance of experimentation through a pilot garden. Our presentation was well received by attendees and triggered positive discussion. Some suggestions for advancing the project were to:

- Approach building owners and corporations that value social and economic development and support green initiatives.
- Present carbon footprint reduction as a selling point.
- Consider selling the produce at a premium to allow some of the produce to be donated.
- Consider selling the produce to building occupants at retail price.
- When the programme expands, look into selling to large corporations such as Woolworths.
- Incorporate a relaxation space for

building occupants and possibly for the public.

- Allow public access to some rooftop gardens for educational purposes.
- Look into supplemental funding through social media sites like Crowdfunding.

Most of these suggestions were previously brought up and considered by our team. Due to time constraints, we were unable to explore all of them but encourage the City and TEL to do so. If the Prestwich Memorial pilot garden (Figures 9 and 10) is implemented, the City and TEL could apply to be a Cape Town Design 2014 project.

We consider our opportunity to present to the Cape Town Design 2014 board a significant step in helping to promote the programme. Consideration as a Cape Town Design or World Design project had been an ambitious goal of ours since the preparation

phase of this project. If our project is included in the World Design Capital project showcase, it will be projected into an international light, giving the programme the support and recognition it needs to expand.

## Laying the Foundation

When we discussed the need for a pilot garden with our sponsors, they recommended we consider using the Prestwich Memorial building. The building was an attractive option because it is managed by a Cape Town city official, was originally constructed to support a rooftop garden, has water and

electrical access, and is waterproof. We discussed this possibility with the building manager who asked us to draft designs for the space.

The original design for the pilot garden included two production areas, a memorial area, an oyster mushroom substrate inoculation space, and a washing and packaging station. . Since our original design cost more than was likely to be available, we simplified the design so that funding was requested for only one of the production spaces. The washing and packaging station was incorpo-

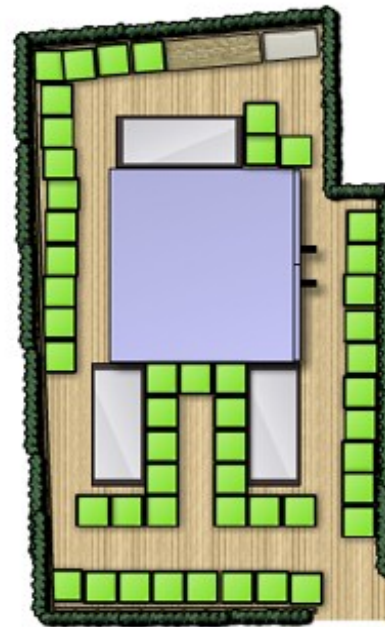


Figure 9: Two dimensional view of pilot



Figure 10: Three dimensional view of pilot garden

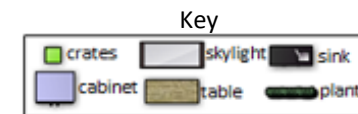




Figure 11: Project team with sponsors Cindy Jacobs and Stephen Lamb

rated into this section, and the substrate inoculation area was moved to another section of the roof. Figures 9 and 10 show our design for the pilot rooftop garden, with a projected cost of roughly R200 000. This proposal has been submitted to the City, and a decision to fund the project is forthcoming. If this project is funded and becomes operational, concrete data will be recorded and allow for a more compelling proposal to gain funding for the 1000 m<sup>2</sup> start-up rooftop gardening programme.

## Reflection

When reflecting on our experiences in Cape Town, we value the relationships we devel-

oped and are proud of our accomplishments.

## Sponsor Relationship

Our relationship with our sponsors gave us a first-hand view of the relationship between bureaucracy and a social entrepreneur. As an entrepreneur, Stephen Lamb was excited by the innovation of this project and valued marketing the programme to excite potential stakeholders. He wanted to see his visionary idea fruit into a practical job opportunity. While also interested in the implementation of the programme, the City carefully considered the legality and logistics surrounding the programme. While working

towards the same goal, occasionally their differences were highlighted. As students implementing this programme, we tried to understand and address the needs of both of our sponsors while focusing on what was in the best interest of the implementation of the programme.

## Positive Outcomes

This project focused on creating sustainable livelihoods through the design of a rooftop gardening programme in the CBD. The programme we have proposed could provide a source of employment for ten full-time low income individuals. We expect that once operational, the gardens will generate enough revenue to support all employees, maintain the gardens, and eventually expand the programme to include more rooftop gardens.

We created four proposals during our term in Cape Town showing how the big vision of

the rooftop gardening programme can be implemented. All of our proposals can be found on our website:

- A proposal to be given to corporations to request funding for the 1000 m<sup>2</sup> rooftop garden programme
- A proposal seeking funding for a pilot garden on the Prestwich Memorial building
- A proposal seeking funding for a pilot garden on the same building within a R200 000 budget
- A proposal submitting our designs for the Prestwich Memorial garden to the building manager

We are confident that the City and TEL will be able to implement the programme using the proposals and marketing materials we provided. Figure 12 outlines the steps that the team recommends be taken by TEL in regards to the pilot rooftop garden with oversight from the City.

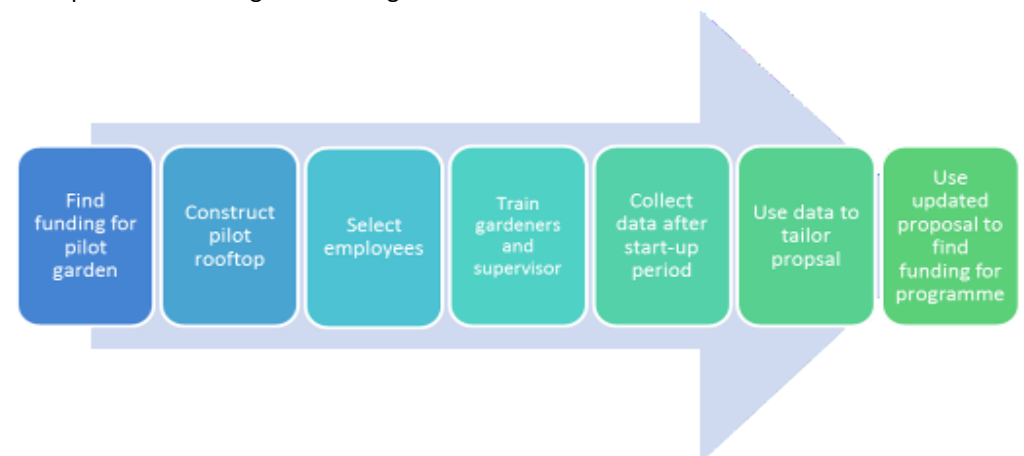


Figure 12: Progression of events that need to occur for the continuation of the programme



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