This question has been answered (on paper) by the Southside Chamber of Commerce in the city of Brisbane, in sub-tropical Australia. The chamber calculated that with a little more than A $200,000, a "rooftop microfarm" based on waste management could yield around 20% return on invested capital, and employ three to four people. The Southside Chamber of Commerce Urban Agriculture Group is now considering how to fund a pilot project in Mt Gravatt Central in Brisbane, in the state of Queensland to prove the feasibility study findings.

Geoff Wilson

Portable organic hydroponic structures for tomatoes

Can Urban **Rooftop Microfarms** be profitable?

The urban rooftop microfarm project proposed at Mt Gravatt is best described as a *nutrient capture system* that offers organic waste recycling as one important community benefit, and reduction of the greenhouse gas, methane, as another. It also provides income and employment

The project in suburban Brisbane's Mt Gravatt Central will further develop and test organic hydroponics and integrate aquaculture with hydroponics ("aquaponics") to offer local restaurants a range of "organic" produce.

Geoff Wilson is also Editor and Publisher of "Urban Agriculture Online" magazine (Website: www.urbanag.info)

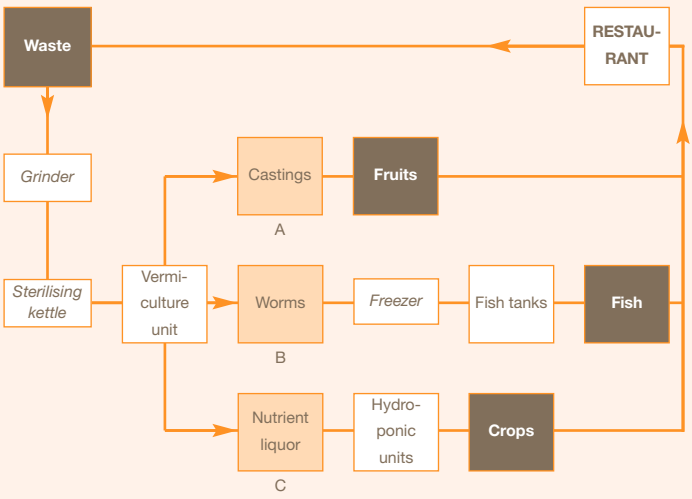

Figure 1: Flow diagram of the proposed urban rooftop microfarm

It will entail the following recycling activities (see Figure 1):

- collecting of food wastes from restaurants within half a kilometre radius of Mt Gravatt Central;
- pulverising and heat-sterilising of these wastes, and perhaps adding supplementary organic material or minerals for nutrient balance;
- feeding of the pulverised food wastes to an innovative worm farm that provides a continuous flow of output rather than a batch process, including: (a) liquid nutrient for organic hydroponics; (b) worm castings for containerised growing of fruits; and (c) surplus worms to be frozen and subsequently fed to fish or crustaceans (crab, lobster);
- production of salad vegetables and herbs from organic hydroponics, fruits in containers; and aquaculture; and
- selling of the produce to the same restaurants.

The Southside Chamber, of which the author is currently President, sought and obtained a A$20,000 grant from the Australian Federal Government of Employment Workplace Relations and Small Business in 1998 for its Urban Microfarm Feasibility Study in Mt Gravatt Central. The commercial microfarm concept was tested in 1999 by Integrated Skills Consulting Pty Ltd, of Brisbane.

THE FEASIBILITY STUDY

The Urban Rooftop Microfarm concept of the Southside Chamber differs from many previous studies in that it involved an urban microfarm with three objectives:

- Production of food in a way that contributes actively to a better environment using minimal space
- Provision of employment opportunities for people disadvantaged in the labour market
- Achievement of sustainability through the profitable sale of produce.

The project studied how a microfarm could be a business serving a market within a small radius of a shopping centre – perhaps only half a kilometre from the microfarm site. This included:

- the collection of waste food from nearby restaurants, hospitals and clubs;
- the use of this waste in the worm farm.
- the microfarm concept situated on rooftops of commercial buildings or at ground level in Mt Gravatt Central, growing salad vegetables and herbs; and

Food wastes that normally go to landfill and then cause methane emissions can be reduced by earthworms to their soluble nutrient form for recycling via horticulture. Methane is some 21 times worse for the environment than carbon dioxide.

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Table 1 Amount of funding required to launch the project successfully

Set up and management facilitation	A $ 30,000
Capital assets purchase/installation	A $ 115,455
Initial working capital	A $ 67,000
TOTAL FUNDS REQUIRED	**A $ 212,455**

1 US $ = 1,85 A $

Table 2: Estimated financial performance for three revenue-earning enterprises over 30 months

	First 6 months	Year 2	Year 3
Hydroponics	A $ 36,360	A $ 108,125	A $ 108,125
Aquaculture	A $ 32,575	A $ 130,300	A $ 130,300
Vermiculture	A $ 5,100	A $ 15,610	A $ 15,610
EST. TOTAL REVENUES	**A $ 74,035**	**A $ 254,035**	**A $ 254,035**
EST. GROSS PROFIT	A $ 47,840	A $ 199,865	A $ 199,865
EST. NET PROFIT	-A $ 32,430	+A $ 34,016	+A $ 35,015

❖ the selling of salad vegetables, herbs and fish back to the same restaurants, hospitals and clubs.

Integrated Skills Consulting concluded that with a total funding of A$212,000, a microfarm on a Mt Gravatt commercial rooftop (or equivalent urban space) could be profitable after 17 months of operation. It could then provide a return of around 20% a year on invested capital. It could provide three to four new jobs for each microfarm, possibly jobs suited to people with a disability.

The consultants said that a capital investment of A $212,455 would ensure that the project would not run short of funds at any stage, but the figure did not give a margin for error.

Cashflow projections were indicative only, because total annual costing was applied evenly on a monthly basis. Nevertheless, the consultants reported that the cash flow showed the expected generation of revenue and expenditure under the economic conditions in Brisbane, Australia in 1999, over the first 30 months, and with progressive repayment of A $32,000 in working capital required to tide the enterprise during the start-up period (see Table 2).

The consultants emphasised that the resultant achievement of 19.4% return on capital invested was conditional on relatively conservative production targets being achieved, and on the following of a recommended marketing plan. Key factors were proximity to markets, consistent supply of high quality fresh produce and stable pricing.

The study set out specifically to:

❖ Identify the project's technical platform components, cost and availability. The three were (a) horticulture which cost about A $50,000 to set up, (b) aquaculture which cost about A $14,000 to set up, and (c) vermiculture which would cost about A $5,000 to set up – the total being around A $70,000 for equipment specific to these enterprises, but not including shared equipment such as a motor vehicle.

❖ Identify job and business opportunities and local target groups for those opportunities. It was estimated that three to four jobs would be created.

❖ Assess any support/concerns from the general and business community. Noise and smell were found to be concerns, but support potential was excellent.

❖ Identify markets, supply sources, product acceptability. Indicated markets within a kilometre were generally most enthusiastic because of the waste management advantage.

❖ Determine commercial viability via a business plan outline. This was proved – at least on paper.

❖ Examine benefits for the built and natural environments and identify issues of concern to authorities.

❖ Provide a skills audit.

❖ Specify potential support for funding.

❖ Review training needs.

❖ Examine effects on current suppliers (e.g. rural farmers).

While there are conventional farms in the periurban areas of Brisbane, these remain under threat from urban expansion, which brings up the environmental concerns about the use of fertiliser and pesticides/fungicides and rising production costs related to land value. The study took the view that an Urban Rooftop Microfarm must avoid such problems by adopting a different approach, using urban spaces not normally considered for farming.

It was clear that the expense of this approach (cost of urban land) could be offset by greatly reduced costs in transport and energy use and by providing high quality produce for a premium price, where it is needed.

Many potential customers interviewed said they were prepared to pay about 10% more for organically grown local produce that was harvested for same day sale. The 10% was elicited as a fair "premium" to pay, and probably was a response based

Portable vertical structures for lettuce and herbs, using oval-pipe organic hydroponic techology

Geoff Wilson

on existing premium expectations reported widely in technical and consumer news media. They were also comfortable with the concept of organic hydroponics via worm liquor developed from restaurant food wastes.

The study identified by-products of vermiculture as being important to the final mix of products to be offered back to restaurants. Worm castings could be used in containerised growing on rooftops, or sold as a valuable soil additive sought by local home gardeners. Also, surplus worms produced would be used as a food source in the secondary food production stage involving holding mature fish or crustaceans in tanks after being bought from rural aquaculture farms.

The proposal required maximum production from a minimal area "footprint". The site size chosen for the study was 600 square metres because such a rooftop size in Mt Gravatt was more readily available than sites of 1000 square metres or more.

Of the various hydroponic systems reviewed in the feasibility study and experience of a number of commercial growers, it was considered that the locally-developed Boxsell "Ell-Grow" system of oval-channels most readily met the needs of this project (in a sub-tropical climate).

The proposed layout for the hydroponics occupied 450 of the 600 square metres, with six rows of eight 3 x 2 metre tables, all covered with hail mesh and insect screening. While the actual growing units formed the core of the system and represented the largest single cost element, other components were needed to complete the whole system. Using commercial worm beds as a basis, a purpose-built system can be configured by stacking a number of them in a robust pallet frame in such a way that they can be rolled out and back for access like a series of filing drawers.

The other equipment was a shredding machine to reduce worm bed material and vegetable matter to a finely ground mulch, a boiler to heat the mulch to remove pathogens, small pumping systems to re-circulate the liquid passing through the worm beds, storage for the worm liquor and a worm/castings separator. An assortment of minor tools and equipment to assist in this process would also be required.

Aquaculture is an established technology and there are many examples of successful fish farms operating in Queensland, which could supply mature fish or crustaceans to be held ready for local restaurants to purchase. The fish species recommended was "Silver Perch" an Australian native freshwater fish, which is ideal for the restaurant and retail markets. The use of aquaculture to grow silver perch thus completes the circle of this proposal. But "Jade Perch" (previously named "Barcoo Grunter") would be an easier option.

The feasibility study concluded that:
"the above systems combine to present a viable means of growing a range of hydroponic vegetables, fruit, fish and worms. The system components are either commercially available, incorporating proven technology, or where they need to be purpose built, they can use proven elements that offer reliable results.(...) It must be recognised that in the use of organic nutrient from vermiculture processes as described, there is a less precise degree of control of nutrient content than would be the case with inorganic fertilisers. This is not considered to be a problem as plants naturally take up what they require for growth from the available medium and the worm liquor analysis shows that such an organic nutrient is rich in what they require. The main difference will be that all of the nutrient available may not be taken up and some will go to waste. (..) On balance The Urban Rooftop Microfarm project appears to positively address all of the issues and should therefore be accordingly judged as a feasible venture,"

Worm liquor is less capable of precise specification than are inorganic chemical solutions, because the nutrient content varies according to the nutrient value derived from different worm food sources – in this case from Chinese, Italian and Australian styles of cooking. However, the nutrient balance of worm liquor can be adjusted by adding rock dust, a natural mineral-rich product, or specific organic materials (such as pineapple tops for extra magnesium). Some additional, simple heat processing would be required to ensure pathogen-free and readily digested waste matter for the worms.

The Southside Chamber's feasibility study also revealed a number of issues requiring resolution in setting up an Urban Rooftop Microfarm. They included:

- zoning issues: in Brisbane and other parts of Australia commercial enterprises are generally banned from residential zones, while in commercial zones there can be problems with perceived noise and smell issues;
- production facility operation issues such as noise; smell; traffic; effluent and waste & exhausted nutrient solution disposal; lighting impact and restrictions; signage and aesthetics;
- space and site management issues;
- health, hygiene and sanitation regulations compliance;
- food waste delivery and storage issues, which focused on the regulations governing the handling, transport and storage of food waste in Australia. These concern both human hygiene and animal protection from exotic diseases, such as Foot and Mouth disease;
- workplace health and safety issues;
- benefits accruing to the built/natural environment; and
- compliance with municipal, state and federal regulations – particularly in food safety for consumers.

The Southside Chamber of Commerce sells copies of its full report of 156 pages for A $35 plus A $15 postage and packing – total of A $50. *A 25-page summary of the report is available for A $5 per view at www.urbanag.info or www.L-COCO.info*

Geoff Wilson

Containerised growing of fruit, using worm castings and cycling worm liquor