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From innovation to sustainability in Milwaukee and Melbourne - urban aquaponics

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From innovation to sustainability in Milwaukee and Melbourne – urban aquaponics

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Drawing on a study of stakeholder experiences building community-based urban aquaponics enterprises in Milwaukee, USA, and Melbourne, Australia, research at the Global Compact Cities Programme explored the elements required to foster the development of urban aquaponics.

Today, urban agriculture is increasingly on the international agenda. Viewed as part of a comprehensive solution to food insecurity caused by runaway growth and rising fuel costs, it is becoming recognized as a model cities can use to move away from current inequitable and resource dependent food systems, reduce their ecological footprint and increase their livability. However, more needs to be known, about environmental, political and social characteristics that contribute to, or inhibit the development and sustainability of food security projects.

Aquaponics is an environmentally sustainable food producing technology that is adaptable and amenable to urban contexts and community-led development and capacity building.

Community-based urban aquaponics enterprises represent a new model for how local agency can be blended with scientific innovation to increase the food security of cities, re-engaging urban communities in their food production while minimizing stress placed on the natural environment caused by unabated urban expansion.

More than ever, the need to create socially responsible and environmentally friendly food production systems is highly relevant (Koc et al 1999, Viljoen & Wiskerke 2012, Ackerman-Leist 2013). Urban aquaponics, a relatively new and unknown form of urban agriculture, has a role to play in the transition to more socially responsible and environmentally friendly food systems. In an era of growing food insecurity and diminishing natural resources, it presents as a promising sustainable food producing technology that is easily adapted to urban environments (LeBlond 2012, Bernstein 2011).

Sweet Water Organics, Milwaukee

Milwaukee is the largest city in the state of Wisconsin in the United States. It has a population of approximately 700,000 people; a population which was, until recently, in decline on account of limited employment opportunities as a result of a broader decline in manufacturing in the region (Alder, Lagakos & Ohanian 2013). Situated on the southwestern shore of Lake Michigan, Milwaukee has never suffered from a lack of water. The Great Lakes region, as it is known, is home to one third of the world's fresh water. However, with a significant portion of the population un- or under-employed, and with large areas of the city lacking access to fresh food (Martinez 2011), food insecurity is a reality that many people face on a daily basis. Over the past few years, a nascent 'foodie culture' has emerged in Milwaukee through increased awareness of and enthusiasm for locally grown fresh produce. This, coupled with the increased availability and affordability of city real estate since 2008, has provided an ideal crucible to test an urban aquaponics project.

Sweet Water Organics (SWO) is an urban aquaponics farm, school and experiment that was set up in a large, unused, inner city, industrial building in the Bay View area of Milwaukee in 2008. It was funded primarily by its founders, who were motivated to develop creative capacity building and employment opportunities in their city, while providing chemical free, fresh, accessibly priced food to the community. Proudly experimental in its approach, SWO provides a living example of alternative uses for urban space and its capacity to produce fresh food.

The Sweet Water Foundation (SWF) was formed from SWO in 2010 with the idea that it would grow as a mutually supportive, cohesive hybrid organization that was both a for-profit commercial urban farm and a not-for-profit aquaponics 'academy'. Local community and schools were engaged from SWF's inception and as

the foundation raised financial resources, it started using aquaponics to teach people of all ages to grow food.

The SWO 'not-for-profit — for-profit' hybrid enterprise model is both new and challenging, with each half struggling to identify their role in relation to the other. Each organization has a different governing structure and funding sources; and although their operations have constantly overlapped, their strategic planning and visions have sometimes not. Critical to the sustainability of this relationship has been sharing board members who have been essential in maintaining 'communication and awareness' on both sides.

The experimental nature of SWO and its delayed financial independence has meant that volunteer and paid workers have often worn a number of different hats depending on their ability and availability. While this form of decision-making has allowed SWO to remain fluid and flexible, it has sometimes presented challenges when personal situations change or skill requirements evolve.

CERES, Melbourne

Melbourne is the capital city of the southern state of Victoria, Australia. It has a population of four million inhabitants and a cool, temperate climate. A steadily growing population has seen property prices increase dramatically over the past 10 years, with most activity around urban infill and peri-urban green-fill growth (ABS 2013). The city is comprised of a multinational population, and although pockets of food insecure areas have been identified in parts of the city (Addy & Pike 2009), food security is not a high priority in local or state politics.

CERES is a community environment park and centre for education and research in environmental strategies. It is a well-known eco/sustainability hub in inner city Melbourne and has over 100 (mainly part-time) employees and 400 or so volunteers (CERES 2012). More than 300,000 people visit CERES each year, and even more engage through their Sustainable Schools program. CERES is an incorporated not-for-profit organization that operates a number of for-profit enterprises to support its not-for-profit ventures. All projects within CERES are expected to be self-sustaining in an economic sense.

The CERES aquaponics system is an 80m^2 floating raft deep bed system, with two repurposed 1,000 litre tanks for fish. The fish tanks sit higher than the plant pools, and are housed in a shipping container that has one side cut out of it so that it opens into the greenhouse. Viewing aquaponics as a way to mitigate community food insecurity, the objective was to build an aquaponics system that had low building and maintenance costs, but which would be capable of producing at a commercial rate so as to employ a single full-time employee. It was built using a $100,000+ grant over a few months. The system, although still not working to capacity, is completely self-sufficient in energy and water and generates enough produce to support the farmer who maintains it. The farmer's wage depends on how much he produces, with all produce being sold directly to the CERES Fair Food organic box delivery enterprise in the neighbouring building.

Challenges and lessons learned

Both the Milwaukee and Melbourne urban aquaponics social enterprises have experimented extensively with different configurations of housing, equipment and fish and vegetable species. Similarly, they have explored a range of social structures and incentives to remain in operation. Expertise and infrastructure for building more than hobbyist-scaled aquaponics systems are more common in developed cities like Milwaukee and Melbourne. Both the United States and Australia have considerable traditions in areas of agricultural innovation generally. It is therefore not surprising that two moderate-scale urban aquaponics social enterprises have been started in these cities.

In both cases profiled, however, urban aquaponics remains challenging. CERES in Melbourne and SWO in Milwaukee have each experienced considerable challenges as they approach five years of operation. Interviews with stakeholders from both organizations reference continued trial-and-error experimentation with the technical designs of their respective urban aquaponics installations. It appears that at least at the 'meso' scale of social enterprise — that is, neither backyard hobbyist nor full-blown industrial — urban aquaponics has yet to settle into a paradigm of 'normal science' with a set of established equipment and operating procedures to follow. Any future commercial aquaponics projects would benefit enormously from drawing on research of viable scales of production for either retail or wholesale markets.

A number of factors are significant to each project's survival to date. Principal among these is the ongoing commitment of key stakeholders. It has been critical that both enterprises have had continued support of personnel with technical and business management skills combined with enduring leadership. Equally important is that these stakeholders have remained involved and prepared to cooperate without strong financial incentives and in the face of technical and political challenges. This is often the case in successful social enterprises — where, despite the need to be economically viable, the driving energy for the project comes from the desire to bring about social change and to stimulate a transition towards a system that measures wealth, health and sustainability in other than purely financial terms.

Despite this underlying motivation, the trials of farming using an untried production technology that has no successful commercial precedent in the urban context — combined with the lack of technological expertise and research in the design of their systems — has caused both enterprises to flounder and struggle to achieve economic viability. In part, this has occurred on account of the limited availability of research-based knowledge, experienced individuals and tried technology in this field of aquaponics. It has also been triggered by the limited research undertaken by both parties into available market opportunities and 'best practice' system technologies prior to commencing their ventures. This has had a significant impact on their ability to gain economic traction in their start-up phases.

The local political context has also been significant for each project. In the case of the City of Milwaukee, strong

financial and legal support has allowed SWO to expand its fixed assets and human resources, build market awareness and acquire a sizeable regular commercial customer base. The CERES project, by comparison, has had little such support beyond an initial grant, and has struggled to generate revenue to expand the project. A positive government environment and relationship clearly provides more opportunity for urban aquaponics social enterprises to reach produce volumes that justify initial capital expenditure.

The availability of markets for urban aquaponics produce also proved to be highly relevant. While the urban aquaponics 'story' is attractive to a customer base that is increasingly responsive to issues of food security and ethical consumption, the CERES example suggests that this story needs to be refined and developed for even Melbourne's sophisticated inner-north consumers. As one respondent suggested, this may well be because the hidden food production costs of water and energy are externalized in many developed world countries, including Australia. The sustainability of urban aquaponics enterprises needs corresponding political and social demand-side support that would be greatly facilitated through political advocacy, community education and existing examples of viable systems.

Aquaponics as a tool for sustainable community development

As both cases work to achieve economic sustainability, the full potential of aquaponics as a tool for sustainable community development and education in cities has yet to be proven. These findings suggest, however, that through strong community networks and outreach opportunities, potential markets can be created as people become aware of the benefits of accessible, locally grown fresh produce.

Overall, the experiences of these two projects show that urban aquaponics is now a tantalizing prospect for social enterprizes looking to build sources of food security and sovereignty for cities. The success of such enterprizes is greatly enhanced by a strongly supportive government environment; one that is willing to share some of the risks. The technical methods to manage moderate-scale aquaponics are slowly coming of age, and these can be readily adopted by volunteers and professionals.

The exact form and financial model of social enterprises is less clear. The split for-profit/not-for-profit structure of SWO introduces higher overheads and potential tensions between stakeholders, while the profit sharing model of CERES is challenging due to the lack of a 'critical mass' market. This remains an open question for urban aquaponics social enterprises, and further social experimentation in this area is expected in the years ahead.

This article draws on the findings of a year-long research project undertaken by Julia Laidlaw during her internship with the Global Compact Cities Programme in 2012 and related Honours thesis. Her research was presented at the International Sustainable Development Research Conference in Cape Town in 2013 and an academic paper has recently been accepted for publication in the Local Environment journal. Julia is currently working as a Food Security Officer on the island of Tanna in Vanuatu.

Stephen Mushin, Green Technology Designer at CERES Environment Park, pictured with the fish that are the lifeblood of 'aquaponics' – a closed recirculating system where cultivation of fish and plants are combined. This new form of urban agriculture is in its infancy but has promise as a food-producing technology amenable to city environments and social enterprises. Image: Neil Faragher.