BUSINESS MODEL PROFILES: WATER
SUMMARIZED FROM THE FORTHCOMING PUBLICATION
RESOURCE RECOVERY FROM WASTE
CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems
LED BY: IWMI International Water Management Institute

Leapfrogging the Value Chain through Aquaculture

Business characteristics

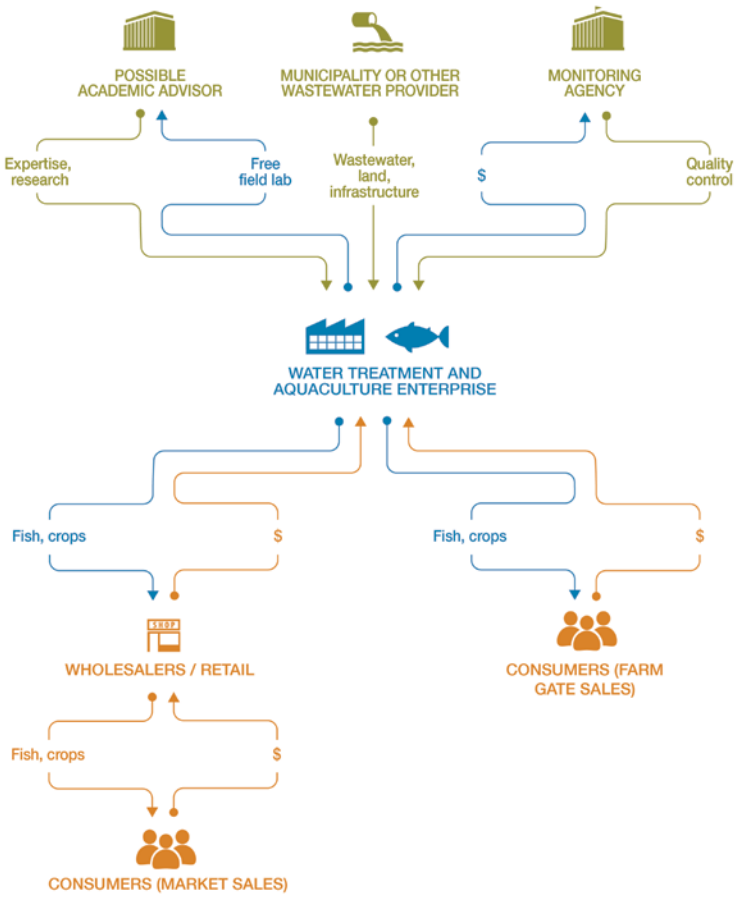
Geography	Where land for fish farming is available, water quality is known, and fish farming and irrigated crops have a secured local market demand
Scale of production	200-2,000 m^3 of wastewater intake per day
Type of organization	Mostly public-private partnership (PPP), with other options also available
Investment cost range	USD 20,000-100,000 plus cost of suitable land/lagoons of about 1-5 hectares
Key costs	Capital investment in fish and fish ponds (unless part of final treatment system), operation and maintenance (O&M) of ponds (mostly labor, including security against illegal fish harvest), fish and crop marketing and sales, research collaboration, and benefit sharing with public partner (optional)
Revenue stream	Pond-side sales of fish to customers, retail or wholesale, pond-side sales of crops and fish feed (if in excess), and payment for water treatment service (optional)

Business model

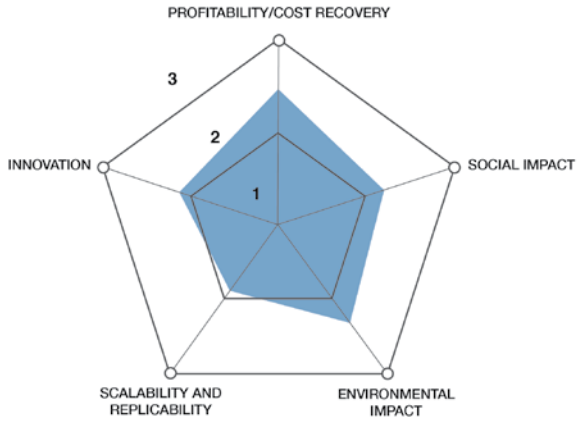
The business model involves the use of treated wastewater to grow fish feed or raise fish directly. In doing so, the model generates profits to sustain treatment plant operation or even recover its capital costs, as well as providing the local population with treated wastewater.

The business can be set up by a PPP or a private-private partnership. One entity provides wastewater and infrastructure for wastewater treatment and disposal, and the other offers treatment and fish farming expertise, invests in additional fish ponds and/or fish fingerlings, and assures the O&M costs of the overall treatment system. The model can function in two ways: (i) fish feed, such as duckweed, is grown on wastewater and harvested as a high-quality protein source which is used to feed fish; or (ii) the fish receives food directly within the treatment system, where it is cultivated in the last maturation pond of a multiple treatment pond set-up. In both cases, fish and water quality are monitored for safety standards. The treated water is released safely into the environment or reused, e.g., for crop irrigation. The business can also enlist the help of an expert partner in order to carry out locally applied research in fish or duckweed farming to optimize production.

BUSINESS MODEL VALUE CHAIN



Business performance



The business model scores highly on profitability – with a strong revenue stream where there is a market for fish – and socio-environmental impact – with reduced water pollution and protection of human health and food security. It scores low on scalability and replicability due to its relatively high land requirements.

Main risks

Market risks: Where the source of fish on the market is known, the business could be affected by negative consumer perceptions of the product. Also, not all types of fish thrive in wastewater.

Competition risks: Fish produced in wastewater competes directly with local freshwater fish and indirectly with frozen products from overseas markets.

Technological risks: Although duckweed production is straightforward, fish farming requires significant expert knowledge as well as quality monitoring.

Social equity-related risks: The model is considered to have more advantages for male entrepreneurs, because women have comparatively less access to land, education or capital, which are crucial for entering aquaculture, than men in many regions.

Safety, environmental and health risks: Health concerns for workers harvesting the duckweed from the wastewater. Where fish is grown with reclaimed water, the risks extend also to the fish and thus the consumer, which makes related monitoring mandatory.

Case study: Mirzapur, Bangladesh

The 'Agriquatics' business was set up in Mirzapur, Bangladesh, in order to locally treat wastewater for fish production and crop cultivation. The project was set up in 1993 and generated over 20 years of net profits and improvements in environmental quality. This occurred until about 2015, when the treatment system was decommissioned for replacement.

This business was set up through a collaboration between a local not-for-profit family trust, Kumudini Welfare Trust, and the Bangladeshi nongovernmental organization (NGO), PRISM. The system received raw sewage and grey water from the local Kumudini Hospital Complex (KHC) in Mirzapur – water which would otherwise flow untreated to a nearby river. No fees were charged for the treatment, no subsidies received from the government, and no water sold, but fish was reared on the harvested duckweed in adjacent tanks fed by groundwater and topped up with treated wastewater. Perennial crops such as papaya and bananas were also grown along the pond perimeter providing additional income. The fish and crops produced were sold on-site and the income received not only covered O&M cost of the combined system, but also recovered the original capital investments.

Key performance indicators (as of 2012)

Capital investment:	USD 20,000 for the plug flow treatment system, of which 32% as a loan for land development and equipment, and 68% for long-term land lease		
Labor:	Four employees for one hour each day, seven days a week		
Operation and maintenance cost:	Harvesting and feeding the duckweed to fish, fish harvest, and seasonal cleaning of the fish tanks		
Output:	About 7.5 tons of mixed carp fish species per year, sold on-site at an average price of USD 1/kg, with revenue of USD 7,500 from fish and about USD 1,000 from crops – annual net revenue of around USD 2,000-3,000 with costs deducted		
Social and environmental impact:	Several part-time jobs, inexpensive source of fish and crops, and a non-chlorinated, treated effluent that meets US advanced tertiary standards		
Financial viability:	Payback period: Less than 10 years	Rate of return: 26%	Gross margin: 20%

For more information on the business model and related cases, see Chapter 15 of **Otoo, M.; Drechsel, P. (Eds.). 2017. *Resource recovery from waste: Business models for energy, nutrient and water reuse in low- and middle-income countries.* London: Earthscan/ Routledge. In press.** The book has been produced by the Resource Recovery and Reuse subprogram of the International Water Management Institute (IWMI), under the CGIAR Research Program on Water, Land and Ecosystems (WLE) and its Rural-Urban Linkages Research Theme. The support of the Swiss Agency for Development and Cooperation (SDC), the International Fund for Agricultural Development (IFAD), and CGIAR Fund Donors (www.cgiar.org/about-us/our-funders/) is gratefully acknowledged.