

# BUSINESS MODEL PROFILES: NUTRIENTS

SUMMARIZED FROM THE FORTHCOMING PUBLICATION  
*RESOURCE RECOVERY FROM WASTE*



RESEARCH PROGRAM ON  
Water, Land and  
Ecosystems



## Phosphorous Recovery at Scale

### Business characteristics

Geography	Urban centers with sewage systems in place; applicable to a wide range of sewage treatment plants
Scale of production	So far, mostly used with a minimum plant capacity of 19 million liters of sewage treated per day
Type of organization	Public-private partnership (PPP)
Investment cost range	USD 2-5 million
Key costs	Investment cost in P recovery unit, operational costs, struvite collection/storage/marketing cost, research and development/validation, license fee to patent holder, and fertilizer certification costs
Revenue stream	Sales of P technology, monthly treatment fees based on P removal, and sales of premium grade P fertilizer

### Business model

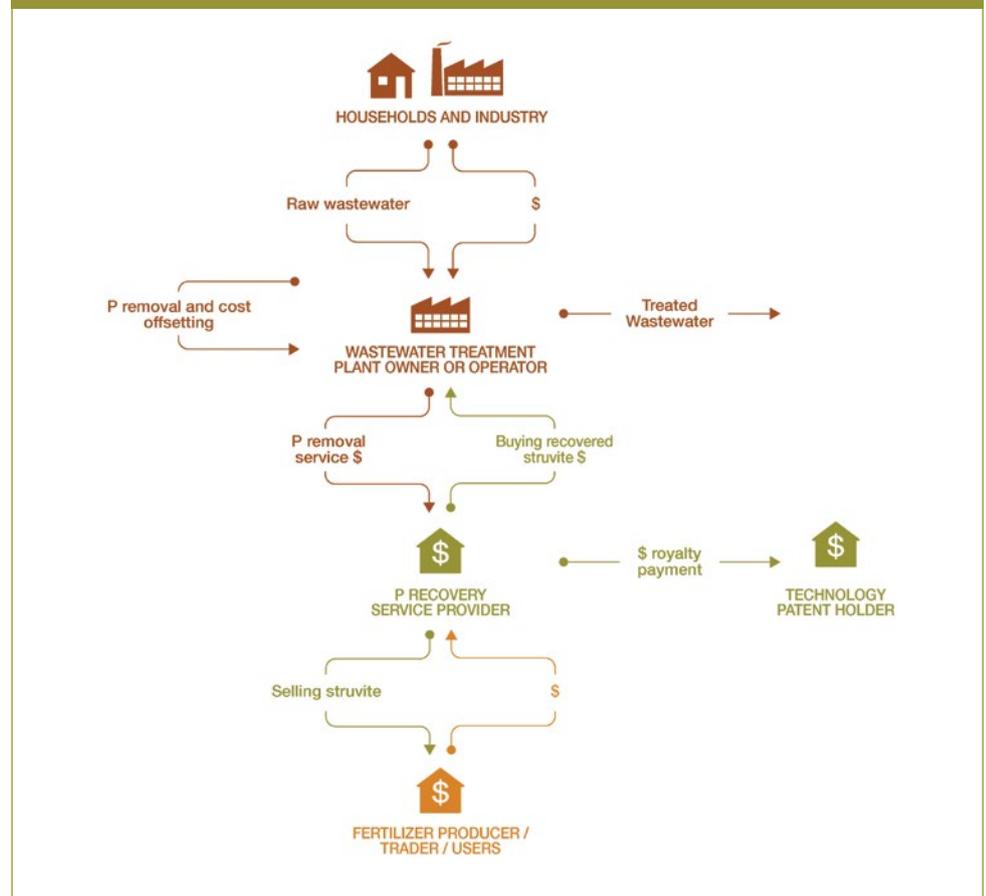
The business model offers a double value proposition: (i) phosphorous (P) removal from sewage treatment plant processes to produce fertilizer; and (ii) treatment cost savings through the prevention of unplanned P crystallizing in the form of struvite (phosphate mineral affecting pipes and other inner surfaces of the treatment process). This extracted P can then be sold to fertilizer companies.

The business can be initiated by a PPP between a sewage treatment plant and a private enterprise which provides the technology for P removal. The model can function in two ways: (i) on a capital purchase basis, or (ii) through treatment fees. In the treatment fee model, the private entity pays for the installation and keeps ownership, while the municipality or treatment plant operator (the client) runs the nutrient recovery process. The treatment fee is lower than the costs of conventional phosphorus removal, leading to immediate savings on operational costs. In the capital purchase model, the client pays for the installation and recovers

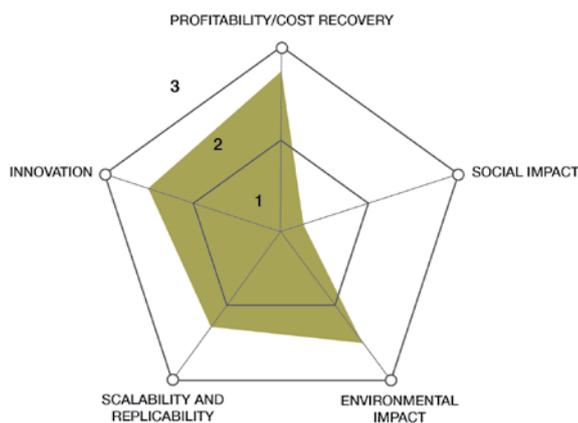
the costs through maintenance savings usually over 3-7 years. In both cases, the P collected is sold,

either by the private company or the treatment plant operator, for fertilizer production.

### BUSINESS MODEL VALUE CHAIN



## Business performance



The business model scores high on innovation, with the use of advanced technology which can be adapted to many wastewater treatment processes; profitability, with good prospects of cost recovery for the public partner and the possibility for revenue generation from the sale of fertilizer and treatment fees; and environmental impacts, due to the reductions in eutrophication and environmental pollution.

## Main risks

**Market risks:** The market for recovered P faces a variety of challenges, including price, its continuous supply irrespective of agricultural seasonal demand which poses storage problems, and perception-related risks, e.g., with the fertilizer industry still being hesitant to accept the product.

**Competition risks:** High competition from rock-P which dominates the market in quantity, price-wise and is favored in view of some physical properties.

**Technological risk:** As the recovery potential and cost-effectiveness between different technologies on the market varies significantly, the business has to choose the most appropriate for its plan.

**Political and regulatory risks:** In many countries, the regulatory context is not yet supporting 'secondary' phosphorous containing fertilizers and their producers, as it is often classified as waste.

**Safety, environmental and health risks:** There can be variations in the heavy metal content with some of the technologies used. For farmers, the fertilizers produced can have an unfavorable pH which might affect crops.

### Case study: Partnering with Ostara, Canada

Ostara is a Canadian company which has designed a technology named PEARL™ to remove P from the liquid generated from sludge dewatering in sewage treatment plants. It has supported 14+ treatment plants in Canada, the United States and Europe, with an annual fertilizer production capacity of 21,000 tons. Ostara works on a PPP basis, where it enters into agreements with treatment plant operators. The process offered by Ostara does not replace traditional sewage treatment and can be retrofitted into the facility's existing treatment process.

As in the generic business model described above,

Ostara offers its PEARL™ process based on either a traditional capital purchase business model or through a treatment fee model. In both models, Ostara has a multi-year purchase agreement with the client to buyback the P crystals generated, which is, for the treatment plant, a 'waste' product. The company then sells the struvite collected to third parties or markets it under the brand name Crystal Green™. As the struvite is generated as a side product, this gives Ostara flexibility in its pricing and makes it relatively independent from the current rock phosphate price.

### Key performance indicators (as of 2012) from the public sector perspective

Capital investment:	USD 2-5 million
Operation and maintenance cost:	Below alternative P removal costs
Output:	P removal and recovery as struvite
Social and environmental impact:	Job creation, cost saving by the local governments (plant operators), reduced exploitation of natural P, reduced pollution from P dumping and improved water treatment
Payback period:	3-7 years

For more information on the business model and related cases, see Chapter 13 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/](http://www.cgiar.org/about-us/our-funders/)) is gratefully acknowledged.