BUSINESS MODEL 23

Wastewater as a commodity driving change

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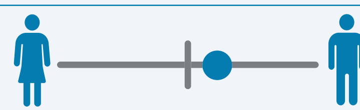
In memory of Jeroen Ensink

Model name	Wastewater as a commodity driving change
Waste stream	Domestic wastewater
Value offer	Untreated, partially treated and treated wastewater for auctioning to farmers
Geography	Arid and semi-arid regions
Scale of business	Medium (function of irrigation demand and wastewater supply)
Location of supporting cases in the book	This model is in its presentation a hybrid of case & model and builds on observation in particular in Faisalabad, Pakistan and Gujarat, India
Objective of entity	Cost recovery [X]; Safety [X]
Investment cost range	Varies largely with type and size of treatment plant (USD 2–4 m for 100,000 inhabitants)
Organization type	Public (utility) and private (farmers)
Major partners in the case example	Water and Sanitation Agency (WASA), Chakera Farmers
Socio-economic impact	The auctioning process is socially inclusive. Wastewater main source of income and food security; health risks can be controlled and are accepted as offset by revenues

Gender equity	In many countries, auctioning will favour men as women have less access to land and capital	

Executive summary

This business model has been informed by two cases where wastewater auctioning is common, in Pakistan and India. With sufficient information being only available from the situation in Pakistan, the presentation of its model here follows a **hybrid of the business model and case templates** focussing on mostly Faisalabad/Pakistan.

With insufficient supply of freshwater of low salinity to support irrigated crop production, farmers in the dry climate of Faisalabad in Pakistan overcame organizational, infrastructure and legal obstacles to secure access to urban wastewater. Like for freshwater (canal water), also wastewater became a marketable commodity farmers pay for[1]. The wastewater provider, the Water and Sanitation Agency (WASA) in Faisalabad, uses public auctions for bulk sale of its wastewater to farmers, a system which keeps WASA's transaction costs low, and is also reported from Gujarat, India. The farmers organize themselves into groups and the highest bidder gets the annual rights to reuse the wastewater and resell surplus water to other farmers. As the annual auction attracts several interested bidders, a floor price guarantee is not required and wastewater auction price is determined through a near competitive market. Despite the common experience that wastewater can only be sold cheaper than freshwater, it is not uncommon that farmers pay for the wastewater on top of their fees for canal water and up to 50% more for untreated wastewater than treated wastewater, given the lower nitrogen and higher salinity levels of the latter. The auction process allows WASA to cover its pumping costs and to maintain administrative control over the wastewater. Most of all, the process turns informal wastewater use into formal wastewater use and gives farmers and authorities a platform for dialog. This is missing in many countries where informal wastewater use is a grey sector. The dialog offers opportunities for negotiating health risk mitigation via alternative treatment options, which match farmers' needs while enhancing safety (WHO, 2006). The high market value of wastewater offers opportunities to introduce incentives (like extra water allocations) in support of the compliance with safety measures.

KEY PERFORMANCE INDICATORS OF THE PAKISTAN CASE (2012–2014)

Land use:	Around Chakera: About 456 ha (71% of farm area) under untreated wastewater irrigation, ca. 25–35 ha under treated wastewater, 12–15 ha with freshwater supply, ca. 85–90 ha with partially treated or mixed sources, and 44 ha without irrigation					
Water treated:	Ca. 37,000m^3 per day (the design capacity is about 90,000m^3 per day. About 79,000m^3 of wastewater enter the plant premises, of which about 53% are redirected for irrigation before reaching the first treatment ponds					
Capital investment:	N.A.					
Labor employment:	N.A.					
O&M costs:	About USD 350,000 sewage system O&M costs (Faisalabad West) in 2012–2014, of which the O&M budget of the treatment plant is about USD 30,000 (WASA, 2014)					
Annual revenue:	Sewerage charges as part of water bill, property tax and non-tariff income from leasing of land to farmers and wastewater auctioning of around USD 6,000–7,000					
Output:	Secondary treated wastewater					
Potential social and/or enviornmental impact:	Job creation/income along the sanitation value chain (i.e., farmers, market sellers, and input suppliers); possible health risks for farmers and urban consumers					
Financial viability indicators:	Payback period:	Data not available (N.A.)	Post-tax IRR:	N.A.	Gross margin:	N.A.

Context and background

This business case pertains to wastewater reuse as seen on the example of Chakera, located on the western outskirts of Faisalabad City in Pakistan. Faisalabad, the third largest metropolis in Pakistan, has an estimated population of 3.6 million (WASA, 2014). Like in other larger cities in Pakistan, the semi-autonomous Water and Sanitation Agency (WASA) is responsibility for water supply and sanitation. It provides about 65–75% of the city area with a sewerage network which is linked to larger channels for final disposal of the wastewater in the Chenab and Ravi rivers. Faisalabad's wastewater treatment plant at Chakera can treat about 25–30% of the collected wastewater. The system consists of a series of waste stabilization ponds (WSP). Given the city's largely flat topography, 31–40% of WASA's O&M costs per year are for electricity (pumping).

Under the arid climate with annually about 350 mm rainfall, irrigation is most common and traditionally supported by canals fed by River Chenab. Due to increasing demands, water supply is declining since a few decades and inadequate for many regions and/or year round production. Common crops are wheat, sugarcane, cotton, vegetables, fruits and fodder crops (clover, Lucerne, barley, etc.). Chakera is a typical suburban village where irrigation canals stopped providing the needed water years ago (ca. 2002). As groundwater is saline, the only remaining option is wastewater, which is abundant in Chakera given its proximity to the city of Faisalabad. However, initially WASA did not support farmers' request for waste and it took some court cases before WASA agreed. The current system is that WASA auctions the wastewater, and this can be untreated, partially treated or treated wastewater. WASA also rents out land with wastewater access (Weckenbrock et al., 2011).

It is noteworthy that more than 90% of the farm households choose untreated wastewater although treated wastewater is in same proximity and cheaper. Freshwater alternatives like canal water and groundwater are too scarce and can only serve less than 5% of the water market. The reasons for choosing untreated wastewater are of agronomic nature, directly affecting farmers' livelihoods: the treatment process is increasing water salinity (see below) beyond what some of their crops can tolerate while significantly reducing the nitrogen and phosphorus content of the water. In fact, 70% of farmers using untreated wastewater reported that they stopped applying fertilizers, and 24% only used very targeted fertilizer applications (Ensink, 2006; Clemett and Ensink, 2006).

Market environment

Demand for irrigation water in Punjab province of Pakistan has increased steadily over the past decades, far beyond what can be supplied. Chakera is one of the villages with irrigation canals but hardly any water. However, farmers in the eastern boundary of the village began to use wastewater coming from Faisalabad. With visible gains in production and income, this informal practice spread among farmers in other parts of the village and beyond. With the increase in demand for wastewater, farmers constructed new irrigation canals to make wastewater available in more parts of the village and the existing canal-water infrastructure was modified to facilitate wastewater irrigation. Over the years, wastewater has become the most important source of water for irrigation with benefits clearly exceeding risks, while the majority of farmers having in fact no alternative (Clemett and Ensink, 2006; Weckenbrock, 2011). There are about 2,200 ha irrigated with wastewater around Faisalabad, and 32,500 across Pakistan (Weckenbrock et al., 2011).

Wastewater farmers around the WSP have, since the construction of the treatment plant, organized themselves and gone to court to establish their rights to use wastewater. For the water use, they pay WASA which allows WASA to maintain control over the resource as a service provider. The water fee ranges from USD 10 to USD 62 per hectare per year depending on the quantity and the quality of wastewater. The payment is on top of what farmers pay for freshwater[2]. The highest fees were paid for untreated wastewater with lower fees paid for wastewater from anaerobic ponds (Clemett and Ensink, 2006). A unique feature of this business case is that the wastewater is sold annually in bulk by WASA through an open auction to the highest bidder from the village, and the winning farmer resells the surplus wastewater to fellow farmers (Box 15). Through the bulk auction of wastewater, WASA outsources likely transaction costs of dealing with individual farmers such as water allocation, monitoring, compliance and collecting the wastewater fees, which is reducing the service provision largely to the energy costs for water pumping, the cost item WASA tries to recover from the business.

Macro-economic environment

The agriculture sector continues to play a central role in Pakistan's economy. It is the second largest sector, accounting for over 21% of gross domestic product (GDP), and remains by far the largest employer, absorbing 45% of the country's total labor force. Given the low precipitation, major investments in water resources management are required to prepare Pakistan for its growing population

Box 15. Wastewater auctioning process

The auction process for treated/untreated wastewater starts with the announcement of the bidding date to farmers. The farmers organize themselves into small bidding consortiums/groups and each group nominates a bid leader, after background negotiations on the maximum bid amount and the exit strategy should the bid amount go higher than their expectations and upper ceiling. On the bidding day, farmers congregate at the venue and group leaders contest the bid in the open auction. Opening bid price is generally the last year's auction price, and then the bid amounts are raised gradually upwards through calling the amounts publically. Only one bid is left with the auctioneer at a time, and a punt by another group leader raises the bid with the hope to snap up the wastewater. Group rivalry and market competition are all at play along with some pride and political capital in winning the bid and this often leads to intense 'bidding wars' across the group leaders. Bids are conveyed to the auctioneer through various gestures, including waving of hand or cloth. The highest bidder wins the auction and WASA auctioneer announces the name of the winning bidder and the completion of the wastewater sale. The winning bidder/ purchaser of the wastewater is generally a wealthier farmer within the village – not an investor or company, and not a speculator. Further, the bid amounts are never undisclosed such that water prices/charges become known to all farmers spot on. Strong cooperation and greater understanding on water allocation rules among farmers ensures that all farmers get water and no one is excluded from using the wastewater, at payment to the winning bidder, like USD 6 per year for a one-hour allocation every ten days. These can be paid in different instalments, which benefits less wealthy farmers unable to pay the fee in a single instalment. There are no reported cases of abuse of power (Weckenbrock et al., 2011; Clemett and Ensink, 2006).

and risks through floods and droughts. One part of this is the promotion of water recovery and reuse. Water quality monitoring in the irrigation sector is generally lax. A main challenge will be to develop local guidelines for cost effective risk mitigation measures, which consider actual exposure and help to optimize the gains to farmers from reuse while reducing risks to actors along the wastewater value chain.

Business model

As a service provider, the enterprise (WASA) charges for the wastewater it is collecting, managing and treating as far as its facilities allow. The wastewater is not given away for free and WASA remains in control of its allocation. Although the revenue stream from agriculture is a minor one given WASA's overall budget, the WSP has limited maintenance costs, and the revenue allows to cover a good part of WASA's pumping costs in the Chakera area.

The auction model has direct and indirect advantages: WASA transfers the water rights (and related pro-poor obligations) as well as the transaction costs of reaching out to individual farmers to the winning bidder who is in charge of supporting all farmers who agree to a transparent pro rata price. There is no penalty to any farmer for breaking the informal contract with the winning bidder, due to high water demand, and collections from the farmers far exceed the bid amount. This allows the business to remain viable at bidder's end, and even provides for the maintenance of the water courses and seasonal canal cleaning. Also, a maintenance charge is factored into the price of wastewater farmers pay. The winning bidder pays WASA on a quarterly basis and collects water charges from the individual farmers in convenient rates. Further, WASA uses a price discrimination model to encourage the reuse of treated wastewater, i.e. the untreated wastewater is auctioned at highest prices followed by partially treated and treated at the lowest price. WASA also earns revenue from leasing of its land (wastewater access priced in). The business has a long history of cooperation and **turns informal wastewater use into formal wastewater use**, which opens space for dialog to address, e.g. farmers' problems with the current wastewater treatment system. A summary of the key elements of the Business model canvas is outlined in Figure 268 below.

FIGURE 268. BUSINESS MODEL CANVAS – WASA PROVIDES TREATED, PARTIALLY TREATED AND UNTREATED WASTEWATER FOR IRRIGATION

KEY PARTNERS

- City of Faisalabad
- Provincial government (PAK-EPA, Department of Health)

KEY ACTIVITIES

- Conveyance of untreated, treated and partially treated wastewater
- Auctioning and sales of wastewater (bulk for resale)
- Setting the price of wastewater through auction mechanism
- Land lease

KEY RESOURCES

- Wastewater treatment facility and related canal system
- Service attitude

VALUE PROPOSITIONS

- Provision of a reliable supply of irrigation water of different quality, either directly or via land lease
- Creation of a formal business platform to discuss wastewater treatment and alternative risk mitigation options

CUSTOMER RELATIONSHIPS

- Contracts with winning bidders
- Direct lease agreement

CHANNELS

- Direct contact
- Public auctions
- Canal system to deliver wastewater

CUSTOMER SEGMENTS

- Farmers and farmer associations around Chakera

COST STRUCTURE

- Capital investment
- O&M for wastewater collection, treatment, delivery
- Service provision and fee collection

REVENUE STREAMS

- Water and sewerage charges to households
- Governmental support
- Wastewater sale and land rental (miscellaneous revenue stream)

SOCIAL & ENVIRONMENTAL COSTS

- Occupational health risks for farmers and food safety risks for consumers, especially if food is eaten uncooked
- Potential environmental impacts including nitrate pollution and loss of soil productivity

SOCIAL & ENVIRONMENTAL BENEFITS

- Farmers job security and creation
- Contribution to food security
- Freshwater saving
- WASA maintains its mandate as wastewater service provider

Value chain and position

WASA is responsible for water supply and sanitation services in the city and has a natural monopoly on supplying any wastewater to the farmers. With the increasing water scarcity and the need to produce more vegetables to supplement local production of food crops, WASA has come under increasing pressure to provide wastewater for irrigation across locations. This can be treated, partially treated and untreated wastewater. However, only farmers with access to untreated wastewater were able to save on fertilizers and achieve higher cropping intensities as well as year-round cultivation which allowed them to earn on average USD 600 per hectare per year more than farmers who used regular irrigation water, easily absorbing the higher water fees set by the WASA (Clemett and Ensink, 2006). By charging farmers for the use of wastewater, WASA is able to recover some of its O&M costs for the wastewater treatment plant, while its main revenue stream (ca. 60%) are water supply and sewerage charges (2:1) billed to the residential, commercial and industrial sectors (Figure 269).

Institutional environment

In Pakistan's Punjab province, water services in the largest cities are provided by publicly-owned Water and Sanitation Agencies (WASAs). WASAs are accountable to both local- and provincial-level authorities, i.e. the respective City Development Authorities, and the Housing Urban Development and Public Health Engineering Department of the Government of Punjab.

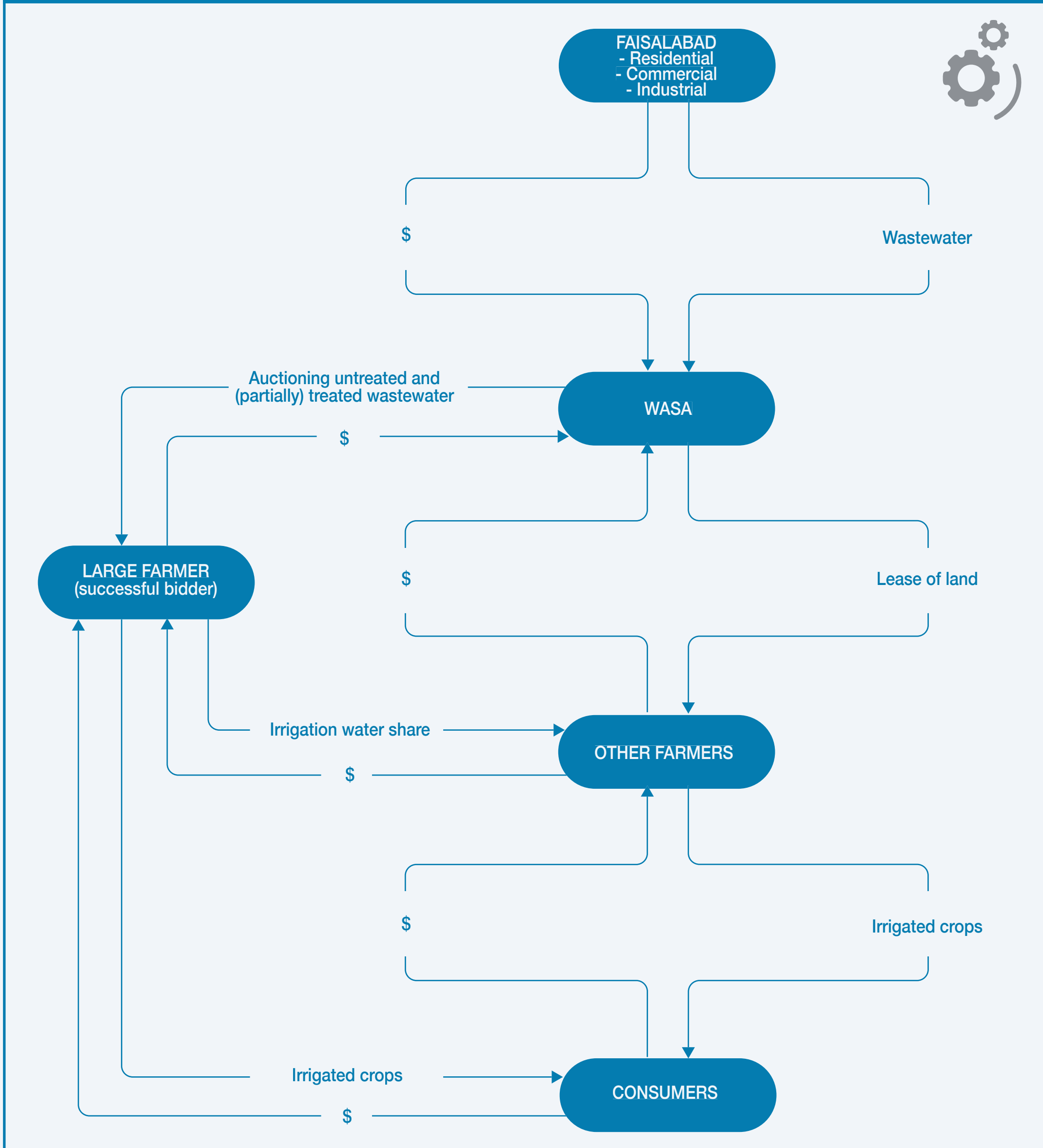
The WASA in Faisalabad was created in 1978. In the 1980s WASA bought land at the outskirt of the city (Chakera village) for the purpose of building a WSP and its operation started in the late 1990s. During this period, there was a lengthy court case between the farmers and WASA over the right to use wastewater. The first court case accepted the lack of alternative water sources, and gave farmers the right to use wastewater for irrigation and to generate income to support their families. The court provided this ruling because there was no alternative canal water for the farmers to use for irrigation. The WASA appealed this decision and the court granted them the water rights, banning wastewater irrigation. As this decision was hard to implement, both parties had to reach an agreement whereby farmers agreed to pay WASA for the use of wastewater. This provides farmers with some legal standing of the practice and institutional support for wastewater reuse while WASA remains in charge as service provider (Clemett and Ensink, 2006). That wastewater can be sold for agricultural purposes is supported by the National Sanitation Policy (Ministry of Environment, 2006). However, there is no universal public acceptance of wastewater use and it is not supported, e.g. by the Ministry of Health.

Technology and processes

The wastewater treatment plant in Faisalabad was built in 1998 and designed for an inflow of nearly 90,000m^3 per day of (mostly) domestic wastewater at a site where untreated wastewater had been used for the past 50 years for the cultivation of vegetables, fodder, wheat and sugarcane. The plant is a basic waste stabilization pond system (WSP), consisting of six anaerobic, two facultative and four maturation ponds (Figure 270). Its operational costs are low while performance in terms of the removal of pathogens, BOD and TSS, as well as ammonia and phosphorus is good. It was expected that WASA sells the reclaimed quality water to farmers to recover some of its O&M costs. In practice however, the majority of farmers continued using the untreated wastewater, which they take from wastewater channels not passing the plant but also the main channel just before it reaches the first WSP ponds (Clemett and Ensink, 2006). Thus, from the expected average daily inflow into the treatment plant of 79,300m^3 per day, about half is diverted before it enters the plant. As a result of the lower flow, retention periods increased and so evaporation and water salinity, which stopped farmers being willing to pay for treated wastewater.

A much smaller quantity of water is also diverted from the anaerobic and facultative ponds. Because of the limited demand for final effluent by farmers[3], much of the treated wastewater has to be disposed

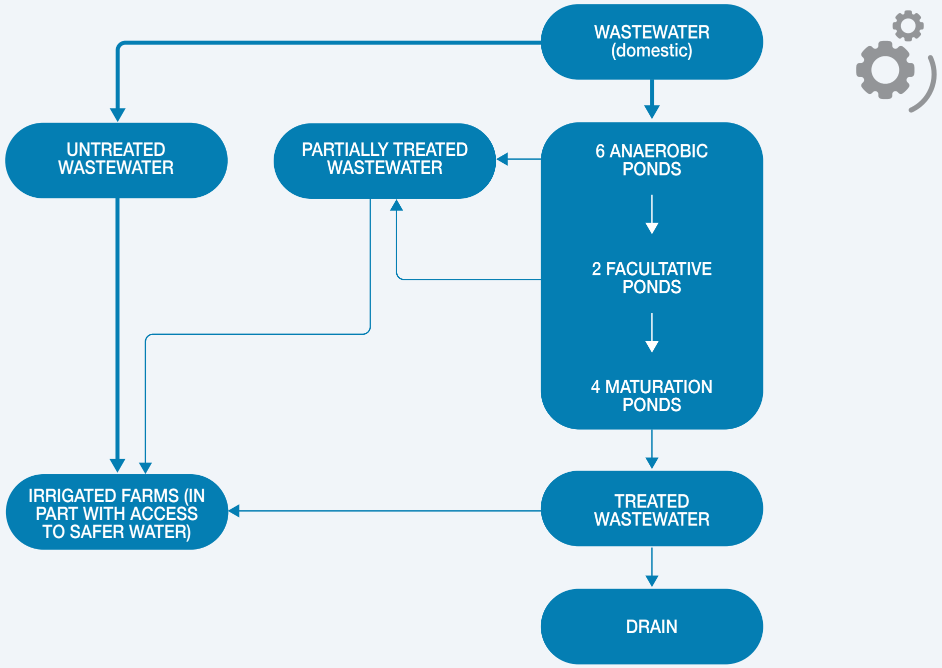
FIGURE 269. WASA BUSINESS PROCESS FLOW



of into the next drain. Other farmers access wastewater which is not flowing to the treatment plant. In total about 60,000m^3 of wastewater is used per day by about 200–300 farmers in Chakera.

Given farmers' dissatisfaction with the treated wastewater generated by pond-based treatment systems, alternative treatment options as well as other risk mitigation measures could be introduced to farmers (WHO, 2006), and linked to the sale of wastewater (or as incentive to a free water allocation).

FIGURE 270. WASTEWATER REUSE FOR IRRIGATION IN CHAKERA, FAISALABAD, PAKISTAN



Funding and financial outlook

In general, the Water and Sanitation Agencies across Pakistan struggle to collect sufficient operating revenue to pay for their operating costs. Also the contribution of wastewater auctioning (Table 62) is financially negligible but allows WASA to maintain control over the wastewater use and achieve some O&M cost recovery with limited transaction costs. The annual income from leasing of land and auction of wastewater were in 2012–2013 about USD 45,000 which is more than the O&M budget of the pond-based sewage treatment system in Faisalabad and about 15% of the total O&M costs of the related sewer system in Faisalabad West. Compared to the revenues from sewerage charges which were in 2012–2013 about USD 2m, the amount is however very modest (WASA, 2014).

Because of the application of nutrient-rich wastewater, wastewater farmers in Chakera save on fertilizer; and although more pesticides are needed, the net gains are so substantial, that WASA could increase its water fees.

Socio-economic, health and environmental impact

The auctioning process as described in Box 15 has been considered as socially fair as it helps also small holders to access a share of the available water. As long as the water is not sufficiently treated, health risks remain. This is in part an accepted professional risk, as the benefit-cost ratio was significantly higher for wastewater than freshwater farmers, as well as farmers using untreated compared to treated wastewater (IWMI, 2009; Baig et al., 2011; Clemett and Ensink, 2006). Similar situations were also reported from other cities (Van der Hoek et al., 2002; Hussain et al., 2002).

TABLE 62. SUMMARY OF IRRIGATION WATER SOURCES AND INSTRUMENTS USED TO ALLOCATE WATER

SOURCE OF WATER	INSTRUMENT USED	AREAS IRRIGATED (HA)	NUMBER OF FARMERS
Canal (paid to Irrigation Department)	Flat rate per acre (varies by season)	12–15	5
Treated wastewater	Priced via land (unit) lease	25–35	Ca. 20
Partially treated (incl. mixed wastewater / fresh water)	Auction (bulk)	85–90	40–50
Untreated	Auction (bulk)	457	150–175

Sources: Weckenbrock, 2011; IWMI, 2014, unpublished.

Overall production costs were highest for freshwater farmers, especially if ground water pumping was required, and lowest were where the wastewater replace fertilizer needs. In addition, farmers using wastewater were able to produce more crops per year, including vegetables which require daily watering and care, and created more jobs. Where vegetables are grown, they are usually cooked which is reducing possible health risk for consumers.

Negative externalities relate mostly to pathogens (especially hookworm infections) and too high nitrogen levels for certain crops, like root crops. Risk reduction measures against hookworm infections, like protective footgear or de-worming campaigns are so far insufficiently used to reduce risks for farmers.

Scalability and replicability considerations

With increasing population and food demands, it appears inevitable that demand for water and its reuse will expand in Pakistan. Given the slow growth of the wastewater treatment sector, untreated or partially treated wastewater will continue to be the leading source of water (Ensink et al., 2004ab). The lessons from the well-researched Faisalabad case offer authorities an opportunity for engagement with farmers to provide regulatory oversight and bring options for health risk reduction into the business discussion. Especially the auction model has a high potential for this given its low transaction costs. Thus, WASA could be flexible in view of financial cost recovery, while targeting farmers' buy-in in risk reduction options which will probably easily pay off for the city in terms of reduced public health expenditures. Replication of wastewater auctions have been seen in other villages across WASA's jurisdiction as well as in India (Box 16). The wastewater auction model could thus be scaled across the region in all those locations where authorities see the livelihood and food security opportunities that wastewater with/out treatment offers as long as farmers and authorities can jointly work on modalities like risk mitigation. Dialog between authorities and farmers can also address other issues: The increased water and nutrient availability calls for changes in cropping patterns and fertilizer rates where farmers might need assistance. On the other hand, many treatment plants are poorly sited when it comes to optimizing their water reuse potential.

Support by the private sector will be needed where industrial effluent is mixed with domestic wastewater, which is according to Weckenbrock et al. (2011) so far not a problem. While pathogenic risks from domestic wastewater can be addressed also on farm via so called 'non-treatment' options (Amoah et al., 2011; Mara et al., 2010), chemical contaminants from industrial origin require conventional treatment, ideally at source. The willingness of the Pakistani private sector to accept this responsibility is high given its wish to comply with European import requirements (see **Corporate Responsibility Model 22** in this publication).

Box 16. Direct and indirect wastewater auctioning

Also in **India's Gujarat**, many cities reportedly sell access to treated and untreated wastewater for use in agriculture, and also auctioning is common (Palrecha et al., 2012). The use of wastewater is recognized by the Government of Gujarat and water charges are being collected at the same rates as applicable for lifting water from notified rivers. Competition is high for its assured availability and nutrient value. Wastewater auctions are held annually, for example in the Kutch district. In the villages of Anadpur (Yaksh), Mota Dhavda and Sanyara, wastewater is auctioned annually at USD 100–200 for irrigating 2 to 6 ha in each village. With increasing demand for freshwater in cities, there have been trade-offs between farmers and the cities for availing freshwater in exchange for wastewater. There exists an MOU, which was signed between the farmers of a wastewater cooperative in Rajkot and the Rajkot Municipal Corporation since around 1970 according to which farmers are not allowed to lift water from Lalpari Lake for irrigation to allow supply to Rajkot city. In exchange, wastewater is supplied to the farmers by the Corporation, similar to the Iran case under Model 20 in the catalogue. This MOU is still operational.

Like in Pakistan, many farmers in Gujarat irrigate with wastewater despite having the option of groundwater irrigation because they see wastewater as (a) more reliable and accessible throughout the year; (b) cheaper to lift; and/or (c) more profitable because of its nutrient value leading to higher yields and savings in fertilizer input costs (Palrecha et al., 2012; www.peopleincentre.org/PiC/?p=748). Also the nutrient value of fecal sludge has been recognized, with reported sludge auctioning in Karnataka, India (see Business Model 17).

Auctioning replenished groundwater has been described from other countries as a new perspective for financing water reuse with the issuance of groundwater credits where treated municipal wastewater effluent is used to recharge groundwater. In Prescott Valley, in the state of Arizona in the **USA**, groundwater credits created in such a manner was auctioned in November 2007 with the help of WestWater Research. The winning bidder, Water Property Investors LLC (a New York-based water resource investment firm) agreed to pay USD 67 million in total annually (USD 20.16/m^3) for the right to withdraw 3.3 million m^3/yr from the ground. Prior to finalization of bids, Aqua Capital Management LP agreed to pay USD 53 million for the equivalent rights, which guaranteed the floor price of the auction (GWI, 2010).

Potential risks and mitigation

In designing any business model, it is assumed that generic business risks are known and will be taken care of. However, some risks might be more model specific and will be acknowledged in the following:

Market risks: Most farming locations where wastewater is formally or informally used are in close proximity to major urban markets and well positioned to respond quickly to market needs, save on transport costs and deliver high-value crops also in the lean season when revenues peak. As crops produced with wastewater or freshwater are mixed in markets and risk awareness along the food chain is commonly low, market related risks are limited.

Competition risks: Only with increasing risk awareness, the potential of competition from freshwater farmers could be growing. So far this awareness is in most low-income countries limited.

Technology and performance risks: WHO approved low cost wastewater treatment and non-treatment options are available which either treat the water before reuse, or on-farm accompanied by safe irrigation practices and post-harvest safety measures (Amoah et al., 2011). Care has to be taken that employed technologies like in the presented case study, do not have side effects (nutrient loss, salinity increase) which are not accepted by farmers.

Political and regulatory risks: The regulatory framework has to acknowledge wastewater as a commodity with value, which water authorities can market. This can give authorities bargaining power to lobby for safety practices.

Social equity related risks: The share of men and women in the informal irrigation sector differs between countries and cultures. In Pakistan, women have significant difficulties accessing irrigation water, and less responsibilities in irrigation than men. In other countries, it can be the opposite, with changing roles along the value chain. However, under the current auctioning conditions, no (additional) gender related discrimination has been reported, although the process is male dominated while there are value chain advantages for women.

Safety, environmental and health risks: The model applies the WHO (2006) recommendation of a step-wise and stakeholder inclusive approach to risk mitigation which is an intermediate step until (a) more comprehensive wastewater collection and treatment systems are in place, which farmers also can accept; and (b) stricter safety guidelines can be implemented and enforced. Within this trajectory, risks, risk monitoring and risk mitigation measures remain important (Table 63) even if the dialog between authority and farmers will lead to the adoption of farm-based risk reduction measures (safer irrigation practices, on farm water treatment, crop restrictions).

TABLE 63. POTENTIAL HEALTH AND ENVIRONMENTAL RISK AND SUGGESTED MITIGATION MEASURES FOR BUSINESS MODEL 23

RISK GROUP	EXPOSURE					REMARKS
	DIRECT CONTACT	AIR/ ODOR	INSECTS	WATER/ SOIL	FOOD	
Farmers	HIGH RISK	MEDIUM RISK	HIGH RISK	HIGH RISK	NOT APPLICABLE	After introduction of farm based risk reduction measures, their adoption has to be monitored.
Community	NOT APPLICABLE	MEDIUM RISK	MEDIUM RISK	MEDIUM RISK	NOT APPLICABLE	
Consumer	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	HIGH RISK	
Mitigation measures				Pb Hg Cd	Pb Hg Cd	

Key: NOT APPLICABLE, LOW RISK, MEDIUM RISK, HIGH RISK

SWOT analysis and business performance

The strength of this business case is its ability to develop cooperative working relationship with farmers based on principles of mutual interest (Figure 271). By this approach, the authorities from the

WASA are able to negotiate land rent with farmers and implicitly determine the price of wastewater with the farmers leasing land from WASA. Another significant strength is the application of auction mechanism in setting the price of wastewater and thus following market principles in determining the price of wastewater.

While joint business between wastewater suppliers and users might be common where treated wastewater is offered to farmers, the case of WASA auctioning untreated wastewater should allow negotiating crop restrictions and other on-farm risk mitigation options. Another entry point for safety regulations is that farmers actively engaged in the discussion about water, organized themselves and did not shy away from legal battles. Also this offers opportunities to formalize the otherwise informal wastewater use.

The institutional linkages between both parties go far beyond other situations and countries where the use of untreated wastewater is considered illegal or authorities do not engage at all, or only with disciplinary action. WASA's engagement, however, and the acceptance of wastewater as a marketable commodity provides authorities with an instrument for the **introduction of a variety of possible risk mitigation options**, which are recommended by the WHO (2006) for the safe use of wastewater

FIGURE 271. SWOT ANALYSIS OF CHAKERA VILLAGE BUSINESS CASE DESCRIPTION

	HELPFUL TO ACHIEVING THE OBJECTIVES	**HARMFUL** TO ACHIEVING THE OBJECTIVES
INTERNAL ORIGIN ATTRIBUTES OF THE ENTERPRISE	**STRENGTHS** ▪ Wastewater accepted as commodity ▪ Low O&M of the treatment plant ▪ Cooperative working relationship (dialog between partners) ▪ Service attitude ▪ Auction pricing mechanism ▪ Continuous supply of wastewater	**WEAKNESSES** ▪ Inter-authority dialog on a joint reuse strategy for minimizing risks while maximizing benefits missing ▪ Treatment process (e.g. retention time) needs to be adjusted to avoid unnecessary changes in salinity and nitrogen levels which do not serve reuse objectives (farmers prefer untreated wastewater over treated wastewater)
EXTERNAL ORIGIN ATTRIBUTES OF THE ENVIRONMENT	**OPPORTUNITIES** ▪ High agricultural wastewater demand and legal support of water reuse ▪ Wastewater sharing arrangements ▪ Freshwater savings ▪ Auctioning gives an instrument for dialog on risk reduction ▪ Urban population growth resulting in increasing food (and agricultural water) demand ▪ Occupational and consumer health risks from pathogens can be minimized even without treatment plants if WHO (2006) guidelines are followed	**THREATS** ▪ Farmers exposed, e.g. to hookworms ▪ Possible human health risk may decrease demand for crops ▪ Potential conflicts due to worsening water scarcity and higher agric. demand than domestic wastewater supply ▪ Changes in policy on reuse ▪ Untreated industrial effluents may increasingly comingled with domestic wastewater ▪ Urbanization and loss of farmland

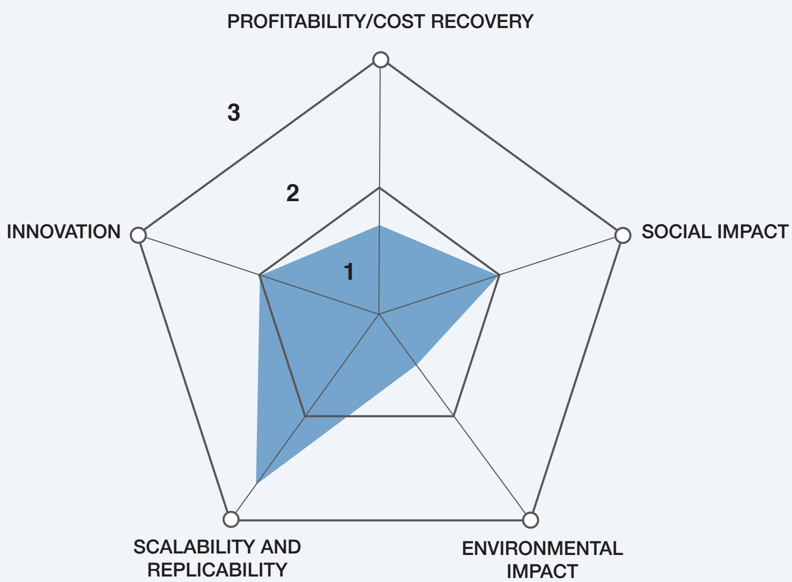
in agriculture. The market value of wastewater allows in addition the introduction of incentives (like extra water allocations) in exchange of compliance with safety measures.

WHO had realized with their 2006 guidelines that their 1989 water quality thresholds for wastewater irrigation as main risk barrier was in many countries unachievable due to the overwhelming challenge of wastewater collection and treatment. Therefore, WHO (2006) started emphasizing alternative risk barriers to protect farmers and consumers. So even where untreated wastewater is used, there are still multiple options for risk minimization, which include safe irrigation practices (Amoah et al., 2011; Mara et al., 2010).

A particular challenge in Faisalabad is that farmers prefer untreated wastewater compared to treated effluent. While untreated wastewater is considered high in nutrients and low in salinity, treated wastewater is considered low in nitrogen and – due to evaporation in the treatment ponds – high in salinity. In fact, the few recorded negative perceptions related to wastewater usually concern more plant growth than human health (Weckenbrock, 2011). A dialog between authorities and farmers should address these perceptions targeting a redesign of the local treatment plant's retention time. The hope is that participatory planning will lead to mutually acceptable standards for water quality and solutions for wastewater risk reduction which could become part of the business deal (Clemett and Ensink, 2006).

The innovative capacity of the model lies in the opportunity of a dialog on the trajectory from unsafe to safe wastewater use, with a relatively high scalability and replication potential due to its low costs. With neighbouring villages investing in pipes to access the wastewater, the models appear scalable as far as water is available, and replicable where policies support a dialog that helps negotiating risk mitigating measures (Figure 272). While the auctioning is not influencing water quality and the environment, it could help the stakeholder dialog which is central to any Sanitation Safety Plan (WHO 2015).

FIGURE 272. RANKING RESULTS FOR THE PRESENTED WASTEWATER AUCTIONING BUSINESS MODEL



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Case descriptions are based on primary and secondary data provided by case operators, insiders or other stakeholders, and reflect our best knowledge at the time of the assessments 2014/15. As business operations are dynamic data are likely subject to change.

Notes

1 Groundwater is of poor quality in the area of Chakera. In general, accessing groundwater is costlier than wastewater, either because of expensive tube well installation, maintenance and pumping fuel prices, or because of paying tubewell owners (Weckenbrock, 2011).

2 When asked about the reason why farmers still pay for freshwater in spite of not having received any for decades, several farmers indicated that the amounts are low and they simply preferred not to instigate trouble (Weckenbrock, 2011).

3 Some farners can only access treated wastewater due to the local topography.

The case has been dedicated to Dr Jeroen Ensink (1974–2015) who worked with IWMI in Faisalabad on safe wastewater irrigation for many years.

www.justgiving.com/fundraising/The-Jeroen-Ensink-Memorial-Fund