



Name: Sarvajal

Date of creation: Aug. 2008

Location: Ahmedabad, India

Nb staff: 95 people

Nb of plants installed: 154

Beneficiary households:
Over 20 000

Business model:
Drinking water selling model
through franchise (equipment
rental or purchase)

Price of the Water: US\$0,6 cents/l

CASE STUDY

Piramal Water Ltd. is a for-profit social enterprise that operates community water-filtration plants through local franchisees in mid-sized Indian villages (approximately 5,000 inhabitants).

They operate under the brand “Sarvajal”. They provide cost leadership, technological innovations, and the appropriate incentives to create market-based solutions that can reach enough scale to impact the health of India’s masses. Their mission is to make pure drinking water accessible and affordable for everyone.

EXECUTIVE SUMMARY

Piramal Water Ltd. is a for-profit social enterprise that operates community water-filtration plants through local franchisees in mid-sized Indian villages. They operate under the brand “Sarvajal”. They provide cost leadership, technological innovations, and the appropriate incentives to create market-based solutions that can reach enough scale to impact the health of India’s masses. Sarvajal, as it is known in the field, is purification technology agnostic. They are always looking for better, more cost effective, and more sustainable solutions to drinking water issues.

Their mission is to make pure drinking water accessible and affordable for everyone. They believe that the existing water infrastructure model (piped model) is fundamentally flawed for rural and underserved areas because of its prohibitive costs. So rather than centralized systems, Piramal Water believes that the purification of water should be done from the “inside” and thus be as close to the customer as economically feasible - isolating points of failure, overcoming the cultural taboo that selling water represents, trust issues and driving community (franchisee) ownership of infrastructure.

Date of creation :	August 2008
Operation area :	Offices: Ahmedabad, Jaipur and Bagar (Rajasthan) Franchisees: Operating in rural villages in Rajasthan (80%), Uttar Pradesh, Madhya Pradesh, and Gujarat, India
Nb staff :	95 employees - 154 franchisees
Production capacity / unit:	For Sarvajal’s Reverse Osmosis units: up to 500 liters per hour.
Total beneficiary :	More than 100 000 persons
Business model :	Drinking water selling model through franchise (equipment rental or purchase)
Supplier:	Locally available source of water, usually from borewell, belonging to the franchisee
Technology type :	Pre-filtration processing followed by RO filtration and UV disinfection
Source of revenue:	<u>For the franchisee:</u> sales of water <u>For Sarvajal:</u> percentage of water sales revenue
Target Market :	Villages (+1000 HH) where available water is infected mainly by mineral contamination
Funding sources :	Project from the Piramal Foundation
Legal Incorporation :	Piramal Water Private Limited - Brand name : Sarvajal (Water for all)

Economical impacts

At user level

- **Monthly consumption:** 20 liters/day/HH
- **Monthly expenses:** In average US\$6 (from US\$3,3 without delivery to US\$9 for chilled water with delivery) with a per liter cost of US\$0,6 cents/L (in comparison to US\$0.5/L for bottled water)

At franchisee level (new business model)

- **Cost of a new kiosk :** US\$14 000 (water purification system + 4 water ATMs + 1 delivery vehicle + 1 chiller + bottles)
- **Equipment lifetime:**
 - » Water purification system: 7 - 8 years
 - » Water ATM: 10 years
- **Total revenue :** In average US\$8000 per year
- **Total cost :** In average US\$4100 per year
- **Breakeven :** 30 - 45 months for a franchisee that has 4 ATMS and 150 families served per days

Social impacts

- Access to reliable, safe and clean water for 100k beneficiaries, via a growing number of franchisees (154 water plants in 4,5 years).
- Real positive impact in remote areas by resolving the access to clean water issue with solar water ATMs
- Water health diseases reduction

Environmental impacts

- **Efficiency comparison:** Sarvajal purification technology is 6 times more effective than a domestic purifier
- **By product:** Brine -> Sarvajal franchisees have to manage up to 4,500-5000 liters of brine per day.
- **Energy:**
 - » Solar Powered ATM
 - » Purification plant (pump & purifier for 500L/h): 2kW
 - » Much lower fuel cost/liter
- **Chemicals used:** Anti-scalant for the membrane, chlorine to clean recipient (not toxic or environmentally dangerous).
- **Hardware recycling:** Refurbishment and repair of end-of-life machines, re-tested before going back to the field. All old parts recuperated by Sarvajal.
- **Container:** No plastic disposable container adding onto plastic pollution

Innovations

- **Water Treatment Plant :** extremely low cost equipment assembled by Sarvajal.
- **Soochak :** a patented two-way monitoring device for each water system that gives real-time information on water production and enables to anticipate maintenance
- **SEMs :** Customized in house ERP that manages water enterprises from source to consumption.
- **Suvidha :** a pre-payment mechanism for franchisees
- **Solar Water ATM :** a solar-powered, stand-alone, cloud-connected RFID-based and cash-less water vending machine

PROBLEM TACKLED AND MAGNITUDE OF THE PROBLEM

General overview of water crisis in India

Of 850 million people globally lacking access to clean water, over 150 million live in India. There, the ratio of people who have access to safe water has improved from 72% in 1990 to 88% in 2008. Steady progress has been made toward the objective of providing sustainable access to drinking water throughout India. However, development of water source and water supply facilities has not kept up with the rise in water demand associated with the population growth and economic development. This results in excess dependency on groundwater, and discontinuous and unstable water supply is a constant challenge.

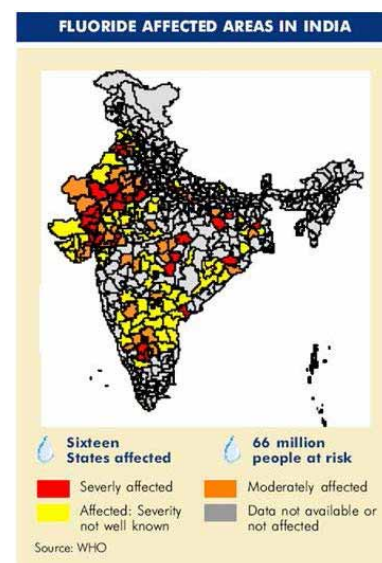
More specifically, India's 1.1 billion people need access to clean drinking water. The demand for domestic water use is divided between the urban and rural populations, and comprises about 4-6% of total water demand. Population growth is going to accelerate the water crisis in India, especially as more and more people move into the cities and become part of the middle class. Because the rivers are too polluted to drink and the government is unable to consistently deliver freshwater to the cities, many urban dwellers are turning to groundwater, which is greatly contributing to the depletion of underground aquifers. Rural citizens face a similar crisis. Currently 30% of the rural population lack access to drinking water, and of the 28

The specificities of Sarvajal operation areas

The area where Sarvajal operates is one of the most water stressed regions of the country. In the Indian state of Rajasthan, where the majority of Sarvajal franchisees operate, a staggering 80% of groundwater wells are already classified as critically over-drawn. But out of these wells, 80% of the water extracted is used for Agriculture in manner that is at least 70% inefficient.

Furthermore, 60-80% of districts in Gujarat, Rajasthan, Punjab,

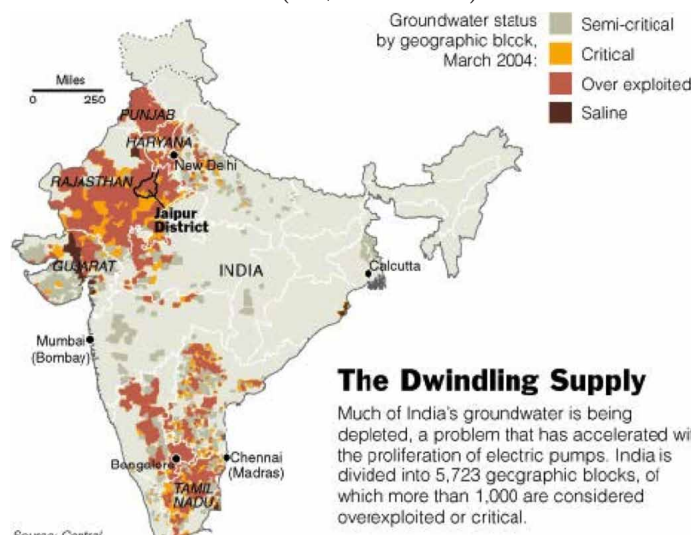
Andhra Pradesh and other states are affected by Fluoride contamination. Crippling effects of fluoride and arsenic toxicity due to non-availability of safe water for drinking and farming has become a major public health problem, which defies simple solutions.



TYPICALLY, SARVAJAL WORKS IN VILLAGES LOCATED IN THE NORTH WEST INDIA (MAINLY IN GUJARAT & RAJASTHAN) WHERE AVAILABLE WATER IS MOST INFECTED BY MINERAL CONTAMINATION .

states in India, only 7 have full availability of drinking water for rural inhabitants.

Furthermore, in some areas, the groundwater contains substances harmful to the human body such as fluoride and arsenic, greatly exceeding the standard provided by the World Health Organization (WHO) Guidelines for drinking water quality. Over 21% of transmissible diseases in India are related to unsafe water. 40 Millions Indians are affected each year by preventable diseases caused by inadequate water supply and sanitation. This leads to an estimated 73 million working days lost annually due to waterborne diseases, erasing INR 2,700 Crore in economic value (US\$600 millions).



Those suffering from fluorosis complain of fatigue and typically the bones of the backbone, neck, hands or legs of the affected person become fragile and lead to deformity. It becomes difficult to stand, run, walk or carry a load.

E.g.: The people of Alwar district, for instance, were reporting increasing incidence of kidney failure as well as dental problems and severe joint pain. A study by Jhunjhunu-based JJT University showed that the fluoride content in the Alwar groundwater stood between 2 parts per million (ppm) and 7 ppm, way beyond the World Health Organisation's permissible limit of 1 ppm.

Previous efforts to address this crisis

Previous efforts to address this crisis limited by:

- Difficulty in creating financially sustainable system for providing water to people.
- Difficulty maintaining reliable machine operations, and high costs of repairing machines.
- No village-level systems for ensuring only clean water is provided to people.
- No systems for ensuring clean water accessible to families every day.

The effort to address this crisis have seen a drastic change with the recent Telecom revolution that India experienced. The GPRS connectivity has indeed enabled Sarvajal to use its technology to solve the problem of the last mile distribution.

ID CARD

General information

Name & creation:

- Piramal Water Private Limited
- Brand name : Sarvajal (Water for all)
- Creation in August 2008

Location:

- **Head Office** : Ahmedabad
- **2 other regional offices** : Jaipur and Bagar (Rajasthan)
- **Franchisees**: In rural villages in Rajasthan (80%), Uttar Pradesh, Madhya Pradesh, and Gujarat, India (1,000+ households per village)

Context: Piramal Water has its roots in the work of the Piramal Foundation, a charitable trust established by Ajay G. Piramal. The foundation initially piloted the Bagar Drinking Water Initiative as part of its Grassroots Development Laboratory in Rajasthan. The goal was to reduce fluoride contamination of drinking water in the Shekhawati region that had been linked to serious health problems.

The pilot revealed the enormous potential for market-based solutions to drive cost leadership, spur technological innovation and establish proper incentives to improve clean water access in India. The initiative was renamed Piramal Water Private Limited.

Human Resources

Employment:

91 and 4 volunteers at Headquarters and regional offices, split over 4 different teams: IT and R&D, maintenance and accounts, business development, and business support to franchisees. 154 Rural Franchisees in total.

Kiosk level job creation:

1-4 employees/ water point (depending on delivery system)

Franchisee profile and identification process:

Franchisee's profile:

Old Business Model : Mostly families wanting a second revenue (due to low investment requirement)

New Business Model : Entrepreneurs with investment capacity

Identification process:

- **Franchisee's Identification** : Advertising in districts where extension is planned (through radio, video or newspaper commercials) - In general, they receive an average of 300 answers - or through referrals (existing franchisees or employees)
- Due diligences process done by someone from the marketing team in villages checking the resources from the candidate, his entrepreneurial skills, asking elders about his image and social standards (it's really important for the franchisee to have some kind of importance in the village and to be trusted by the local inhabitants)... etc.

Main product

Clean and affordable drinking water

Business Model

Context:

During its 5 years of operation and because of its "learning -on-the-go" approach, Sarvajal has modified its business model, from a business format franchise with equipment rental to one with equipment purchase. The reasons for that are:

To increase scalability: The target of the old business model was villages of more than 1000 Households. But to be able to reach the 600 000 villages (out of 650 000 villages of India) that have less than 1000 households, Sarvajal needed to introduce a new BM with Water ATMs.

NB: Water ATMs couldn't be incorporated in the earlier business model because of its cost, almost equivalent to the price disbursed by the franchisees to set up their purification plants.

To ensure price & quality transparency: In the old model, there was no way for Sarvajal to control the price and the quality of the water at each remote locations. With the new Water ATM and its predetermined parameters, Sarvajal can guarantee that the customer will get the price and the quality that it has chosen.

To ensure sustainability: The purpose of the earlier model was to prove the concept. Now it's to ensure sustainability.

- In the earlier model, every new machine represented a lock down of capital, legal infrastructure was not very strong in case of the default of a franchisee, Sarvajal had no precise data on customers; franchisees were completely at the mercy of the inconsistency of the electrical supply, and the fact that franchisees didn't own the water treatment plant had side effect : the machines were not properly operated and taken care of. The employed operators were changed regularly and not correctly trained and the machines were not used to their full-capacity (mostly only 30% of their capacity)
- In the new business model, Sarvajal has a better knowledge of the customers (prepaid card for the customers), ATMs are solar powered which enables franchisees to run their machines the entire day, the franchisees are much more "incentivized" now that they have to pay for the capital cost and as a consequence, Sarvajal's is reaching a lot more people and its impact is much larger than before.

Old Business Model: Business format franchise with equipment rental

- Sarvajal purchases, assembles, installs at the franchisee's premises a ready to use reverse osmosis machine with a controller/ monitoring device and takes care of maintenance, quality monitoring and marketing.
- Franchisees buy a license, pay a monthly fee to Sarvajal for its services (maintenance, quality monitoring and marketing support fee), operate the kiosk and sell water to villagers in 20L containers with an optional delivery service for extra fees.
- Franchisees have a "reserved zone" of 3 km radius, to ensure a minimum of clients to support the plant.

NB : To secure the payment of the monthly fees, Sarvajal introduced a prepayment mechanism for franchisees that has reduced the costs of collection from 30% to 8% of operational costs: machines only operate for the volume the franchisees have purchased up-front. The minimum recharge amount is ~US\$250 - 41667 liter/month.



New Business Model: Business format franchise with equipment purchase

- Franchisees purchase a water purification unit, 4 water ATMs, a chiller (to cool the water), a delivery vehicle and the bottles they will deliver the water in. Then they operate the kiosk, sell water to villagers in 20L containers with an optional delivery service (normal or chilled water), or through Water ATM (that they have to fill regularly in). For maintenance & support fee (1 monthly marketing visit and 1 monthly maintenance visit), they have to pay to Sarvajal, using the same prepayment system mentioned previously, a monthly fee.
- For its part, Sarvajal purchases, assembles, sells and installs at the franchisee's premises a ready to use reverse osmosis machine with a controller/ monitoring device and at least 4 Water ATMs placed in remote areas. Like in the former business model, Sarvajal takes also care of maintenance, quality monitoring and marketing.
- And newly, Sarvajal is organising bank financing for its franchisees, as they wish to make it a complete standalone economic business model.

Revenue Model

Sources of revenue for franchisees:

Old Business Model:

Franchisee operates the machine and sells water in 20L batch for INR6 (US\$0.12), keeps 100% revenues for first month, then gives back 40% of water sales to Sarvajal (he keeps 100% of delivery fees).

New Business Model:

Franchisee operates the machine and sells water in 20L batch for INR6 (US\$0.12) and through Water ATM at US\$ cent 0,6/L, with an optional delivery service of INR4 for normal water and INR 9 for chilled water (US\$ cent 0,4 extra fees for 1 liter of normal water and US\$ cents 0,9 for chilled water), keeps 100% revenues for first month, then gives back to Sarvajal 20% of water sales revenue from the purification unit and INR 3 Paise (cent) per liter for the Water ATM sales. (He keeps 100% of delivery and chilling fees).

NB: In its R&D program, Sarvajal is developing an ATM with a temperature sensing technology that will enable the ATM to charge the customer accordingly to the temperature of the water delivered

Average billing:

Average households customer consumes 20L per day (4L for each of the 5 member of the family)

Old Business Model:

An average household pays ~US\$6 per month

New Business Model:

Idem but in addition there is the revenue from the water sales from the Water ATM (in average, 1000 liters per day per ATM from April to October and 500 liters per day per ATM the rest of the year) which represent a revenue of ~INR 22 000 during the summer season .

Economic Sustainability

Target Market:

Sarvajal is only targeting 60% of the total drinking water market of its operating areas. It does indeed not target:

- 30% of the population that is below poverty line and therefore can not afford to pay for water,
- The top 10% that can afford to buy a domestic water purifier.

Penetration rate:

50% penetration among Sarvajal's target market in mature kiosks with an average of 150 households per plant.

At franchisees' level:

Old Business Model:

- Capital expenditures: Initial investment of US\$950 to buy the franchise
- Operational costs: Franchisee bears cost of electricity (average US\$40/month), distribution (diesel costs - average US\$20/month), HR costs (average US\$110/month), tax, loan repayment for the vehicle and additional marketing/awareness activities
- Average Revenues: 150 households costumers - about US\$600 revenues/month (and 30% to 45% profit margin).

Franchisees typically reach breakeven in 6-12 months.

New Business Model:

- Capital expenditures: Initial investment of US\$14 000 to buy the water plant, a minimum of 4 ATM, a chiller, a delivery vehicle and the bottles to put the water.
- Operational costs : Franchisee bears cost of electricity (average US\$40/month), distribution + water ATM refill (diesel costs - average US\$30/month), HR costs (average US\$220/month), tax, loan repayment for the vehicle and the purchase of the equipment and additional marketing/awareness activities.
- Revenues: 150 households from the water purification system + 100 households from the 4 Water ATMs which represents in average a US\$900 revenues/month (and 50% to 65% profit margin).

Franchisees typically reach breakeven in 20-30 months

At Sarvajal's level:

- **Capital expenditure:** Sarvajal bears up-front cost of purchase and assembly of the equipment (US\$ 3000 for a water treatment plant and US\$ 1000 for each Water ATM), and the up-front costs of installation of the equipment.
- **Operational costs:** recurring costs (US\$90/month/franchisee) including expenses for parts, maintenance, marketing, and business development support.

VALUE CHAIN OF BUSINESS

Input

Water sourcing:

Locally available source of water, usually from borewell that belongs to the franchisee.

Space & Energy:

To set up the machines, the franchisee has to possess a space with an electricity connection.

R&D & Innovation

Water Treatment Plant:

Sarvajal has managed to source extremely low cost equipment and assemble it itself to keep costs down. The machine body, for instance, is done locally, rather than purchased (typically US\$500-1,500). Similarly, the tanks are extremely low cost. Max production: 84kL/week if working 24/7, constrained by electricity use and operator work time. Machine lifetime guaranteed for 6 years - lifespan: 7/8 years

Sarvajal lowered technology costs to US\$3k per machine (instead of a cost of \$45,000 in the U.S) including set up and installation.

Soochak:

All machines are equipped with a patented two-way monitoring device “Soochak” that gives real-time information on water production and enables to anticipate service issues before they create downtime for franchisees, thus improving quality management, and reducing operational costs (-20% since the installation of the remote system with 2 years ago: 2,3visit/machine/month now 1,7visit/machine/month).- price: (US\$700)

SEMs:

Customized ERP that manages water enterprises from source to consumption. Integrated with the Soochak™, Water ATM™, and with service, maintenance, and supply chain operations.

Suvidha:

A pre-payment mechanism for franchisees - machines only operate for the volume the franchisees have purchased upfront.

Solar Water ATM:

A solar-powered, stand-alone, cloud-connected RFID-based and cashless water vending machine that the franchisee has to refill regularly with treated water from its water treatment plant - also assembled by Sarvajal to save costs - These ‘water ATMs’ are operated by smart cards that can be topped up just as users do to buy talk time for prepaid mobile phones: at any local store or through

a roving representative. In opposition to the former solution of small and standardised plants that required a minimum village size of about 4,000 inhabitants to be financially viable, this new technology now enables Sarvajal to get water to the ‘last mile’ of the population, reaching the hamlets where water is an even more acute problem.

Production

- **Production capacity:** Sarvajal's RO units are generally designed to process 500 liters per hour. On average, Sarvajal franchises produce between 3,000 – 5,000 liters of potable product water per day during peak summer months, and around 2,000 – 3,000 liters during non-peak months.
- **Efficiency:** For a number of maintenance and management reasons, including the desire to prolong machine life and adhere to Indian water discharge regulations, Sarvajal's RO machines currently operate at 40% efficiency. Even though this figure might sounds low, it is still well above the domestic purifier yield, which is 6 times less efficient than Sarvajal's RO.
- **Quality of water provided:** 50 to 150 TDS (WHO standard).



Sales & Distribution

Access to the treated water at a fixed, affordable price:

- By purchasing it directly at the franchisee's premises,
- From the distribution system put in place by the franchisee for an additional cost.
- From a “Water ATM”, a solar-powered, stand-alone, cloud-connected RFID-based water vending machine that allows access to reliable drinking water to previously unreachable rural hamlets surrounding larger villages. (1)

NB: Nearly 80% of franchisees provide home delivery to their villages with their own last mile distribution system at an additional cost to users (up to INR 4, or US\$ 0.08, per container of normal water and up to INR 9 for chilled water). They typically own lightweight, three-wheeler trucks called “tempos,” designed to handle rural roads and be affordable to rural entrepreneurs. (2)



Billing & Payment

Daily for each 20L unit, or with prepaid 30-day cards that can be topped up just as users do to buy talk time for pre-paid mobile phones: at any local store or through a roving representative (with a monthly free cleaning of recipients).

Marketing

- Awareness/advertisement campaigns done by Sarvajal in new villages (within their first three months, included in upfront franchise fee) and low performing franchises, through full day event with role plays, games for kids.
- Marketing training for franchisees every 2 months
- Value proposition: "Clean water is accessible right in the beneficiaries' village and clean water is vital to health"
- Approach to developing consumer insights: Toll free land line to have direct feedbacks from clients
- Loyalty reinforcement: For the end-user, monthly prepaid card with free container cleaning at the end of the month. For the franchisees, incentives are given on volume sold, as well as rewards on referral schemes.

Consumer financing

Consumer financing:

None - But the new Water ATM allows anyone to purchase as much or as little water as they want at anytime for a low budget.

Franchisee financing:

Old Business Model: Family savings or microfinance. Not organized by Sarvajal.

New Business Model: Sarvajal is trying to negotiate with banks good loan conditions for the future franchisees.

After sales services

Water quality control:

Done by a controlling device that reports automatically to Sarvajal's headquarters every day, and more thoroughly every quarter at the plant with TDS meters. Cleaning solution for containers by Sarvajal free of charge to franchisee.

Maintenance:

E-monitoring device on each machine counting liters, detecting technical issues, checking repairers' work through individual pin code, and communicating information directly to Sarvajal HQ. Sarvajal can also block the machine at distance, if it faces maintenance issues. The interventions of the maintenance teams are also monitored at distance. Franchisee can send SMS to ask for an operator in next 48 hours. Technology is local so spare parts are easily available.

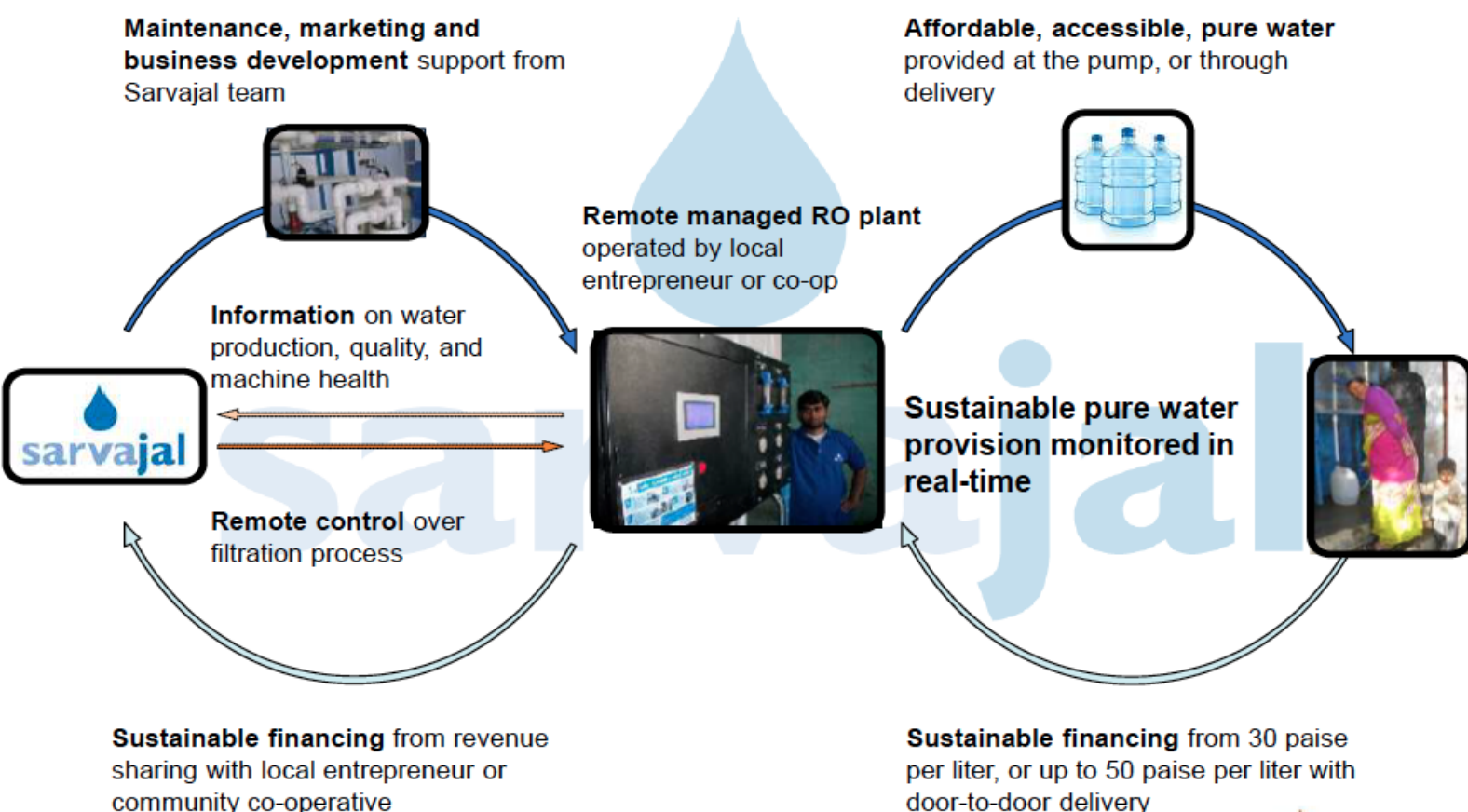
New franchisee's installation process

Area for a new kiosk:

Unoccupied public building or private building from franchisee.

Sarvajal engagements: Sarvajal's marketing & sales team provides each new franchisee with a minimum of 25 costumers per ATM immediately (viz. 100 costumers for the 4 ATMs)

1. By placing this point-of-sale device (Water ATM) in a central area, customers have 24/7 access and Sarvajal can track individual-level water usage.
2. To incentivize distribution, franchisees are allowed to keep 100% of the revenues they receive from doorstep delivery.



IMPACT TO DATE

Social impact

Scale and reach:

- 154 water plants in 4,5 years,
- More than 200,000,000 litres of clean drinking water served,
- More than a 100 000 regular costumers in 6 states.

Health impact:

Reduction of waterborne health diseases (especially those due to an excess of fluoride).

Overcoming social segregation:

As solar powered water ATM can be placed in any locations, it can deliver water to any community overcoming social segregation & caste issues.

Economical impact

Household:

- **Average beneficiary household income per month:** US\$150-250 (INR7,500-12,500), equals to Purchasing Power Parity \$390-651 (2009 data). Assuming 20L/day/household, monthly water expenses (US\$6) represent less than 4% of the average household's income.
- **Access to poorer costumer:** The new Water ATM allows anyone to purchase as much or as little water as they want at anytime. Prior to the ATM, Sarvajal only sold its water in 20L bottles because its price per liter of water was so low that it didn't make operational sense to sell it in smaller denominations. However, given the convenience for customers and franchisees (they only need to deliver water once), people are now purchasing water amounts at just 1L and 5L quantities. These lower denominations have also brought down the initial purchase price of water and added more customers to the Sarvajal network. Typically they see a 150% increase in customers for each location where they add an ATM. Additionally, the purchase variations allow people to buy based on their own usage needs instead of a one size fits all purchase. This is especially valuable for those making less than \$2/day as they can make smaller purchases when they need it.

NB: Cost of alternative: Water bottle costs US\$0.5/L - Extortionate for most of beneficiary households

1. One of the reason why Sarvajal has kept the operating efficiencies so low is to keep the brine stream relatively dilute for ground application and to keep the efficiencies constant for maintenance simplicity. Sarvajal also believes that by keeping the TDS concentrations relatively low, franchise owners will be able to find more uses for the brine.

Business - Job creations: 1-7 employees/kiosk (depending on delivery system and the number of ATM) - creation in total of 400+ jobs that encourage clean water in communities.

Environmental impact

Water efficiency:

Sarvajal's RO machines have been able to bring down the waste water generated drastically, as compared to a domestic RO unit. It's purification technology is indeed 6 times more effective than a domestic purifier.

Waster water usage:

Based on the level of efficiency at which the machines operate (40%) (1), for every 500 liters of raw water that enters the treatment process, 200 liters are available as product water (i.e. purified drinking water), and 300 liters leaves the processing unit as brine. Using such levels of efficiency leaves Sarvajal franchisees with up to 4,500-5000 liters of brine per day to manage. Aware of this situation, Sarvajal is consistently working on the waste water usage problem and trying to figure out a solution for this still world-wide issue. As a palliative measure, Sarvajal estimates that the majority of franchise locations employ ground application to discharge the brine water (and remaining contaminants) that flow to the underlying groundwater table.

Energy consumption:

- **Purification:** 2kW needed to power pump and purifier for 500L/h
- **Transport:** With the ATMs, much lower fuel cost/liter. Maintenance visit by public transport. Container delivery transportation depends on franchisee.
- **Solar Water ATM:** In order to reduce the energy needs of the franchisee, Sarvajal has developed decentralized solar powered ATM.

Chemicals used: Anti-scalant for the membrane, chlorine to clean recipient (not toxic or environmentally dangerous).

Hardware recycling: Refurbishment and repair of end-of-life machines, re-tested before going back to the field. All old parts recuperated by Sarvajal.

Container: No plastic disposable container adding onto plastic pollution





ECOSYSTEM CONDITIONS

Corporate finance

Looking for new equity to scale up. Difficulty in accessing cheaper loans, without a recoverable and liquid asset, or a guarantee from a credit worthy or listed entity.

Legal / Regulatory

The sector for unpackaged drinking water is unregulated so far. On the contrary, to sell 'packaged water,' bottled water where you break a seal before you open it, you have to have regulatory approval.

For now, the Water ATM model thus enables Sarvajal and its franchisees to sell clean water that's not in a bottle.

Nonetheless, this could be seen as a possible future risk if competitors lobby for regulations that would be unfavourable to Sarvajal.

To overcome this risk, Sarvajal is working on an ISO certification, an innovative approach that is being carried out for the first time both in the social entrepreneurship field as in the unpackaged drinking water. They should get it within an year.

Key factor of success

Understanding regulatory loopholes & customer beliefs :

"Water is a very politically sensitive issue in India, as in many areas of the world. People feel like water is a resource given to them by some sort of divine power, not something someone can charge them for."

To allay those fears, Sarvajal made sure their filtration machines were transparent--literally--because seeing the water being processed allows users to feel as though they are paying for a service; likewise, the franchise model adds a human face to the business, rather than a corporate one.

"Instead of buying from a large company, you're really buying from a neighbour."

This nuance is critical to success. Almost a fifth of households started buying from Sarvajal within weeks, and franchisees were making money.

Technological innovations to overcome management & quality issues:

Managing Sarvajal's network of over 150 unstaffed micro-industrial plants requires deliberate planning. For example, the modules cannot be one size fits all; rather they need to be adapted to their location's environment while remaining capable of handling changes in environmental dynamics. Nevertheless, the plants cannot become too individualized. If Piramal Pvt Ltd was to build a solution for each household, they would lose efficiency and ensuring quality would become even more difficult. For this reason they developed Water ATM which resulted in more points of sale and distribution for clean water without having to build each time a new micro-industrial plant. In addition to that, they developed a combination of remote and automated controls that allow engineers to ensure that each drop of water is served with a guarantee of tight quality control, while providing real-time data on the amount of water produced at our plants and on the customers accessing Sarvajal water. The best example is that the water dispensers are fitted with automated controls which stop dispensing water in case the product water quality lies outside WHO defined limit for potable water.

"The key to finding an answer is to reduce the problem to one you can solve, setting constraints and innovating until you make it work. Technology is an enabler, but the real wisdom is building an operation that sustains service delivery at the last mile."

GROWTH GOALS

Piramal Pvt Ltd expects the community level water filtration market to be \$730M annually by 2020.

They expect to have 70% to 80% franchisees on the new business model and 20% to 30% that remains on the former business model.

- **2013:** Serve 200 villages and 20 slums, serving a total of 200,000 people by deploying 300 plus functional water ATMs
- **2014:** Serve 600 villages and slums in 10 cities to serve a million people daily
- **2016:** Be present in 1,900 villages in Rural India, serving 2 million villagers daily. In the slums and underserved areas of 20 big cities of India, serve another 2 million people daily.

But for that, they are seeking \$2M in equity over the next 4 years to serve 2,000,000 people.

The Piramal Foundation is also looking at organisations that get a large number of footfalls and has teamed up with some municipal schools in North India, where school children can get around 5 litres of free water every day.

TECHNOLOGY OVERVIEW

Technical description of the power plant

Sarvajal's treatment schematic consists of pre-filtration processing followed by RO filtration and disinfection. Groundwater is the predominant source, and is first pumped through a carbon cartridge filter, followed by a micro filtration cartridge. The purpose of these pre-filtration processes is to remove contaminants that may otherwise damage the RO membranes, including large particles, suspended solids, and dissolved organic materials. The water is then pumped using higher pressure through the RO unit filtration, where most dissolved particles and ions are separated from the product water. The brine stream is also removed from this part of the process while the units are in operation. The last part of the treatment schematic is ultraviolet (UV) disinfection, where remaining biological contaminants are treated.

Explanation of reverse osmosis techniques

The term 'reverse osmosis' is derived from the basic concept of osmosis, which is the diffusion of water from higher to lower concentrations of dissolved solids. Whereas conventional osmosis concerns the movement of water from lower to higher solute concentrations, RO works in the opposite direction by using external pressure to pump water across a selectively-permeable membrane. The membrane acts as a filter, leaving large particles and ions behind and allowing water and smaller ions to pass through. The final product of this process is two-fold:

- A purified water stream that can be used for drinking water (also called the product water or permeate),
- A highly-concentrated waste stream that can be routed for disposal (also called the brine stream).

The brine stream is much more highly concentrated than the source water, and it presents both a challenge for proper disposal and an opportunity for reuse.

Reverse-osmosis is reducing the amount of totally dissolved solids (TDS) in the water by pressing it through a membrane. The biggest disadvantage of the technology lies in this procedure, as around 50% of waste water with an almost double TDS amount is occurring. It seems like no solution has been found yet what to do with this waste water.



The downside of reverse osmosis

Sarvajal works to provide clean and affordable drinking water to rural communities in India by employing the technology of Reverse Osmosis (RO) on a local scale. This process is considered one of the best water purification technologies currently available; however, as a by-product of this process, brine is produced that contains concentrated contaminants.

Discharging RO brine to the ground may, over time, lead to increased metal and mineral concentrations in the surface soil and underlying groundwater. Long-term increases in TDS concentrations in the surface soil could be detrimental for local ecosystems as well as challenging for successful agricultural production. Increasing TDS concentrations in groundwater is also problematic since higher concentrations in the source water lead to higher future operating costs for the RO unit, reduced volume of recoverable drinking water, and higher brine concentrations in the future, further perpetuating the problem.

NB: For franchises in areas of Rajasthan with high TDS concentrations in groundwater already, this problem is further exacerbated. That's why Sarvajal is consistently trying to figure out a solution for this still world-wide issue. Nevertheless, this result must be put in perspective knowing that only 0.5 per cent of all extracted water is used for drinking, whereas most of the rest is used for agriculture, (according groundwater extraction data).



Sarvajal's purification plant



Sarvajal's new ATM



SEVEA – Synergie pour l'Echange et la Valorisation des Entrepreneurs d'Avenir - is a not-for-profit organisation that strives for an improvement of the answers brought to energy and water issues (from an environmental, a social and a societal perspective) in developing countries by supporting social enterprises from these sectors.

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