



## Business model innovation in the water sector in developing countries



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### HIGHLIGHTS

- We describe the importance of business model innovation for water services in low-income countries.
- We describe business models for household devices and community-filter.
- We examine current business model innovations.
- We highlight the capabilities for making business models successful.

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### ABSTRACT

Various technologies have been deployed in household devices or micro-water treatment plants for mitigating fluoride and arsenic, and thereby provide safe and affordable drinking water in low-income countries. While the technologies have improved considerably, organizations still face challenges in making them financially sustainable. Financial sustainability questions the business models behind these water technologies. This article makes three contributions to business models in the context of fluoride and arsenic mitigation. Firstly, we describe four business models: A) *low-value devices given away to people living in extreme poverty*, B) *high-value devices sold to low-income customers*, C) *communities as beneficiaries of micro-water treatment plants* and D) *entrepreneurs as franchisees for selling water services* and highlight the emergence of *hybrid business models*. Secondly, we show current business model innovations such as cost transparency & cost reductions, secured & extended water payments, business diversification and distribution channels. Thirdly, we describe skills and competencies as part of capacity building for creating even more business model innovations. Together, these three contributions will create more awareness of the role of business models in scaling-up water treatment technologies.

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### 1. Introduction

Although water treatment technologies improve continuously, challenges remain in making water safer and more affordable for the low-income segments of the populations in developing countries. Low-income segments refer to the approx. 3.3 billion people living close to the poverty line of about 3975 USD per year in purchasing power parity (PPP) (World Bank, 2012). These people already pay for their water, and have annual water expenditures estimated at 20 billion USD (Rangan et al., 2009; Hammond et al., 2007). However, these people face a “poverty penalty”, as their water is less safe while they simultaneously pay a higher price for it than higher income segments (Banerjee and Morella, 2012; Mendoza, 2011; Prahalad, 2004).

In the context of fluoride and arsenic mitigation, for example, relevant water treatment technologies (such as pretreatment oxidation, adsorption and ion exchange, adsorption, precipitation and coagulation

and membrane methods) face difficulties in becoming more affordable for the low-income segment (see German et al., 2014; Johnston et al., 2014; Osterwalder et al., 2014 for further information). For example, the Ethiopian organization *Oromo Self Help Organization (OSHO)* has experimented using bone char as a low-tech adsorption solution for fluoride mitigation for a couple of years already. Until now, *OSHO* has installed a few community filters and promoted a few hundred household filters. This scale remains minor when compared to the 14 million Ethiopians in the rift valley affected by fluoride mitigation (Zewge and Emiru, 2011). The Nepalese organization *Environment and Public Health Organization (ENPHO)* has promoted *Kanchan* filters on a large scale, but many filters are not maintained and people do not use them continuously (e.g., Ngai et al., 2006; Thakur et al., 2010). Safe and affordable drinking water for mitigating fluoride and arsenic is therefore still available on a limited scale only.

Although reaching scale with water services has been financed primarily by philanthropic contributions, donations and government subsidies, supplementing these investments with market-based approaches has however been discussed recently (Easterly, 2006; Sachs,

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2005; UNDP, 2010). Market-based approaches rely on the view that serving low-income markets is an economically viable business strategy. As such, these market-based approaches differ from grant-based poverty alleviation initiatives because the goods and services provided by the venture are not free of cost (London, 2008). Market-based approaches advocate traditional “business” based investments in which the revenues cover these costs and generate profits. Unlocking private investments allows the water sector to become more independent of donations, governmental subsidies and philanthropic efforts (London and Hart, 2010).

Market-based approaches also change the awareness of people from getting something for “free” to receiving something “valuable”. When people pay for goods and services, they become aware of their value, which, in turn, motivates them to use and maintain them more carefully. People become more self-confident and even prouder, because they can afford something themselves (Viswanathan et al., 2009).

Within the debate of market-based approaches, providers of water services have started to experiment with business model innovations. OSHO, for instance, experiments with water revenues from the community to finance the bone char material. Unfortunately, the water sector still lacks knowledge of how business model innovation could reshape water markets. Lack of knowledge means that there is little empirical evidence of the long-term impact of business models and business model innovation (see Section 2 for definitions) on the demand and supply of water (Ahlstrom, 2010; Hystra, 2011; London and Hart, 2004; Prahalad, 2004; UNDP, 2010; Yunus et al., 2010).

We attempt to close this knowledge gap by drawing on our recent empirical investigations. However, being a feature article rather than a full research paper, neither the research methods used to collect the data nor the analysis of the specific case studies of business model innovations is described in detail. In short, an ethnographic method (e.g. interviews, observations and participation in workshops and meetings) (Arnould and Mohr, 2005; Lindeman et al., 2010) and secondary data (e.g. research reports and documentation of water projects) were used. We have taken examples from *A Vision for Clean Water*, ENPHO, Grameen Veolia, Nakuru Defluoridation Company (NDC), OSHO, Sarvajal, Trunz, Unilever and Water Health.

## 2. Theoretical framework for business models and business model innovation

A business model is an overarching concept, which assembles the different components that constitute an organization as a whole (e.g. Chesbrough et al., 2006; Demil and Lecocq, 2010; Morris et al., 2005; Johnson et al., 2008; McGrath, 2010; Osterwalder and Pigneur, 2010; Zott et al., 2011). A business model is a representation of an organization’s underlying core logic and strategic choices for creating and capturing value (Shafer et al., 2005).

The term “business” is not meant to imply that the business models are only useful for organizations aiming at economic goals (Foster et al., 2009). They are also relevant for organizations trying to maximize public welfare (or “social value”). Business models are often discussed within the categories of profit-oriented firms, social businesses and non-profit organizations. In the case of profit-oriented firms, the list of business models includes “low-cost providers”, “fast followers” and “razor and razor blade”. These have become common sense and outline how a profit-oriented firm can create value. Non-profit organizations describe their funding models as being “member motivator”, “beneficiary builder” and/or “resource recycler” (Foster et al., 2009). Social businesses can be classified into “service subsidization model”, “fee-for-service model”, “organizational support model”, etc. (Grassl, 2011). Table 1 highlights some business models of profit-oriented firms, social businesses and non-profit organizations.

Business models in the water sector can be organized either under a non-profit or for-profit oriented form, even if they are engaged in similar activities. Non-profit organizations or profit-oriented firms describe

the choice of the organizational form. Social and/or economic goals play a decisive role in the choice of the organizational form (Townsend and Hart, 2008). Individuals at NDC with a stronger social than economic motivation are, for example, more likely to choose a non-profit organization. Conversely, managers at Unilever with stringent economic goals would be more likely to integrate the Pureit water filters into a profit-oriented business unit.

The choice between non-profit and profit-oriented organizational forms depends not only on the economic and social goals but also on the institutional environment. Water providers operate mostly as non-profit organizations because it is easier to attain legitimacy. Legitimacy is more likely, due to the fact that water is a human right (United Nations, 2010). As a non-profit organization, it is also easier to gain access to donors and philanthropic investors. Stakeholders, such as the Ministry of Health and other governmental and non-governmental organizations, also favor co-operation with non-profit organizations rather than with profit-oriented firms. There is the risk of a public debate on whether profit-oriented organizations take advantage of severe health conditions if the Ministry of Health co-operates with profit-oriented firms.

We do not use non-profit and profit-oriented firms as a business model framework because they are solely organizational forms, and consider the importance of social and economic goals as being a more suitable framework (Townsend and Hart, 2008). This framework is a continuum spanning across the relative importance of economic and social goals. At one end of the continuum are business models in which social goals dominate and economic goals play a very minor role. At the other end are business models in which economic goals dominate and social goals play a very minor role.

*A Vision for Clean Water*, for example, maximizes social goals. In order to achieve the highest number of beneficiaries, the organization gives away household water filters “for free”. Economic goals, such as donations to finance the water filters, play a minor role here. Grameen Veolia offers simplified surface-water treatment systems to provide rural populations with affordable access to water distributed at village drinking fountains or via cans. Grameen Veolia applies economic goals such the recovery of investment and operational costs through water revenues. It also has a broad set of social goals such as distributing water to rural areas and thereby creating jobs for rickshaws drivers (“Grameen Boys”) distributing the water, and keeping the water affordable for all income levels (Yunus et al., 2010). Economic goals dominate for Unilever’s Pureit water filters. Unilever maximizes profits by achieving retail prices that are higher than the manufacturing and distribution costs.

Business model innovations describe the development and/or modification of the elements in a business model. *A Vision for Clean Water*, for example, has developed a partnership with the Nepalese non-governmental organization ENPHO for marketing water filters. Grameen Veolia has established prepaid card systems to make money collection more efficient. Unilever has developed different water filters (e.g. in the 19–45 USD range) to maximize market penetration. Supplementing the initial direct-to-home distribution channels with a distribution approach to embrace commercial retail channels accelerates market penetration further.

Organizations need to integrate other actors, such as non-governmental organizations (NGOs), governmental agencies, research institutes and other private firms (Gradl and Jenkins, 2011; Hammond, 2011) if they are to succeed with such business model innovations. Unilever develops, for example, partnerships with doctors as key opinion leaders in urban areas to facilitate the promotion of their Pureit filters.

The following section devises a framework for business models for water services. These models must be neither too general nor too specific if they are to be useful. The advantage of having such a business model framework is that it allows organizations to articulate clearly how they intend to succeed in providing water (Foster et al., 2009). Moreover they should not only highlight the existing situation but also depict

**Table 1**  
Typical business models within the domains of profit-oriented firms, social businesses and non-profit oriented organizations.

Profit-oriented firms	Social businesses (entrepreneurs)	Non-profit oriented organizations
<i>Low-cost providers</i> Low-cost providers offer low prices. Prices are kept low as providers offer lower quality and fewer services. Customers are often asked to perform self-services. All business elements are designed in a cost-efficient way.	<i>Entrepreneur support model</i> The entrepreneur support model offers business support and financial services to self-employed individuals or local firms.	<i>Public providers</i> Public providers access government funding and follow a collective interest. They concentrate on services that are perceived as being a core government responsibility.
<i>First-movers</i> First-movers gain advantages by being the initial occupant of the market segment. They gain control of resources, technological leadership, brand building, market creation, etc. that followers may not be able to match.	<i>Fee-for-service model</i> The fee-for-service model sells services to the low-income segment. The revenues received are used for recovering costs and paying for delivering the service, e.g. marketing associated with commercializing the services. Surpluses may be used to subsidize social programs that do not have a built-in cost-recovery component.	<i>Member motivators</i> Member motivators access multiple individual funders. They create an inherent collective community for fundraising activities. They concentrate on services with a collective interest.
<i>Razor and blades</i> "Razor and blades" is a business model wherein one item is sold at a low price (or given away) in order to increase sales of a complementary item that is essential to the initial product, e.g. inkjet printers and ink cartridges, mobile phones and service contracts.	<i>Service subsidization model</i> The service subsidization model sells services to an external market. The income that is generated funds social programs. Business activities and social programs overlap, thereby sharing costs, assets, operations, incomes and often program attributes.	<i>Beneficiary builders</i> Beneficiary builders access the decision maker of multiple individual funders. Their funding motivation is a combination of self-interest and altruism. The basic idea is to attract individuals who pursue, and are willing to pay for, specific societal benefits.
<i>Premium providers</i> Premium providers offer high-end products and services that appeal to discerning consumers. Brand image is an important factor, as quality is often a subjective matter.	<i>Employment model</i> The employment model pertains to employment opportunities and job training. Products or services are sold in the market.	<i>Resource recyclers</i> Resource recyclers concentrate on corporate funding. Corporate funders have a strong self-interest. Resource recyclers simply use the services and products created in the market economy for addressing social issues in low-income countries.
...	...	...

new business model innovations that make water services more affordable. Such new business model innovations are described in Section 4.

### 3. Business models for fluoride and arsenic mitigation

The mitigation of fluoride and arsenic from water sources in peri-urban and rural areas requires decentralized water treatment solutions such as household devices or micro-water treatment plants (capacity ranging from 5000 to 25,000 l per day). Such decentralized solutions have high investment and operational costs. The concentrations of arsenic and fluoride in the water source, which also affect costs, vary across the seasons, and are therefore, difficult to predict. Costs for chlorine sachets, used to combat microbial contamination, are much easier to predict. Moreover health risks associated with fluoride and arsenic contamination are rather long-term, making them difficult for water consumers to predict. Water revenues are thus uncertain because it is difficult to convince people to pay for water treatment. All in all, business models for arsenic and fluoride mitigation are challenged on both sides: cost structures and revenue streams.

*Kanchan* filters using slow sand filtration and iron hydroxide adsorption principles, *Sono* filters using zero-valent iron to remove arsenic from drinking water and *NDC*'s bone char filters are all examples of household devices. *NDC* has also installed its bone char technology as community filters. *Trunz water systems* using a reverse osmosis approach and the *Sidko* community filters using granular ferric hydroxide for adsorbing arsenic water are further examples of micro-water treatment plants.

Business models for household devices and micro-water treatment plants are illustrated in the next few paragraphs, where we describe the relevant organizations in the business model, revenue mechanisms, customers, cost structures, value proposition and value chain. The revenue mechanisms describe how organizations recover their costs. The cost structures cover research & development (R&D) expenditures, manufacturing costs, marketing & distribution and customer service costs. A value chain is a chain of activities (Porter, 1985) that delivers household devices or micro-treatment plants.

Business models for household devices take two basic configurations: a) *low-value devices given away to people living in extreme poverty* and b) *high-value devices sold to more financially viable customers*. Basic business models for micro-water treatment plants can be described as

c) *communities as beneficiaries of micro-water treatment plants* and d) *entrepreneurs as franchisees for selling water services*. Fig. 1 illustrates these four business models along the dimensions "households versus micro-treatment plants" and "social versus economic goals".

#### 3.1. Business model A: low-value devices are given away to people living in extreme poverty

An organization with a dominant social motivation employs this business model, financing household devices through external funding such as governmental subsidies and/or donations. It means cost coverage is achieved by subsidies or donations and not through economic goals for revenues from the households being supplied. The households in question live in extreme poverty, with annual incomes of just 500–1000 USD (PPP), and are thus not regarded as customers to whom the devices can be sold. The organization does, however, need to "sell" the necessity of using the household devices to treat water to them. The goal is to reach as many households as possible within a given budget in order to maximize the social impact.

The organization executes two value chains. Firstly, it undertakes fundraising: this starts by identifying funding sources and continues by developing funding proposals for promising projects, administering the funding received and reporting the project's progress to the funder. Secondly, the organization manages R&D, manufacturing, awareness building, distribution channels and customer services.

The need to raise funds for water services leads the minimization of costs. Organizations take, for example, advantage of research institutes. These institutes cover the R&D expenditures and the organization gets the device developed more or less for free. The *Massachusetts Institute of Technology (MIT)*, for example, developed the *Kanchan* filters (Espinoza, 2011). Bearing in mind the conditions prevailing in the low-income countries, MIT tried to minimize manufacturing costs. Cost minimization, however, led to limited functionality and convenience. Although the *Kanchan* filter has many advantages, it also has a few functions that limit its convenience to households. Filters should not be removed after installation because they may crack. They should not be used for harvesting rainwater as this compromises the removal of arsenic. Even if the flow rate is good, with 15 to 20 l per hour, the water has to be produced in batches. People need to plan their consumption of water and be able to store it. Households also need to

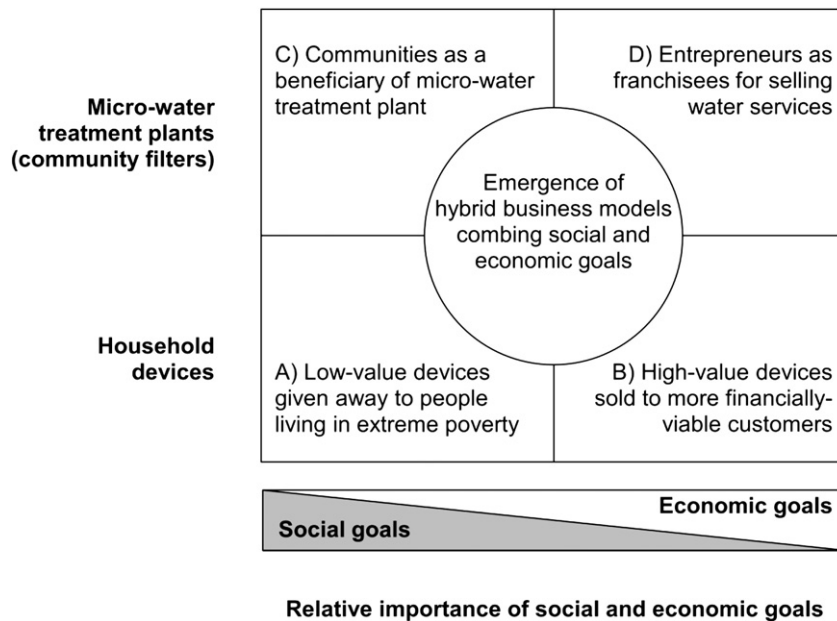


Fig. 1. Basic business models for water services addressing the mitigation of arsenic and fluoride.

change the filter material themselves. The cost-driven design is highly standardized and difficult to customize for various household sizes, water preferences and water sources (e.g., Ngai et al., 2006; Thakur et al., 2010).

In order to reduce distribution costs, this business model concentrates on sharing distribution channels with other NGOs. Sharing distribution channels concentrates on temporary support in the physical transportation of household devices. The organization relies on a self-service approach to minimize service costs, whereby the people simply maintain the household devices themselves.

### 3.2. Business model B: selling high-value devices to more financially viable customers

An organization in which economic goals dominate employs this business model and co-operates with NGOs and micro-credit institutes. NGOs act as educational and distribution partners, as in Model A. Micro-credit institutes finance upfront investments in the household devices. The value proposition is not only about health protection but also greater convenience and improved reputation for the actual owner. Such a value proposition makes customers more willing to pay for the devices, so they are sold initially to medium-income segments with annual incomes ranging from 1500 to 5000 USD (PPP).

Compared to Model A, this one extends the value chain. It starts with R&D and continues with manufacturing and distribution. Marketing and sales processes, however, are additional and important value chain activities. The value chain ends with customer services. This business model includes some minor external fundraising activities usually for a portion of the capital investments, but the revenue generated by selling filters covers the remaining costs. The goal is still one of the safe water, but the funding mechanism is from people buying filters rather than from donors or aid agencies.

This value chain balances the equation of low costs and high-value products. R&D focuses on designing more comprehensive functionality and higher levels of convenience. Manufacturing and distribution activities resemble Model A. Marketing goes beyond the pure education of households in hygiene and health issues and is more about brand building and positioning the household devices as aspirational product categories. Customers actually buy the device, so they expect a choice of high-value products and alternative payment options. *Unilever*, for example, began with two high-value product variants. This has since

doubled and there are now four alternatives (*compact*, *classic*, *autofill* and *marvella*) that provide customers with a valuable choice of product. Customers can also choose the payment scheme that suits them best, e.g. up-front versus deferred payments, weekly versus monthly payments and, for financing up-front payments, micro-credit versus savings groups. Finally, the value proposition of high-value devices goes beyond the self-service approach and also requires value-added services (e.g. installation, maintenance and repair).

### 3.3. Business model C: communities as beneficiaries of micro-water treatment plants

This business model for micro-water treatment plants involves the supplier of the micro-water treatment plant and the community operating it. The supplier has a strong social motivation to install the plants, which are financed through fundraising. The value chain consists of R&D, manufacture, installation, transfer, operation and maintenance. Once the organization has raised a certain amount of funds, it attempts to maximize its social impact within a given budget. Thus, the supplier organizes the value chain to minimize costs.

As in Model A, research institutes conduct the R&D activities and offer support in setting up the community-based filters. The *Swiss Federal Institute of Aquatic Research (Eawag)*, for example, supports *OSHO* and *NDC* in developing bone char technology in terms of usage and production of bone char. *OSHO* and *NDC* minimize costs by transferring the responsibility for operation and maintenance of the filters to the community. Both organizations do this by selecting caretakers among the members of the community. These caretakers are trained with basic operational and maintenance skills so that each micro-plant can be run relatively autonomously. The supplier only monitors the operation through occasional site visits. *OSHO*, for example, takes frequent water probes to test the mitigation rates of fluoride. Based on the test results, the bone char material is replaced when necessary. *NDC* educates the caretakers in taking probes and sending them to *NDC* for testing. Bone char material is replaced if the test results do not comply with a pre-defined value. Experience gained from the *Sidko* community filters in Bangladesh suggests that the role of the caretaker is decisive for the use of community filters. The acceptance of the *Sidko* filters by the village people can be either positive or negative, depending partly on how well the caretaker manages the filter.

Normally, this business model does not demand the recovery of the investment and operational costs. Members of the community do not pay for the water services. The community is more of a beneficiary than a customer of the micro-plant. The organization uses two criteria when choosing communities: poverty and water quality. Firstly, it selects the poorest communities (ones that cannot afford any other micro-plant themselves) and, secondly, it selects those facing the greatest challenges in water quality. *OSHO*'s first three bone char filters, for example, were placed in communities that had a high concentration of fluoride.

#### 3.4. Business model D: entrepreneurs as franchisees for selling water services

The fourth business model departs from the idea that the community and its members are beneficiaries. This business model involves the supplier of the micro-treatment plant, a local entrepreneur who operates the plant and sells the water and, finally, the community members who buy the water. All three focus on economic goals. The micro-plant supplier recovers the R&D expenditures and manufacturing costs by franchising the plant to a local entrepreneur. These entrepreneurial franchisees come from the villages affected by fluoride or arsenic mitigation and thus possess valuable market knowledge. In the case of *Sarvajal*'s reverse osmosis water plant, for example, the local entrepreneur becomes a franchisee. A franchisee makes an initial up-front investment of 500 USD and then pays 40% of the actual water revenues to *Sarvajal* as a franchising fee of 100 USD per month. The monthly water revenue in a typical village of 3000 people amounts to approx. 250 USD. This sum is derived from selling 1400 l per day at a price of 0.12 USD per 20-liter jerry can. As these numbers illustrate, this business model is triggered by an easy and favorable business proposition for the individual entrepreneur.

The micro-plant supplier selects promising entrepreneurs based on two criteria: skills and water demand. The entrepreneurs should possess the skills to develop the water market and build trustful relationships in the community, as well as the technical skills necessary to operate and maintain the plant. The communities that are favored have a certain demand for water services and can afford a certain water price.

The supplier of the micro-plant recovers the R&D and manufacturing costs through small up-front payments and franchising fees from the local entrepreneurs, for whom these payments and fees nevertheless represent a major cost. The advantage of the franchising fee is that it is paid only if revenue is generated. The second major cost is the salary of the actual entrepreneurs (for promoting the water services) and the operation and maintenance of the micro-plant. These entrepreneurs recover their costs through selling water to the community.

The community also has an economic incentive. Community members already pay for expensive bottled water, or have to finance the drilling of holes and installation of pumps for accessing ground water. This business model will be successful if the full price of water (i.e. including the cost of drilling holes, buying and installing pumps, etc.) is higher than buying water from the franchisees.

The suppliers do not sell the micro-plant to the franchisees, but rather identify and train entrepreneurial-oriented franchisees who then take over the operation and sales activities for the water services. Distributing jerry cans or installing a small network of water pipes can be an essential part of the sales activities.

The value proposition for the micro-plant supplier is about offering local people the opportunity of starting a small-scale water business. The water business provides the entrepreneur with a livelihood and the ability to generate a stable income. The value proposition for the entrepreneur is to provide villagers with safer and more affordable water.

#### 3.5. Emergence of hybrid business models

The four business models illustrated in Fig. 1 make a distinction between social and economic goals, although recently these two goals

have been seen to converge all the more. Organizations in which social goals dominate are turning increasingly toward economic goals. In other words, these organizations recognize the increasing difficulty in fundraising and, therefore, attempt to generate water revenues as well as to reduce costs. Setting up such economic goals means that the organizations are more likely to cover their costs but, at the same time, they have to learn from profit-oriented firms how to organize professional marketing campaigns and build entrepreneurial capacity. Such marketing campaigns should make customers aspire owning household devices; entrepreneurial capacity refers to not only arranging caretakers for community filters but also considering these people as entrepreneurs who are entitled to develop small-scale water businesses.

Achieving economic goals might only be feasible in medium-income segments or situations wherein people face a high poverty penalty when paying for water. Organizations emphasizing economic goals have no financial incentive for concentrating on the low-income segment. Hybrid models combining economic and social goals might emerge through external, social impact investors. Such investors could purchase the household devices and/or micro-treatment plants and rely on the expertise of economically-driven organizations to operate them. If *Trunz*, for example, was to focus purely on economic goals in the Nepalese market, it would concentrate on selling its water treatment equipment to international hotels. By focusing also on social goals, however, *Trunz* tries to market its equipment to rural villages and hospitals, which are financially less attractive markets. *Trunz* co-operates with the *World Wildlife Fund (WWF)* and the *Swiss Development Corporation (SDC)* in order to extend the scope of its business toward the low-income market segments. *SDC* gives an interest-free loan to finance the equipment if the people living in extreme poverty are targeted; *WWF* takes over parts of the investments if the equipment is used to provide safe and affordable water in its designated protected areas in Nepal. *Trunz* supports community members in becoming small-scale entrepreneurs who can cover the operational costs incurred.

In the future, more hybrid business models will emerge and become white spaces for business model innovations. They could make selling treated water at a very low rate possible to less financially viable groups of society. The following section describes business model innovations that, on the one hand, increase the probability of success for the four business models and, on the other hand, support organizations in establishing hybrid business models that combine social and economic goals.

## 4. Business model innovations

Table 2 summarizes four main directions for business model innovations. The first innovation is a *diversification* within the water business model. A business diversification describes a strategy for increasing revenues by expanding into new services and/or new markets (Ansoff, 1957). Organizations invest in a promising business beyond the scope of the existing water services. Some water service providers have, for example, looked into the carbon credit market to create additional revenues (Williams and Murthy, 2013). The operation of a micro-plant could be extended to become a (water) kiosk that also sells chlorine tablets for removing bacteria, soap for personal hygiene and/or provides particular grocery services. The main idea is to not only create additional revenues but also increase customer satisfaction by meeting more comprehensive needs. These additional revenues make it easier to finance the micro-water plant. Diversification allows distribution channels to be shared between different product categories, such as chlorine tablets, hygiene products and other consumer goods.

A typical illustration is *OSHO*, which is contemplating providing additional services and products through the caretaker of the community filter. *OSHO* assumes that this would make the community filter more attractive and thereby generate additional revenues. *OSHO* also creates additional revenues through selling bone dust and/or bone char as fertilizer to local farmers, and is currently monitoring its sales costs and revenues. If the revenues from bone dust and bone char are higher

**Table 2**  
Examples of business model innovations.

Business model innovation	Description
1) Business diversification	<p>Goal: increasing sales revenues</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>– Using carbon credits to achieve additional revenues</li> <li>– Selling additional water services and products (e.g. chlorine tablets, disinfection kits = water kiosk concept)</li> <li>– Selling additional value-added services (e.g. hygiene products, grocery goods = kiosk concept)</li> <li>– Selling by-products from the production of filter material</li> </ul>
2) Water payments	<p>Goal: extending &amp; securing payments</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>– Introducing electronic payments at the micro-plants (e.g. water ATMs, pre-paid cards)</li> <li>– Accepting payments made by mobile phones for micro-credits for household devices</li> <li>– Linking payments to customer services (e.g. replacing bone char or germ kits)</li> </ul>
3) Cost recovery	<p>Goal: increasing cost recovery and improving cost transparency of the various business activities</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>– Analyzing the life-cycle cost</li> <li>– Reducing investment costs through local production of components, training local people to assemble water filters</li> <li>– Using activity-based cost estimation</li> <li>– Reducing operational costs by reducing production costs of the filter material; enhancing operational and maintenance skills to avoid break-downs</li> <li>– “Paraskilling” operations and maintenance activities</li> <li>– Increasing the number of micro-water treatment plants in the service area (to reduce service costs per plant)</li> <li>– Identifying and reducing operator failures</li> </ul>
4) Distribution channels	<p>Goal: professionalizing the distribution channels</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>– Developing a multi-channel distribution approach</li> <li>– Defining distribution schemes for each channel (e.g. distribution targets, distribution margins, sales volumes)</li> <li>– Extending the role of distribution centers to becoming service centers, thus allowing them to also handle marketing, sales, payments and services</li> </ul>

than the sales costs, the additional income would make an important financial contribution. This would make water more affordable in the long term.

The second business model innovation deals with extending and securing payments for the water provided. Securing payments means moving from using cash to paying electronically. *Grameen Veolia*, for example, has introduced a pre-paid card system: customers load their pre-paid card account and use it to pay for water at their surface-water treatment systems. The system used by *Sarvajal* is similar, but is based on the concept of a “water ATM”: customers withdraw water from the machine by paying for it with a type of credit card. These electronic systems enable the micro-plant supplier to monitor both the volume of water and the actual payments made, and financial losses caused by the misuse of cash payments are avoided.

Securing payments in the case of household devices means relying on micro-credits and/or deferred payments. Organizations experiment with payments made by mobile phones and linking payments to service activities to guarantee that households pay back the micro-credits. *Unilever*, for example, links payments to the replacement of their “germ kit”, which needs to be replaced up to four times a year. If households do not pay, the germ kit does not get replaced and the water filter ceases to function. *NDC* and *OSHO* are currently experimenting with prices for their bone char material. They expect communities to pay for their water and to use the revenues to finance the replacement of bone char material to an increasing extent. If this is successful, *NDC* and *OSHO* would increasingly recover their costs of providing water from the communities themselves.

Increasing the recovery of costs also requires a third business model innovation in the cost structures. While organizations must increase their cost transparency, they nevertheless have a good understanding of their investment costs. Deficits are mostly evident in the transparency of the operational costs. For example, *OSHO* analyzed its cost structures through a life-cycle cost assessment. The goal was to understand how much each activity (e.g. testing the actual fluoride mitigation and the production, exchange and recycling of bone char) in the operation of a community filter costs. With a higher degree of cost transparency *OSHO* was able to raise funding not only for investment costs but also for different levels of operational costs (i.e. first level regeneration of bone char, second level exchange of bone char and third level costs for

testing). Combined with higher revenues, it might be possible for the contributions made by the community to finance the exchange of bone char, and the sales of bone dust to finance the recycling of bone char. The costs necessary for testing (e.g. equipment and labor) would nevertheless have to be financed through external funding.

Organizations strive, however, to reduce investment and operational costs even further. *Kanchan* filters, for example, rely on local components to minimize investment costs. In an attempt to reduce transportation costs, they are now assembled as closely as possible to the location of the actual beneficiaries. Furthermore, assembling filters in situ has the added advantage that local people learn how to do this themselves, and thus avoid having to recruit employees formally and paying them to do it. The cost reduction depends, naturally, on the actual water treatment technologies employed. Some of them may remain too expensive, thereby making the provision of water financially unsustainable.

Another favorable way of reducing costs is to lower the number of operator failures. Experience from the *Sidko* community filters suggest that, in more than 50% of the filters, there is malfunction at some point during operation. The high level of skills required for operating and maintaining the micro-water treatment plant is often the cause of such failures. Local people often tend to have insufficient training and therefore cause breakdowns that, in turn, incur service costs for solving and correcting them. Suppliers of micro-plants are now tending to implement a “paraskilling” approach in which they re-engineer the operational activities into smaller, often discrete, processes that can be performed by lower-skilled people. *Sarvajal* has gone one step further by installing a monitoring system in the reverse osmosis units that allows operator failures to be identified. These failures provide valuable information on the actual design of the units and can be used for educating operators. Organizations generally need to reconsider the training programs offered to the communities and entrepreneurs, and understand that they need to provide more long-term support.

The fourth business model innovation concentrates on distribution activities. Organizations move increasingly from single to multiple distribution channels. *Unilever*, for example, started with a single door-to-door distribution approach but now manages multiple distribution channels such as direct-to-home, retail and partnership channels. Multiple distribution channels strengthen market penetration. Multiple distribution channels will fail, nonetheless, if each channel is not

optimized. In the case of *Unilever*, distribution targets, incentives, distribution turnover, sales prices, etc. were optimized. *Unilever* has discovered that the most reasonable way to meet the distribution target for the door-to-door channel is by making about 40 household visits per day. For its retail channel, an 8% retail margin is considered to be the best incentive for retailers to market the water filters.

Organizations also extend the scope of the activities in their distribution centers. *ENPHO*, for example, extends the role of health centers in the distribution of water filters to embrace payment collections and service offering for supporting their long-term usage, operation and maintenance.

Cost recovery, water payments, business diversification and distribution channels are the four main directions of business model innovations. Summarized in Table 2, they are not meant to be exhaustive, but rather highlight innovations with the greatest relevance to water services.

## 5. Early suggestions on capacity building for business model innovations

Business model innovations do not happen automatically: they require certain capacity building. Our research has indicated some early suggestions for facilitating capacity building. Capacity building refers to strengthening the skills, competencies and abilities of organizations so they can succeed with their business models and business model innovation. While the term capacity building is used in the context of economic development, business research frames these skills and competencies as being capabilities. Capabilities are generally defined as the resources and processes necessary to accomplish strategic goals (Penrose, 1959; Wernerfelt, 1984; Barney, 1991). Capabilities ensure the efficient execution of the business model and enable the organization to create business model innovations (Teece et al., 1997; Nelson and Winter, 1982; Eisenhardt and Martin, 2000). Capabilities are a bundle of competencies and skills that organizations need to strengthen through capacity building.

Capacity building techniques can include skills and competencies related to *market creation, cooperation between non-profit and profit-oriented organizations, “inclusive” business models, questioning existing approaches, long-term commitments, preparing for disengagement and small-scale market studies.*

Water markets have to be created from scratch. Organizations need to shift from discovering needs where markets exist to creating markets where needs exist (London and Hart, 2010). If the challenges in providing a safe supply of water were easily solved, some organizations would already make profits in a functioning water market (Thompson and MacMillan, 2010). While the demand for safe water, affordable household filters and functioning community water filters are enormous, and water markets often fail for two reasons: only a few customers demand safe drinking water and water treatment technologies receive insufficient investments (World Bank, 2013). Organizations have to focus on market creation rather than on market penetration. The business models should show how the organizations intend to establish a situation whereby people with low incomes are convinced of the idea of paying money for the value proposition of safe water and are willing to adopt it in their daily life (London and Hart, 2010).

Such market creation requires cooperation between non-profit organizations and profit-oriented firms. Non-profit organizations concentrate on the initial creation of the market structure and educate people in the long-term health effects of exposure to arsenic and fluoride. Better education changes preferences toward valuing safe water (WHO, 1997). Non-profit organizations and research institutes might conduct basic research on water treatment technologies and influence policymakers by defining acceptable levels for arsenic and fluoride mitigation. Alongside these positive influences there are also situations in which non-profit organizations provide households with filters and build community filters free of charge. It is in such cases that organizations with economic goals face difficulties in making profits. Moreover, organizations focusing on social

value often suspect profit-oriented organizations of trying to squeeze money out of the poor. The logic is that drinking water is a human right that should not be exploited through maximization of profits. Balancing economic and social goals is, however, essential in the creation of water markets.

Organizations should make business models more “inclusive”, i.e. the poor should transition from being purely consumers to becoming producers of water filters or entrepreneurs, distributors of household devices or franchisees for micro-plants (Karnani, 2007; London et al., 2010; UNDP, 2010). *Waterhealth*, for example, not only sets up water distribution centers but also creates economic opportunities for village women in India. The women, who understand the benefits of using safe water, function as promoters and can later become water distributors. Each woman can sell and deliver between 30 and 50 20-liter cans of clean water per day and thereby earn at least 20 USD per month.

Business model innovations take significant amounts of time. Organizations should, therefore, think in the long term. Long-term commitments refer not only to financial resources but also, and more importantly, to the development of human resources in terms of recruiting, developing and rewarding local managers for developing and implementing new business models.

Organizations should also continuously question the approaches that have previously led to success. In the cases of business models A and C, organizations concentrating on people living in extreme poverty should question whether the approach being employed could label water solutions as being a symbol of poverty. It may actually make people living in extreme poverty unwilling to use the water filters because they would be seen as being poorer than others in their own community. People with a little higher income might not use filters because they do not want to be regarded as being poor. Such negative branding effects can be avoided if organizations reposition water filters and make them a symbol of status, and also offer aspirational product designs (Vousvouras and Heierli, 2010).

For business models B and D, organizations should question the assumption that selling household filters rather than renting them to customers, or being paid directly for installing community filters, is preferable to relying on loans to the community. Organizations with a strong economic motivation favor the sales of household filters, since it has the shortest amortization time and allows them to keep full control of their finances. Renting household filters and granting community loans, on the other hand, mean that these organizations have to accept longer payback periods and need to start cooperating with mobile phone operators and/or micro-credit institutes.

Organizations should understand that simple market studies or client surveys are inefficient and therefore not very useful for business model innovations. Surveys of the willingness to pay for water services do not provide very valid information on which pricing decisions can be based. People not only have trouble imagining access to safe drinking water, but also systematically underestimate and falsify their willingness to pay (Merrett, 2002).

Organizations should favor small-scale over large-scale market studies. *Trunz Water Systems* in Nepal, for example, has transferred its emphasis from launching one business model for one micro-plant to a series of smaller experiments with three variations in the size of the plant and the business model used (e.g. hotel, hospital and village). The experiments can start off on a small scale, be modified and evaluated and then selected for a scale-up. *Trunz* expects these experiments to help minimize the risks of business model failures as well as to maximize the rate of learning. Such learning would enable successful business models to be identified more efficiently. *Trunz* will either redirect further efforts or terminate them while resource commitments are still minimal if the unfolding model does not appear to yield acceptable outcomes. Organizations focusing on social goals are often unenthusiastic about small-scale studies, as they might delay the accomplishment of significant social impact. Small-scale studies are hard and often painstaking to conduct.

Nevertheless, organizations should be more open to undertaking small-scale studies, as these would allow them to learn which business models might be the most promising. Less promising business models can then be modified without incurring any greater costs providing, of course, that it is still part of a small-scale study.

Business model innovations are much more likely to fail than to be successful. This puts the low-income segment at risk if organizations do not plan their disengagement. The disengagement plan should be made as early as when business model innovations begin. It should not only describe the direct costs of exiting the market but also include the costs of preserving their reputation and fulfilling obligations with partners (e.g., Karakaya, 2000; Matthyssens and Pauwels, 2000). Financial resources to cover these costs have to be made available and be included in the initial budget. For example, if an organization like *OSHO* recognizes that installing more bone char community filters would never be achieved in a financially sustainable way. *OSHO* and its donor the *Swiss Church Aid (HEKS)* could decide to disengage from the installation of new filters. At the same time, they would have a responsibility to ensure the necessary resources for continuing the operation of the existing filters. In short, organizations should hope for a take-off but plan for an exit from the market.

Organizations have to develop all of the skills and competencies that are a part of their capacity building strategy, i.e. *market creation, cooperation between non-profit and profit-oriented organizations, "inclusive" business models, questioning existing approaches, taking on long-term commitment, preparing for disengagement and small-scale studies*. This will enable the organizations to become more creative and successful with their business model innovations.

## 6. Conclusions

This article provides some early insights into business model innovations for water services in low-income countries. Four business models are described for the mitigation of fluoride and arsenic: A) *low-value devices given away to people living in extreme poverty*, B) *high-value devices sold to customers on low incomes*, C) *communities as beneficiaries of micro-water treatment plants* and D) *entrepreneurs as franchisees for selling water services*. Our four business models are key examples but, of course, other models can, and do, exist. These four business models can be positioned closely to the extreme ends of the continuum between economic and social goals. However, an increasing convergence has recently become apparent between economic and social goals. Organizations in which social goals dominate gravitate increasingly toward economic goals, and vice versa. We also describe the emergence of *hybrid business models*. These hybrid business models explore the possibilities of selling treated water at a very low rate to the less financially viable groups of society. Business model innovations increase the likelihood of success of the four business models and support organizations in establishing hybrid models that combine social and economic goals.

Current business model innovations that make the provision of water safer and more affordable are also highlighted. These innovations involve cost structures, water payments, business diversification and distribution channels. Although not exhaustive, they represent a starting point for driving new business model innovations. We described some early suggestions for the capacity building activities of water services providers. We highlight a preliminary set of skills and competencies that can enable water service providers to develop more innovative business models. This set of skills and competencies is not meant to be exhaustive. There might be additional skills and competencies for making business models successful.

All these findings are not restricted to business models focusing on arsenic and fluoride mitigation: they can be also applied to water businesses concentrating on microbial contamination. For example, our insights into the capacity building are relevant for all providers of safe water. Competencies for creating water markets, cooperating between

non-profit and profit-oriented organizations, making business models more inclusive and so on should be part of the capacity building of any water business. Business model innovations such as securing payments and increasing cost transparency costs are beneficial to providers of chlorine sachets or small water utilities in rural villages. Providers of water services also face problems of high default payments and of little cost transparency.

However, research should depart from considering the business model from a simple outcome-based perspective on how providers of water services capture value. It is more important that business model innovation is understood from a process-based perspective. Researchers should describe how water businesses evolve, i.e. how business models unfold in the context of providing water services to low-income customers.

Hopefully these key contributions will inspire organizations to reconsider the relevance of business models and business model innovations and also understand how they can be created and implemented. Sections 3, 4 and 5 can be considered as guidelines for providers of water services for assessing their current business models, ongoing business model innovations and the capacity building that is necessary.

Seen from a research perspective, this article is a call for more research on business models for water treatment technologies in low-income countries. Business models have often been studied in a rather isolated manner in organizational forms such as non-profit organizations, social businesses and profit-oriented firms. In order to make water provision safer and more affordable it is necessary that they be integrated. Furthermore, engineering scholars and natural scientists should become more aware of the role of business models and business model innovations in scaling-up water treatment technologies. Future progress in sustainable, safe and affordable drinking water in low-income countries should adopt a more interdisciplinary approach spanning, for example, the fields of social sciences (e.g. health and consumer psychology and business research), engineering (e.g. process technology and product design) and natural sciences (e.g. chemistry, physics and biology).

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