

Playing in invisible markets: innovations in the market for toilets to harness the economic power of the poor

Citation for published version (APA):

Ramani, S. V. (2008). *Playing in invisible markets: innovations in the market for toilets to harness the economic power of the poor*. UNU-MERIT, Maastricht Economic and Social Research and Training Centre on Innovation and Technology. UNU-MERIT Working Papers No. 012

Document status and date:

Published: 01/01/2008

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.



UNITED NATIONS
UNIVERSITY

UNU-MERIT

Working Paper Series

#2008-012

**Playing in Invisible Markets:
Innovations in the Market for Toilets to Harness
the Economic Power of the Poor**

Shyama V. Ramani

February 2008

Playing in Invisible Markets: Innovations in the Market for Toilets to Harness the Economic Power of the Poor¹

Shyama V. Ramani²

Abstract

Sanitation is at the heart of not only environmental security but also food security and health. Today about 41% of the global population or about 2.6 billion people do not have access to toilets and about 42,000 people die every week due to drinking water polluted with faecal matter. The problem is most acute in India, China, many countries of Africa and a few countries of Latin America. Why is there such a crisis in the toilets market? How much of the present problem is due to a lack of supply and how much is it due to a lack of demand? What is the optimal role of the State, the firms and the NPOs? The present paper attempts to give some insight on the above questions through the case study of the market for toilets for the poor in India. It examines the toilet history and achievements of India, the innovations in the market for toilets targeting the group at the bottom of the income pyramid and the factors that influence the adoption and usage of toilets in an Indian coastal village, in order to infer answers to the above questions.

Key Words: Toilets, BOP group, Innovation, India

UNU-MERIT Working Papers
ISSN 1871-9872

UNU-MERIT Working Papers intend to disseminate preliminary results of the research carried out at the institute to attract comments

ACKNOWLEDGEMENTS

I am grateful to Suma Athreye for useful comments on the paper. I am most grateful to Antonin Benycar and Annabelle Didier for excellent assistance with the formulation and implementation of the Franco-Indian Reconstruction Project. I would like to thank Sangeetha Venkatesh for conducting interviews with

¹ This paper was given at the 2nd UNU-MERIT Charles Cooper Memorial Lecture in Maastricht on 13th February 2008

² Institut National de la Recherche Agronomique (INRA), 65 Bd de Brandebourg, 94205 Ivry sur Seine Cedex, France and Ecole Polytechnique, 1 Rue Descartes, 75005 Paris, France.
Email : ramani@ivry.inra.fr

Bindeshwar Pathak and Paul Calvert and the latter for their generous sharing of their experiences. Finally, I would like to thank M.Subburman and V.Ganapathy of SCOPE and Lucas Dengel of EcoPro (Auroville) sincerely for having introduced me to the realities of sanitation in India and for all our animated discussions on the same topic.

1. Introduction

A number of thinkers in recent times have pointed out that activating or creating markets that are accessible to the bottom of the income pyramid group (or BOP), comprising three billion people around the world living on less than 2\$ a day³, can generate benefits for all in the pyramid (Prahalad⁴, 2006; Sachs⁵, 2005). Researchers have also documented that the delivery of commodities and services to the BOP group is increasingly activated by non-profit organizations (or NPO) and ordinary citizens evolving as social entrepreneurs (Bornstein⁶, 2005). Many of these commodities and services are *innovations for the BOP group*, in the sense that they were not accessible to the BOP group earlier. Taking this as the point of departure, the present paper aims to explore the complementarity between ‘technology’ and ‘economic design of markets’ and the optimal role of the State, firms, NPOs and ordinary citizens, in generating and commercializing innovations for the BOP group, through a case study of toilets in rural India.

In September 2000, 189 Heads of State adopted the UN Millennium Declaration agreeing upon eight essential objectives, referred to as the Millennium Development Goals or MDG to be attained by 2015. The MDG proposes concrete targets in terms of improving economic security, food security, health, education and environmental security for the world’s poor. In order to attain the MDG it will be necessary to increase the quantity and quality of products and services produced in these sectors, while ensuring their sustainability and accessibility. A four-pronged approach will be required to attain these ends: (i) improving the efficiency of production and distribution systems; (ii) investing in capacity building (infrastructure, training etc.); (iii) changing regulation; and/or (iv) introducing innovations. Focussing on the last option, a useful indicator to guide investment in innovations creation for the BOP group would be a measure of the impact of the concerned innovation on the attainment of the MDG goals.

Today about 41% of the global population or about 2.6 billion people do not have access to toilets and about 42,000 people die every week due to drinking water polluted with faecal matter⁷. The problem is most acute in India, China and many countries of Africa and a few Latin American countries as well, such that the percentage of the population without access to toilets ranges between 25% -75% in developing countries⁸.

It is clear that sanitation is at the heart of not only environmental security but also food security and health, as better sanitation improves health and thereby labour productivity. As labour productivity increases, the capacity to generate revenue also increases, enabling larger expenditures on purchasing essential commodities and building skills. Given that all the 8 goals enunciated in the MDG can be linked to food security, health security or environmental security directly or indirectly, improving the supply and access to toilets will contribute significantly to the attainment of the MDG and therefore is a commodity worth examining.

There are two ways of looking at innovation creation at a macro-level. One is the input-output approach that involves examining the relation between investment inputs and innovation outputs. The other is the systematic approach that considers the creation of technological competence and the generation of innovations as a collective and cumulative process involving a variety of economic actors such as firms, public laboratories, financiers, consumers,

³ <http://www.globalissues.org/TradeRelated/Facts.asp>

⁴ Prahalad, C.K., “The fortune at the bottom of the pyramid”, Wharton School Publishing, Upper Saddle River, NJ, USA, 2006.

⁵ Sachs, J., “The end of poverty”, Penguin Books, New York, New York, USA, 2005.

⁶ Bornstein, D., “How to change the world”, Penguin Books, New Delhi, India, 2005.

⁷ <http://www.worldtoilet.org/>

⁸ <http://www.who.int/ceh/publications/05sanitation.pdf>

institutions and the State, within a well defined national or sectoral system⁹. The common point of both approaches is their assumption that new technology does not develop in vacuum. It emerges due to the forces of societal demands and market supply. Thereafter, the systematic approach tries to identify and understand the nature of the economic actors, the market environment and the regulatory environment that comprises an ‘innovation system’ and leads to a particular pattern of innovation creation, while the input-output approach focuses only on relations between investment and outcomes, leaving the middle as a black box. It is this latter approach that we adopt in the paper in order to highlight the rationality of the different economic actors.

Markets are an important component of any innovation system. A market is an institution that facilitates exchange between buyers and sellers of commodities. It is said to be ‘efficient’ when the ‘price’ is readily known and maximizes welfare by equating it with the average costs of production or the societal costs of producing the commodity (at least in the long run). When a market is efficient, the price reflects the scarcity of the product in terms of quantity and quality. However, there can be instances, when the market price does not reflect the societal costs of producing that commodity including the economic costs imposed on third parties, such that potential gains can be captured by changing the pattern of resource allocation. Economists have identified the cause of such market failures to be rooted in either the asymmetry of information between buyers and sellers, the presence of externalities, the public good nature of the commodity in question or an abuse of market power (due to a lack of sufficient competition). In common parlance, invisible markets refer to markets that exist but are not visible because they deal in commodities that increase societal problems like drugs or transactions directly based on exploitation of human misery and helplessness, like human slave trade, forced trade in human organs etc. in which both buyer and seller must invest in an effort, in addition to paying the market price, to effectuate the illegal transaction. However, taking liberties as an economist, by an invisible market, I refer to a specific kind of market failure, where a market is thin, either due to a lack of buyers or due to a lack of sellers, such that it is unable to generate exchanges of a desired commodity in sufficient amounts. This is characteristic of a number of products and innovations targeting the poor.

Why then is there such a crisis in the toilets market? How much is the present problem due to a lack of supply and how much is it due to a lack of demand? To give some insight on the above questions we present a brief outline of the toilet history and achievements of India, before examining the factors that influence the adoption and usage of toilets, through a case study of an Indian coastal village called Kameshwaram. The methodology used consists of analysis of government documents, documents available on the internet, a number of extensive direct interviews with five representatives of non-governmental organizations and several government officials¹⁰ and direct observations of the author over three years (2005-2008) during the formulation and implementation of a Franco-Indian project of reconstruction in Kameshwaram in the aftermath of the tsunami of December 2004¹¹.

⁹ C. Freeman, ‘The National System of Innovation in historical perspective’, *Cambridge Journal of Economics*, 19, 1995, pp. 5-24 ; B.A. Lundvall (Ed.) *National Innovation Systems : Towards a Theory of Innovation and Interactive Learning* (London, Pinter, 1992); R Nelson., (Ed.), *National Innovation Systems : A Comparative Analysis*, (Oxford, Oxford University Press, 1993). Malerba, F., 2002. Sectoral systems of innovation and production. *Research Policy* 31, 247-264.

¹⁰ The persons interviewed were: Bhindeshwar Pathak (Sulab), Paul Calvert (EcoSolutions), M.Subburaman (SCOPE), V. Ganapathy (SCOPE), two officers of the district of Nagapattinam and a Panchayat member of Kameshwaram who wish to remain anonymous.

¹¹ Kameshwaram was severely damaged by the tsunami of December 2004 and about 30 villagers lost their lives. Association Un-Ami (France) and a sister Trust called Friend-in-Need (FIN, India) were created by the author in order to contribute to the attainment of the Millennium Development Goals in Kameshwaram through the introduction of innovations. These included new structures, new technology, new management routines and new social norms. The objective was to empower the residents of Kameshwaram by initiating actions suggested by them and justified by them in terms of need and utility

The rest of the paper is organized as follows. Section 2 briefly outlines the evolution of toilet technology in India. Sections 3-6 present the innovations on the supply side, the rationality of the demand side, the role of the government and the role of NPOs. Section 7 contains two success stories and section 8 proposes recommendations. Section 9 concludes.

rather than giving charity. Additional information can be found on www.friend-in-need.org

2. *Individual Household Toilets in India¹² : Past and Present*

In India, excavations have revealed that as early as during the Indus Valley Civilization (around 2500 BC), many individual houses were equipped with water borne toilets linked to drains indicating a high knowledge of sanitary engineering¹³. However, over time not only did such knowledge wither away, but the toilet models themselves became more rudimentary.

Individual household toilets were mainly restricted to urban areas and to rich households in the rural areas and the toilet technology was relatively simple. Each street had a front side and a back side, such that the front side opened to the front doors of the houses and the back side opened to a much smaller lane used by scavengers rather than the residents of the houses. The toilets were constructed along the back wall as far away from the house as possible and contained a hole a bit way from the back wall with a slope towards the back wall and two foot rests. On the back street there was a door that opened into the toilet. Urine was let off into the back street and faeces was taken away by scavengers with long brooms with brittles and the floor was washed with water from the outside¹⁴. The night soil was transported in wheel burrows and dumped into specific sites for composting. In India, as an offshoot of the caste system, specific communities (called Bhangis in Northern and Central India and called by other local appellations in the South) performed all scavenging activities including the cleaning of night soil from these toilets. **This kind of toilet technology is referred to as the “traditional dry latrine” model.**

Later on, the British introduced two important innovations in India, the centralized sewer system and the septic tank. London was the first city in the world to have a sewer system in 1850, followed by New York in 1860, and Calcutta in 1870. The septic tank was developed in London in 1596 but introduced in India only after 1850¹⁵. The cleaning of septic tanks was payable by the owner and it was the municipality which offered the cleaning services.

In the rural areas, open defecation was collectively practiced (in social groups, e.g. groups of men or groups of women going) in the fields without any risk. Usually, they went with a pick, dug a hole in the ground (or identified a depression) and after defecation covered it with soil or leaves, so that natural composting occurred without infestation by flies.

What is the situation in India today?

Open grounds in India receive an estimated 100,000 tons of human faeces everyday¹⁶! The Human Development Report 2006 of the United Nations Development Program (UNDP), entitled ‘Beyond Scarcity: Power, Poverty and the Global Water Crisis’, applauds India for being on track to meet the Millennium Development Goal (MDG) of halving the number of people without access to clean water by 2015¹⁷. However, as the report points out, India is much behind its target for halving the number of people without access to toilets by that date. Even as the Indian government works to increase the availability of clean water, only one in three

¹² Parts of this section were presented earlier in a conference: “Technology, Innovation and the attainment of the MDG”, Trichy, July 12-14, 2008.

¹³ <http://www.plumbingworld.com/toilethistoryindia.html>

¹⁴ Of course, as children, our mother would warn us to get up early and brush our teeth and use the toilet before coming to have a glass of milk, for if we were late we would get poked by the brooms of the scavengers and have dirty water thrown on our bums, a warning that terrorized us so much that we all got up early, brushed our teeth and used the toilet as soon as possible thereafter !

¹⁵ http://www.indiawaterportal.org/Network/interview/ngos/pathak_eng.html;
<http://www.worldtoilet.org/articles/wts2001/Our%20Toilets%20-%20Indian%20Experience.pdf>

¹⁶ <http://southasia.oneworld.net/article/view/150540/1/>

¹⁷ <http://hdr.undp.org/en/reports/global/hdr2006/>

Indians has access to any form of a functioning toilet. Less than half (48.95 percent) of the 738,150 government primary schools countrywide are equipped with toilet facilities and only 28.25 percent of primary schools countrywide offer separate toilet facilities for girl children¹⁸, leading many girls to drop out of school after adolescence.

In 2007, out of 5000 towns in India, only parts of 232 towns are connected to a central sewage system¹⁹. Even as of 2002-03, the Union Ministry for Social Justice and Empowerment stated that there were about 9.2 million dry toilets in India, which are cleaned manually by about 676,000 people, mostly coming from the traditional scavenging castes of India²⁰. Though, septic tanks are widely used, a major problem is that desludging agencies are notorious for doing their work badly. Sludge from septic tanks is often taken from one place and just dumped in the open a few kilometres away, encouraging every sort of health hazard possible. Therefore, the hazard is not from the septic tank itself but from inefficient de-sludging agencies making it an institutional inefficiency problem. Finally, in congested areas as well as waterlogged and high water table areas, pit latrines and badly conceived (for the local conditions) septic tanks have been found to contaminate ground water.

3. The supply side story: Technology, Business Models and the Toilet Knights

At the end of WWII, three types of technologies were available in decreasing order of costs for individual household toilets: septic tanks, traditional dry toilets and direct and free communion with nature. The market was in equilibrium without any innovative activity being undertaken. The psychological costs of outsourcing maintenance services of toilets to a caste was low and the environmental and health costs of open defecation was also low, because there was enough forest coverage both near cities and in rural areas to permit privacy and natural composting. However, some social entrepreneurs felt that the existing market equilibrium was unjust and they contributed to the evolution of the toilets markets either by changing beliefs about the way the market should function, or by introducing new technology or by creating new business models. We will now discuss the works of the three main social entrepreneurs and it will be quite evident that each of these individuals stands out as a knight in shining armour motivated more by a concern for humanity and a will to improve the world than by personal gains.

The first Toilet Knight: Mahatma Gandhi and his search for a new toilet technology (1936-1948)

It is not surprising that it is one of India's greatest fighters against oppression by caste designations, namely M.K.Gandhi, popularly known as Mahatma Gandhi, who launched a call for a search for a toilet technology that could be maintained without either the help of the government or manual scavengers. Champion of the community formerly called as "untouchables" (referred to outside of India even today by this appellation) and referred to as "dalits"²¹ within India today, he continually and opened insisted even in packed political

¹⁸ Sangeeta Venkatesh, Education World, September 2007, http://www.educationworldonline.net/eduworld/article.php?choice=prev_art&article_id=951&issueid=58

¹⁹ http://www.indiawaterportal.org/Network/interview/ngos/pathak_eng.html

²⁰ <http://www.hinduonnet.com/thehindu/fline/fl2318/stories/20060922005900400.htm>

²¹ Gandhi wanted to remove the horrible term "untouchables" and changed the appellation of this community to "Harijans" or the children of God and he created a journal called the "Harijan" that he edited throughout his life (1933-1955) to fight against social and economic discrimination by caste in India. However, in the untouchables community itself, today Mahatma Gandhi's popularity is completely overshadowed by Ambedkar, an untouchable, whose brilliance was noted by his school teachers in Bombay (all of higher caste) and he was encouraged by his teachers to finish school; he was the first

meetings²² that there was no place for scavengers in India and that everyone should clean their toilets. As his grandson notes, Gandhi realized that it was necessary to improve upon the conventional scavenger-maintained latrine model and he was definitely the first to realize (a la Marx!) that every technology engenders a socio-economic network in order to ensure maintenance.

In his ashram (or retreat) he broke all taboos by experimenting with different models of ‘dry closets’ and different modes of maintenance of the traditional dry toilet. His biggest achievement was to get his followers to clean the experimental dry toilets, by setting an example himself²³. While, Gandhiji’s experiments did not give rise to any technological innovation, his writings, his speeches and the routines for toilet maintenance that he initiated were responsible for the creation of a collective consciousness (however small) of responsibility and guilt about the existing market equilibrium in toilets. Even while, neo-Gandhians lament that such high ideals are completely lost in the museums of today (both private and public) consecrated to the memory of Gandhi, where toilets are dirty with no motivation or value given to the tasks performed by the cleaners²⁴, the biggest achievement of Gandhi was to create a consciousness of the need for a new toilet technology, accessible to all and capable of being maintained autonomously.

The second Toilet Knight: Bhindeshwar Pathak, the two pit toilet technology for households and public toilets as a business opportunity (1970-

The Sulab toilet model, created and developed by Bhindeshwar Pathak during the 1970’s, is surely among the technological innovations that have impacted the lives of the poor the most in rural India, along with the Green Revolution, micro-financing and satellite TV. What Mahatma Gandhi started in his experiments at the Sewagram Asharam, Bhindeshwar Pathak finished in the creation of the Sulab toilet model. In the true spirit of Gandhi, for Pathak, the toilet was also an instrument of empowerment, of both the scavenger community and of women.

Pathak’s contribution to the creation of the toilet market was two fold. First, he created a model of an individual household toilet for rural families that was far more accessible than a septic tank and that could be autonomously maintained. Second, he demonstrated that running of public toilets could be a business opportunity and with private management the quality of the services offered could greatly improve.

Individual Household Toilet: From the outside, the Sulab toilet model for individual households looks just like the standard Indian squatting style toilet slab with one hole for flushing, but actually it embodies three innovations. First, the Sulab toilet pan has a smooth floor with very steep sides so that little remains to be flushed and very little water is required for flushing. Second, instead of the flushed waste going directly into the ground or a septic tank or to a central sewer canal, it falls into one of two deep pits that are outside the toilet. Third, the pan

untouchable to enter into the University of Bombay and he won a scholarship to do a Ph.D. in Columbia University in political science. On returning to India he found that it was very difficult to succeed in any profession given the caste stigma. His personal experience shaped his destiny as a political activist, a militant vehemently critical of Gandhi. Ambedkar demanded separate electorates on religious and sectarian lines as a necessary condition for independence. The British colonial powers were only too glad to listen to Ambedkar to divide India even further, but a fast unto death by Gandhi gathered mass support for the birth of a united India. However, independence was accompanied by the truncation of the Indian British colony along religious lines into Islamic Pakistan and secular India, born in a blood bath of horrific mass murders and brutality on both sides, which continues to feed terrorism and civic strife to this day. Ambedkar coined the term “Dalit” or the “oppressed” as a generic term denoting the unity of all oppressed people in India.

²² <http://www.goodnewsindia.com/index.php/Magazine/story/sulabh/P2/>

²³ <http://www.lifepositive.com/Spirit/masters/mahatma-gandhi/community.asp>

²⁴ <http://makarand.com/acad/Neo-GandhianPraxisAPersonalReport.htm>

also has a water trap and a gas-trap with a water-seal that keeps the toilet odour free and isolated from organisms in the pits. Each pit is about one and a half meters deep and lined with a lattice of bricks, conceived to permit a family of five to use the first pit for up to four years. The pits are covered by air tight lids. When the first pit is full, the family can switch to the second pit, while the waste in the first pit is gradually and naturally transformed into a rich material that can be removed and used as dry, powdery fertilizer. When the second pit is nearly full, the first pit can be emptied and its contents can be used as compost and the two pits can be used alternatively and continuously. By decentralizing the waste treatment, the Sulab model eliminated the need for scavengers, encouraging them to seek other job opportunities and by granting privacy to women, it lent them immeasurable dignity.

Privately Managed Clean Public Toilets: Pathak was also the first to break the myth that the government must provide public toilets as a merit good; i.e. as something that the public merited. This has clearly led to sub-optimal maintenance of public toilets in India. He insisted that a public toilet must also be supported by a robust business model that permits accessibility to all, while generating enough revenue to employ personnel to ensure its cleanliness. By 2001, Sulabh had constructed 700,000 individual household toilets and about 3000 pay-and-use public toilets, generating employment for about 50,000 people²⁵.

The third Toilet Knight: Paul Calvert and the urine-diversion toilet (1994-

The Sulabh toilet model, while being suitable for dry areas was found to be unsuitable for those with a high water table such as coastal zones. Hence, the Sulab model was never adopted widely in such regions.

Paul Calvert is a British engineer who joined 'ITDG UK' (Intermediate Technology Development Group) in 1985 in order to translate his faith in Schumacher's dictum 'small is beautiful' into action and use appropriate technology to uplift disadvantaged populations. In 1989 he was based in Trivandrum Kerala, as Technical Manager for ITDG's farmers, herders and fisherfolk programme. He was a boat builder and an appropriate technologist with a strong community, social and environmental bias.

When he saw the horrific open defecation sites that women had to use, he felt moved and was compelled to do something about it. The first attempt was an organic treatment system for a community water flush block. It had limited application and he could understand that women needed their personal toilets. However, this was a severe challenge as the water table was very high, often partially flooded, houses were clustered together and there was a very high phobia about smelly toilets. He wrote to WEDC (UK) and WASTE (Netherlands) requesting information and both informed him that there was no solution to his problem. There was no internet available at that time and he was very much alone to try to find a way out. So he started designing toilets himself.

He started thinking about a new compost toilet, but then realized that if urine and faeces were to go into the same compost chamber then it would require huge amounts of carbonaceous material to avoid going anaerobic and becoming very smelly. **Then he tried a model that separated urine and faeces after they combined, and while trying to reduce the costs of this model, realized that there could be substantial efficiency gains if faeces and urine were not allowed to get mixed in the first place, and herein was the heart of his innovation.**

The toilet created by Paul Calvert is now popularly called the eco-toilet (or ecosan toilet) in India. It contains three major technological innovations. First, the toilet pan has three holes, one behind the other, with different slopes. The user urinates first and shifts slightly back to defecate permitting the faeces to fall into a compost pit. A mug of ash or saw dust is then thrown into this hole facilitating dehydration of the faeces. Then the user moves back further to wash the behind. The urine goes out through a bamboo pipe to irrigate a garden planted around the toilet.

²⁵ <http://www.sulabhtoiletmuseum.org/profile.htm>.

The wash water is filtered through layers of gravel so that the water that leeches out into the soil is harmless. Thus, urine, faeces and wash water are completely separated and recycled. Second, the toilets are on raised platforms, so that the toilets themselves can be entered only by climbing a few steps but there is no water logging during the rains. Third, there is a vent pipe going from the compost chamber to remove moisture by the passage of air. This is not a vent pipe for smells - there is no smell when these toilets are used correctly. Bad smells come from septic (ie anaerobic) tanks and water flush pit toilets because they are septic, or anaerobic systems – anaerobic decomposition gives off bad odours not the faeces and urine themselves.

Calvert left ITDG in 1994 to launch his own organization ‘EcoSolutions’ and become a social entrepreneur. EcoSolutions has built over 2000 ecotoilets all over India. Furthermore, ecotoilets were largely diffused by the UNICEF in the coastal areas, where its functionality was made obvious in the aftermath of the Tsunami.

Again, Calvert points out that his success is not due to the innovative design alone but due to their investment in building close and sensitive relationships with the families in the villages and through reliable long term support and backup. This helps families overcome fears over use, operation and maintenance and at the same time permits feed-back from users to make further improvements in design.

The above discussion on the toilet knights leads us to our first result.

Result 1: The market for BOP toilets is invisible from the supply side, because the evolution of technology in this market has been mainly driven by a few NPOs motivated by their organization-specific managerial vision, rather than by incentives provided by the market. Innovations have been generated through ‘learning by doing’ routines rather than by ‘investment in learning’.

4. BOP consumers on the demand side: Rationality of the invisible market

It is well known that preferences can vary according to the income of the family and its socio-cultural identity. In an extensive survey covering 13 countries, Banerjee and Duflo (2006)²⁶ document the consumption patterns of the poor at the household level. They demonstrate that in BOP markets also, consumers make choices on income allocation between essential goods like food, entertainment goods like cinema and luxury goods like radio or TV and that their consumption choices, which contribute to keeping them poor, are in part due to inefficient public and private markets.

What then is the willingness to pay for a toilet in a BOP market? We present some elements to answer this question from a case study of a representative coastal village Kameshwaram, in which the author initiated a Franco-Indian reconstruction project after the killer Tsunami of 2004.

Kameshwaram is an isolated coastal village along the Indian Ocean in the Nagapattinam district of Tamil Nadu. It has a population of about 5300 and is home to 1620 families, most of whom are below the poverty line (less than 1\$ per day per person). Before the Tsunami of December 2004, no family in Kameshwaram had toilets. In a Franco-Indian reconstruction project initiated after the Tsunami by the author, extensive discussions with the villagers on different possibilities for investment in infrastructure revealed a real demand for individual household ecosan toilets, of the Calvert variety, but only if they would be subsidized!²⁷

²⁶ Banerjee A. and Duflo E. (2006) The economic lives of the poor, Journal of Economic Perspectives, Volume 20, Number 1, Winter 2006, pp. 117–132.

An ecosan toilet with brick walls and the standard pan, costs about Rs. 7000 (or about 120 €). This is equivalent to the average revenue (excluding self-consumption) generated by a family over 2.5 months (average revenue is Rs. 2000 per month per family above self-consumption from farming and fishing).

Most families in Kameshwaram have a TV that costs Rs. 5000 or more, some have a DVD player that costs at least Rs. 3000, the family of a bride pays on average Rs. 100,000 to Rs. 300,000 for dowry and wedding expenses, while the bridegroom's side spends about Rs. 50,000. Family celebrations marking the evolution of every individual are shared with the community (births, puberty, marriage, death etc.). Furthermore, the Gods of every season are appeased in every season with particular rites and celebrations (whether Hindu, Christian or Muslim, ancient rites are mixed with modern ones). These, celebrations account for about Rs. 5000 to Rs.10,000 per year. There is also expenditure on alcohol but since drinking is considered to be a bad practice, we were not able to obtain information on the amounts spent. Yet, nobody was willing to invest in a toilet costing Rs 7000 unless at least 80% of the cost was subsidized.

What is the rationality behind this? Why wouldn't anyone want to use a toilet, especially if it is given practically free of cost? There are a number of reasons.

First, as in all rural areas, the need for toilets is gender biased. Toilets are craved for by women but not that much by men. Women suffer from obvious feelings of shame and degradation in exposing themselves in public. Therefore, they are obliged to go either at dawn or at night, in poor light and often on rubbish heaps. They are exposed to bites from rats, snakes, scorpions and other vermin. Rates of urinary infection and other related problem resulting from unnatural retention of urine and faeces is higher among women. Sexual harassment is not uncommon. But these problems hold only for women. Therefore, for a BOP group family, if a toilet can be obtained and later rented out to earn money, only the female members of the family suffer, but as a whole if the family can earn higher benefits from the revenue generated, then it is rational for them to use a toilet for purposes other than a toilet.

Second, when one is poor and leading a very difficult life, consumption of goods that offer a temporary escape has a very high marginal utility. Thus, consumption of alcohol is high among men, while entertainment goods, especially in the form of TV programs, provide high marginal utility to the entire family. The consumption of TV shows seems to yield even more utility to women (as compared to men), as it permits an escape into a fantasy world, in which women enjoy a much better status and far more opportunities to change their lives.

Third, the poor in marginalized zones are often in debt for petty amounts and the only source of finance for such paltry sums are the village money lenders, who charge between 15% to 25% per month (which is higher than the rate of interest charged by a bank to a hi-tech start-up) on small sums ranging from 10 Rs to 1000 Rs, which no bank will lend. In order to minimize borrowing from the money lender, it is important to build social capital with those who can help the family in times of need. Given the extreme spatial segregation based on caste lines that mark the rural landscape, which most of the militant backward (self-given name) caste leaders also do not want to change (as it helps to build and control power bases), social networks are invariably limited to members of the same caste. Celebrations of birth, ear piercing of infants, puberty attainment of girls, marriages and mourning of deaths, in addition to countless local and religious festivals, are all occasions to share wealth and contribute to a collective consumption

²⁷ In order to work towards a collective vision of needs and reciprocal payments, the villagers were taken on three discovery tours (to an agricultural extension unit of a public lab, a government fish processing lab and a nearby college for women). Women were particularly encouraged to come as it was a unique opportunity for them to discover life outside of the village. In the aftermath of these tours, the men came up with a variety of ideas of what they wanted. Among the women, there was a consensus about they wanted: toilets! They had seen the ecosan toilets constructed by SCOPE elsewhere and here they discovered a model that was accessible to the village even without connection to any central sewer system.

and building of social capital. Collective conspicuous consumption serves two purposes: first, it ranks the financial resources of the family and establishes its position in the village pecking order bringing along with it other associated benefits, and second, it fulfills a motivation to redistribute wealth and share with those less fortunate in the village.

Fourth, though a toilet cannot increase the revenue of the family in the short run, it can increase its disposable income in the medium run by reducing expenditures on medicines and health care. But this can happen only if a critical mass of neighbouring families also invest in toilets and waste management. Otherwise, the negative externalities created by unsanitary conditions are so high, that an individual investment in a toilet cannot lower the family's health-related expenditures.

Our second result can now be stated as follows.

Result 2: The market for BOP toilets is an invisible one from the demand side because there is a higher preference for commodities and services that strengthen social networks providing socio-economic security or for commodities that yield immediate utility in the form of entertainment than for toilets.

5. The role of the Indian Government

In any innovation system the government is usually the major player. Mahatma Gandhi is quoted as having said that sanitation was more important for India than freedom and the first Prime Minister of India Jawaharlal Nehru echoed his sentiments by stating that India could consider itself to have truly progressed, only when each and every family has access to a toilet²⁸. However, till the 1980's there was no public investment on sanitation. The initial concern of the policy makers of independent India was to invest and create capacity in heavy industries such as power, iron and steel, machinery production and chemicals. The need of the hour was thus to develop the capital goods industry that would form the foundation for industrialization. The private sector was left to cater to the demand for consumer durables and non-durables. Thereafter, three distinct phases can be distinguished.

Phase I: Government as toilet supplier and banning manual scavenging (1986-1999)

The first public program to focus exclusively on sanitation was the Central Rural Sanitation Program (CRSP) initiated in 1986²⁹ by the Ministry of Rural Development. Offices of the District Rural Development Agency (DRDA) financed recipients, partially or totally, to build toilets. However, the supply and maintenance of the toilets offered to the poor was blatantly sub-optimal. According to a UN report³⁰ the CRSP failed to be effective because the cost of the existing toilet models was out of reach of many rural households, the public sector employees were not very motivated, and other economic actors like NPOs and firms were not very involved in the sanitation drive.

In 1991 a 'National Scheme of Liberation and Rehabilitation of Scavengers and their Dependents' was passed and is now under the portfolio of the Department of urban employment and poverty alleviation. The objective of the scheme is to provide financial assistance to scavengers for their training and rehabilitation in alternate dignified occupations³¹. To

²⁸ <http://www.iht.com/articles/2006/03/28/news/village.php>

²⁹ <http://www.un.org/esa/agenda21/natlinfo/countr/india/CaseStudyIndiaws1.pdf>

³⁰ <http://www.un.org/esa/agenda21/natlinfo/countr/india/CaseStudyIndiaws1.pdf>

³¹ <http://www.mhupa.gov.in/programs/upa/nsdp/NSLRS.htm>

strengthen this scheme further, a ban was passed against manual scavenging in the form of the “The Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act” in 1993³². All dry latrines had to be destroyed and violations of the provisions of the Act could lead to imprisonment for up to one year and/or a fine of up to Rs. 2000.

Phase II: Government as financier and tournaments organizer (1999-2004)

With the adoption of economic liberalization and the initiation of policy reform in 1991, the Indian State began withdrawing as a direct player on the supply side of the market to becoming an indirect player, financing sanitation drives. From being the main supplier on the toilets market, the State became the main financier.

In 1999 the ‘Department of Drinking Water Supply’, ‘Ministry of Rural Development’, launched the ‘Total Sanitation Campaign (TSC)’ in order to provide incentives for the development of a private market for sanitation that involved a demand driven approach, including education as a major component and actively soliciting the participation of Panchayats (or village level government bodies), NPOs, women’s groups and youth clubs³³.

State policy for providing incentives for the development of a market for sanitation, involves financing for individual toilets, toilet complexes, sanitary marts and production centres. For individual toilets, initially Rs 500 was given in the ex-post period (i.e. after building of the toilet) and since 2006, this sum has been increased to Rs 1200. For toilet complexes, sanitary marts and production centres, an interest free loan of Rs. 300,000 is given and it is up to the NPO concerned to develop a business model to amortize the costs.

Another policy innovation in recent times is the “Sanitation Tournament”. Since 2003 the Department of Rural Development has instituted the Nirmal Gram Puraskar³⁴ providing cash incentives to rural Panchayats, NPOs and individuals, who help achieve complete toilet coverage in a given district. The cash prizes increase in terms of area or population covered. Even with modest cash prizes, the prestige of being awarded this prize has created tremendous incentives for complete toilet coverage and the number of applicants for the award has been increasing yearly since its inception.

Phase III: The take-off with the Tsunami, visible success and the work continues

(2005-2007)

According to the officials and NPO representatives to whom we have spoke, the TSC really took off the ground only after the Tsunami of December 2004. In fact, the management of the refugee camps and the rehabilitation of tsunami victims highlighted the sorry state of sanitation in rural India and served as a trigger for shifting the sanitation-related-activities to a higher gear. From 2005, the number of projects launched under the TSC scheme increased and the reimbursement accorded by the government to every toilet that was built increased from Rs 500 to Rs 1200. The enormous amounts of private donations received in the aftermath of the Tsunami also provided finance for sanitation drives in the post-Tsunami period.

Between 1999 and 2003, the Department of Rural Development spent Rs.2.92 billion (or approximately US\$ 62 million)³⁵ and the allocation has increased from Rs. 13.5 billion in 2002-

³² <http://www.hrw.org/reports/1999/india/India994-19.htm>

³³ <http://www.un.org/esa/agenda21/natlinfo/countr/india/CaseStudyIndiaws1.pdf>

³⁴ http://ddws.nic.in/tsc-nic/html/nirmal_gram.htm

³⁵ <http://www.un.org/esa/agenda21/natlinfo/countr/india/CaseStudyIndiaws1.pdf>

03 to Rs.70 billion in 2005-06³⁶. This investment has had a spectacular success. In 1981 only 1% of rural households had a toilet, but this figure increased to 22% in 2001 and 30% in 2004. Schools with toilets have increased from 9.15% in 1993 to 45% in 2004-05.³⁷ Thus, the impact of government policy can be summarized as follows.

Result 3:

- *In the market for BOP toilets, the government is more effective as a financier than as a direct supplier and it enjoys higher returns to investment as a financier than as a direct supplier.*
- *Direct subsidies from government support the demand side of BOP toilet markets by lowering the price of toilets for individual families.*
- *Loans from government support the supply side of BOP toilet markets by providing business opportunities for NPOs.*
- *Sanitation tournaments provide incentives for local governments to improve the mode of governance of sanitation at the village level.*

6. Indian and Foreign NPOs

By definition an NPO is an organization that cannot distribute the excess of its earnings over cost to a set of partners as profit, but must invest the same in the organization. However, in order to survive and grow, it must either find clients who are willing to pay for its services directly; or find donors who are willing to pay so that others may receive the service. Two kinds of competencies are important to generate contracts: ‘technical competence’ (knowledge of an activity, a technology or a context) and ‘marketing savvy’. Smaller NPOs, which do not have the right mix of the two competencies often cover their costs through a second venue of revenue generation (like a second business) or are subsidized by the State (like a number of student run NPOs).

Local NPOs: In the pre-liberalization period, when the State was the major player in the market for toilets, there were only a few NPOs dedicated to the cause of sanitation (e.g. Sulab). Founders of such NPOs invested their time and efforts to bring out innovations and develop business models for the maintenance of sanitation infrastructures. They also managed to survive because they were able to attract funds with their message, their personal charisma and their efficiency. Given the paucity of financiers, only NPOs which were highly efficient in raising funds could be active in the field of sanitation.

In the post-liberalisation period, business opportunities for NPOs opened up with the State becoming a financier, and with the entry of multinational NPOs and agencies as contract providers. Thus, the NPO sector is growing steadily in India. According to Srivastava and Tandon (2002)³⁸ there are about 1.2 million NPOs in India today. They are mostly rural based, nearly 50% are unregistered and about 73.1% have only 1 or 0 full time employees. About 50% of the NPO have no particular activity focus, but are broadly active in ‘social service and development’ and do whatever they get a contract for. About 20% are involved in education (after school, alternative school etc.) and about 6.6% are involved in health (including sanitation), with the residual being active in promotion of the arts, culture and sports. So we may safely conclude that sanitation forms the main activity of less than 5% of the NPOs in India. According to the available statistics, the main source of income of NPOs is self-generated. However, it is not clear who the ‘consumers’ of their services are. For instance, there

³⁶ <http://abdulkalam.nic.in/scripts/sllatest1.jsp?id=747>

³⁷ http://ddws.nic.in/ngp_booklet_eng.pdf

³⁸ Srivastava and Tandon (2002) <http://pcserver.nic.in/ngo/conference/ngo-pria.pdf>

is no information on how much of the revenue of the NPOs comes from direct payment by beneficiaries, and how much comes from contracts (given by the government, a body of donors, another Indian or foreign NPO), which must be distinguished from donations.

International agencies and Western Multinational NPOs: An extremely positive side-effect of liberalization in India and globalization is that it permitted foreign NGOs active in sanitation in Europe to take a greater interest in India, as a possible terrain for the diffusion of ecologically friendly waste management programs developed in the West. International agencies like the UNICEF and UNDP have been active in environmental management since many years. But with the new ease of mobility of people, commodities, capital and knowledge permitted since 1991, India has seen an influx of international organizations like Water Aid, GTZ, BORDA and now SuSanA or sustainable sanitation alliance, which are extremely active in various fields of sanitation promotion. Most of these organizations create business opportunities in India through offering contracts for Indian NPOs, though some of these organizations also have their own subsidiaries or at least a front office in India. Through contracts with local NPOs, they have greatly contributed to the improvement of sanitation conditions through financing of toilets and other sanitation projects and transferring savoir-faire or know-how from abroad leading to our fourth result.

Result 4:

- *In the BOP markets, NPOs are important service providers, whose survival and growth depends on their ability to generate contracts through their technical expertise, knowledge of local contexts and marketing savvy. They are usually small and non-specialized.*
- *International NPOs, International and National foundations and private donors are the most important sources of contracts for small NPOs.*

7. Good Practices: Two Success Stories

The findings of sections 2-5 confirm that the market for BOP toilets is thin and yet regularly there is news of triumphs. Here we share two success stories to identify good practises

7.1 Individual household toilets: Making the market visible from the demand side

Given the wide spread reticence to investing in toilets, the installation and usage of 250 ecosan toilets in Kameshwaram, facilitated by the Franco-Indian reconstruction project is considered a major achievement. Kameshwaram is now the village with the largest number of ecosan toilets in India. Consequently it has been awarded the Nirmal Gram Puraskar award by the Government of India. While the relief on the faces of the women is sufficient reward in itself, the village has also gained a lot of publicity and its name has appeared regularly in the papers. As a result it has begun to attract other NPOs, which have won contracts to build toilets and are in search of a 'suitable village' where the market for toilets has already become 'visible'. Thus, a dynamic process has been set into motion making the market for ecosan toilets in Kameshwaram visible and active. These are the measures that were taken to achieve this result.

- **Subsidizing 80% of the cost of the construction of an ecosan toilet:** This is a necessary but certainly not a sufficient condition to ensure optimal utilization of a toilet.
- **Reducing asymmetry of information through education:** This is the speciality of our NPO partner SCOPE. In lectures, that would have students anywhere in the world

spellbound, SCOPE director, M.Subburaman and the liaison officer, V. Ganapathy, told most interesting stories and funny anecdotes imparting knowledge of the benefits of toilets and the dangers of open defecation. They especially made sure that women were fully informed.

- **Adding value to the product, i.e. toilet through celebratory rituals:** A toilet is perceived as a room that is impure, smelly, dirty and used by others and therefore, undesirable. In order to inculcate pride in owning such a room, SCOPE introduced rituals, to mark the evolution of its use, as it is normally done for the inauguration of a new house in India. For instance, the blessings of the Earth Goddess are invoked as the site of the toilet is chosen in a simple ceremony with prayers and partaking of sweets. Then its construction is celebrated, followed by a final one as the first compost pit is opened and the compost is used on new saplings.
- **Involving the beneficiaries in the construction:** Economic theory tells us that gains to a beneficiary are greater when a cheque (or cash) is gifted rather than a commodity in kind. However, if only a gift in kind is permitted, then the beneficiary gains more if they have a say in the choice of the gift. Similarly, it was insisted that at least some features of a toilet should be decided by the family, so that there is a personal touch to the design of each toilet. The family members also help the masons construct the toilet, which clearly increases the feeling of ownership and the commitment to use it well.
- **Creating trust by reducing the ‘us’ and ‘them’ divide:** In India, one of the cultural attitudes that is often manifested in a myriad of explicit and implicit ways, when it comes to communication with the poor or the less formally educated, is the ‘us and them’ attitude. This is very much present in many NPOs as well. Most of their directors do not visit villages. During the rare occasions, when they do, they lapse into English often, even when they know the local language (to distinguish their linguistic ability, as fluency in English is clearly a mark of the upper-crust of society), do not respect local customs like taking off shoes while entering a home or office, do not take the time to talk to the village elders or to the headmen or to the women’s groups and do not use the respectful form of ‘Sir’ or ‘Madam’ while addressing them. They leave this to their underlings and the visit of an NPO director then becomes a quick ‘business affair’ to ensure that the project is carrying on well and the contract can be terminated well. In our case, the very fact that the NPO director of SCOPE, the liaison officer and myself took the time to speak to the villagers, the elders, the infirm and the leaders regularly made all the difference. The villagers came to trust us.
- **The Toilet Beauty Contest:** I found it very difficult to accept that toilets were to be used mainly by women, because men were men and women were women! According to game theory, a change in behaviour should be possible, if sufficient incentives are offered and backed up by an efficient monitoring system. So a toilet beauty contest with high prizes was announced, (first prize of Rs 5000, equivalent to 2.5 months revenue; second prize of Rs. 3000 and third prize of Rs. 1000) for best garden watered by the toilet liquid waste, best maintenance (including surroundings) and best innovations added, but only open to families where all men used the toilets ! Any family, whose men folk did not use the toilet, were disqualified. Since honour and truth-telling have high reputational rewards at the village level, only 71% of the toilet owning families self-declared themselves to have qualified. However, this is touted to be the highest rate of complete utilisation of toilets by men in rural India !

Result 5: The demand side of the market for BOP toilets can be made visible by : (i) reducing asymmetry of information through education; (ii) changing ‘beliefs’ about the value (positive or nuisance value) of a commodity through strategic moves; (iii) providing financial incentives with random monitoring for usage.

7.2 Public Toilet: Maintained by the government and still clean ! (with a bit of monitoring!)

As everyone knows, it is notoriously difficult to maintain a public toilet. Pathak (Sulab toilets) changed this widely held belief by demonstrating that with good private management public toilets can be kept clean. Very often, as soon as a commodity with a ‘public good’ aspect is provided well, the local government wants to take over and use it as a tool for future vote mobilization. Toilets have been no exception. As soon as a public toilet is run well, a bid is made for it by the local government. Thereafter, it is offered free to all users, since providing services and commodities (including TV) as a ‘merit good’ (i.e. something that the recipients merit) is often used as a strategy to mobilize votes during election times. However, agency problems of public maintenance then creep in. When public toilets are maintained by staff, who are given a monthly salary, whatever the rate of use or the state of cleanliness of the toilet, usually the quality of maintenance falls rapidly.

However, here too there are success stories. Mr. Subburaman, the director of SCOPE or the Society for Community Organization met Paul Calvert in a UNICEF conference and the former discovered ecosan as the toilet technology that was low-cost and accessible to the poor. Thereafter, he has been very active in promoting the ecosan technology in rural areas. The innovation milestone achieved by SCOPE is that it has proved that community Ecosan toilets can be as well maintained as any standard toilets (even though it calls for an extra effort on the part of users, using different holes for urine and defecation, putting ash, moving over another hole for washing etc.).

In a slum of a suburb called Musuri, near the town of Trichy, a community toilet served most of the residents. But, it was so badly maintained and got clogged so frequently during the rainy season, that people began using the outside of the toilets rather than the inside, and the river Kaveri close by, the main source of water for the residents, started getting rather polluted. The people were thus ready for a new form of communal toilets. The old one was demolished and in its place an ecosan toilet complex was constructed with the financial contribution of the Dutch NGO and financing agency WASTE.

Working closely with the local Panchayat and especially the women of the Panchayat, SCOPE makes regular visits to the Ecosan toilet complex and has trouble-shooting sessions with the users and the staff maintaining the toilets. Through initiating visits by other villagers and dignitaries, it has made the toilet complex visible in the media. This has had two impact. First, it has brought media attention to the local Panchayat for their good practises in terms of mode of governance, for which they are grateful. Second, because such media attention has been obtained, and the toilet regularly attracts visitors from other villagers and Panchayat, the local government body is now entrapped to respect its commitment to maintain the toilets credibly and the quality of the public toilet has become an indicator for the efficiency of governance of the elected body.

The ecosan community toilets currently yield 250 litres of urine per fortnight and this is used to water the resplendent banana trees surrounding the complex. The entire scene is completely changed from the earlier stench emanating, dirty complex. Users, who are given a banana to eat from the trees after using the toilet and having a wash, can note that the banana trees are healthier and the bananas are larger than those in their own gardens ! This has created a demand for urine and the compost that will be eventually available, and therefore, in order to increase urine production (for sales after irrigating the garden) and compost creation, SCOPE has started to offer a small sum for toilet users (in addition to the banana!), making this slum’s eco-san toilet, the only public toilet in the world, where users get paid for using the toilet!

Result 6: Public toilets are an essential service in urban slums, where due to land constraints it is often not possible to build individual toilets. If through strategic moves a credible commitment for maintenance can be enforced on the local governing body, cleanliness of the toilets and its accessibility can be ensured as merit goods, but not otherwise.

8. Market failures, Market Design and Market Interventions

Prahalad (2006) makes three types of recommendations pertaining to characteristics of an appropriate BOP innovation, guidelines for producing such an innovation and good strategies for transfer to beneficiaries, in order to activate BOP markets. According to him, a BOP must create a new price performance envelope, lowering the prices so as to permit accessibility while preserving quality; it must address local constraints, be viable for adoption under the local conditions and economize on scarce resources. To create such an innovation creative mixing of a variety of technologies (of different generations) may be necessary, the focus must be on functionality keeping in mind existing constraints with respect to complementary assets required for adoption. Ideally the innovation should be scalable. Effective transfer may require education and a marketing strategy designed for the local context.

What can economic theory add to this? Economists have proved that free markets can maximize gains from trade if some extremely stringent conditions are satisfied such as perfect competition on the supply side, perfect, complete and free information on both sides of the market and absence of environmental effects by production or consumption. This year the Noble Prize in Economics has been given to three men, Leonid Hurwicz, Eric Maskin and Roger Myerson, for giving us insight on the nature and design of allocation mechanisms that can offer a second-best solution under more general conditions. They showed that a variety of second best resource allocation mechanisms can be designed if a premium can be paid to make players reveal their true preferences and any possible equilibrium (that is socially optimal) can be reached if a reward cum punishment system can be embedded in the game, so that players choose the social optimum. But somebody has to pay for the ‘truth telling premium’ and the implementation of the ‘carrot and stick’ mechanism. This means that in principle, if there are enough State resources, any market can be made to function in a way that is useful to society, by embedding appropriate incentives on the supply side and the demand side of the market.

This is of course, easier said than done. Roth (2007)³⁹ gives a number of examples of how this has actually been done in real life cases such as the labour markets for doctors, school choice programs and auctioning of the radio spectrums to make the corresponding markets more efficient and he also shows that the same principles can be used to create markets where none existed before, such as for kidney exchange (note exchange because sale of human organs is banned in the USA and most other countries). According to him, a market designer needs to ensure that markets are: (i) thick, i.e. with sufficient number of participants on both sides; (ii) safe, i.e. buyers and sellers can reveal their true preferences and (iii) uncongested, i.e. market participants must have enough time to make satisfactory choices. The mechanisms that he has used to design efficient markets in the above markets have two components: (i) algorithms that operate clearing houses of bids and offers and (ii) routines for making offers and bids that are formulated according to the specific features of the market concerned, in order to arrive at the desired result. Thus, there can be no general theory of market design that can be applied to any context and market design itself is as much an art as a science because it calls for an expert knowledge of the context concerned.

³⁹ Roth Alvin E., ‘The art of designing markets’ Harvard Business Review, October 2007.

Finally, there can be situations where an efficient market simply cannot be designed because there are not sufficient resources to pay for truth telling or the incentive mechanism. In this case, a policy intervention is called for.

Let us now apply these principles to identify the problems in the BOP toilet markets in order to propose recommendations to solve the same.

8.1 BOP toilet market functioning problems

Asymmetric information on demand side: Many in the BOP income group are not aware of the technologies accessible to them, their costs and their benefits. Unlike for standard innovations, creating a market demand for BOP innovations, does not refer to advertising, but education and persuasion. Consumer acceptance does not mean placating fears of risk as in the case of nanotechnology or GMOs, but warning of risks of non-consumption.

Asymmetric information on the supply side of governing bodies: There is a major problem of coordination between Centre and State Governments and between the different Ministries of Rural Development, Health and Water and Sanitation (and even between Water and Sanitation Boards) with respect to resource allocation on toilets and monitoring their use afterwards, because of asymmetric information. As a result, some areas have too many toilets (with the excess being closed up or used for other purposes) and some areas have too few toilets.

Moral hazard problems on the supply side with respect to provision of finance by government bodies: A sad but true fact, reported by many NPOs to the authors, is that NPOs often need to bribe petty officials in order to be reimbursed under the TSC scheme. When bribes are not given, then payments to NPOs are greatly delayed. Such petty corruption chokes the life-line of government initiatives and must be eliminated to improve efficiency. Transactions are apparently easier with other Indian or foreign NPOs, and therefore are the preferred choice of NPOs. Such a market situation can be detrimental to public policy in the long run, as the process of development cannot be controlled.

Adverse selection and Moral hazard problems on the supply side in terms of service provision: Most NPOs are not specialized and building BOP toilets is wrongfully perceived to be a 'non-skilled' work. As a result, there are NPOs which get contracts to build toilets and build them badly. Then due to faulty construction, there is seepage and sometimes even accidents, again leading to the non-use of toilets.

Moral hazard problems on the demand side on adoption of toilets: For the BOP group, opportunity costs of all goods are higher than for higher income groups, leading to diversion of use. Therefore, providing toilets is not a guarantee that they will be used as such.

Compliance problems outside of the market: Between 1993 when manual scavenging was prohibited to 2003, the law on abolition of dry latrines has been adopted in 16 out of the 28 States of India and has not been enforced in any State. The two main reasons cited for the persistence are lack of coordination between Centre and State public bodies and lack of knowledge of this prohibition among the poor^{40,41}. The availability of alternative, inefficient technologies that continue to permit human exploitation is clearly an obstruction to the adoption of more socially optimal and efficient technologies.

⁴⁰ <http://www.ncdhr.org.in/ncdhr/campaigns/manualscavenging>

⁴¹ <http://www.deccanherald.com/Content/Nov212007/scroll2007112136945.asp?section=scrollingnews>

8.2 BOP toilet market incentives/access problems

Lack of finance on demand side: BOP families have problems finding funds given their other essential needs.

Lacunae in the technology : Urine diversion toilets are difficult to offer as public toilets as they need to be used in a particular way. At present, there are a number of sophisticated decentralized waste water treatment systems, which consist of a specifically designed series of vats filled with different materials that act as filters so that the waste water that comes out is free of faecal matter. However, these are rather expensive, costing between 6000 to 12,000 Euros. **To mark the need for a ecological technology that is also economic, I would like to ask the reader, if a nano car can be made for 2000 Euros by an Indian firm, how come water from a public toilet can't be cleaned for the same amount?** I am not an engineer, but I have a feeling that this is not because it is not possible, but because the State has not bothered to consecrate enough funds to initiate research. And furthermore, none of the academics in the engineering schools have bothered to either.

8.3. Recommendations

Standard applications of market design theory to the above problems yields a number of interesting recommendations that can be divided into two categories. The first set aims to minimize informational problems related to adverse selection and moral hazard and the second tries to increase the volume of transactions by suggesting mechanisms to bring buyers and sellers together. Computers and the internet have opened new vistas for market design that were unimaginable earlier and these can be put to good use to activate BOP markets.

To minimize adverse selection and moral hazard problems

- (i) *Put an 'e-bay' type rating system on internet for maintenance of public toilets, efficiency of payments by local governing bodies and service provision by NPOs*

Benefits of rating governing bodies: One of the main problems with fighting petty corruption is that the NPOs are afraid that if they complain once, their reimbursements will be even slower the next time. The internet here again permits an anonymous collection of information, by which the NPO can always present its case of a wrong-doing and claim ignorance about who actually leaked the information. Complaints followed up with inquiries can serve as a deterrent against misdoings.

Benefits of rating NPOs: The NPO market is notoriously grey. There are problems of adverse selection while giving out contracts and problems of moral hazard in the project implementation phase. Currently, the awarding of contracts to NPO is more network based and less market based. Contracts are often obtained through the personal networks of the founders or the notoriety of the NPO. Therefore, it is easier for established NPOs to get contracts than for smaller NPOs. On other hand, the motivation and dedication of the smaller NPOs is almost always superior to that of the larger ones, though their competencies may not be so well developed. It would therefore be helpful to have ranking of NPOs based on basic performance indicators so that donors can get some idea of the potential of an NPO and contracts can be more market based and less network based. By the same argument, a record of performance is also a very good deterrent against defection in the implementation phase. There are scores of cases where NPOs do a bad job and the village Panchayat simply does not know how to resolve the problems created. In this case, the State government is obliged to invest funds to rectify the wrongs done by the NPO, against which a legal action cannot be sought as the contract is usually informal.

- (ii) *Create a user-friendly data base on NPOs rendering service on sanitation with their technology models and the services offered along with their prices*

Even most NPOs have an imperfect and incomplete information on other NPOs and input suppliers working in the same area. Governing bodies and donor bodies have to invest time and effort to identify service providers, input suppliers and prices. To tackle all these problems, again a freely accessible database or website would be most helpful.

- (iii) *Use local Panchayats to have a database on sanitation needs in villages*

The main problem for State allocation of funds for sanitation (or any other merit good for that matter) is that there is still a real lack of data on what has been achieved and what is needed. Most databases in India stop at the district level and the data is collected by central statistical agencies. Now with digitalization, this can also change. Electronic forms can be issued to village level Panchayats and they can fill in the information. Again, some care has to be taken about the formulation of questions so that there is maximum 'truth telling'.

- (iv) *Impose fines on consumers who do not use toilets as toilets*

The problem of toilet-use-diversion-to goat keeping or other innovative uses is mainly because such diversion increases the economic revenue of the BOP family. By introducing fines, non-use or other-use of toilets can be minimized. In China, I am informed that plain-clothed policemen and policewomen hand out fine-tickets to unsuspecting people using the outdoors as a toilet. I am also informed that most of London is free of dog-poo thanks to stiff fines levied on dog-owners caught for non-compliance. In France, this is a voluntary standard and therefore only socially conscious owners pick up after their pets, as it is felt strict rules on this issue are unenforceable.

- (v) *Start applying the law on the use of traditional dry toilets*

Applying any sort of fine will have an impact. This is self-evident.

- (vi) *Give a pricing policy on access to public toilets based on convenience offered and state of maintenance*

In China, public toilets in some cities are auctioned out to private groups or individuals, who are then responsible for its maintenance. However, after that a government agent makes surprise checks and gives it a number of stars, ranging from 0 to 4. A zero star means that the toilet has to be closed down, while ratings 1 to 4 permit the owner to charge differential pricing and earn different revenue. Furthermore, there can be quotas on the proportion of toilets of the different varieties so that access to toilets is ensured in any area. This is an excellent system.

In India, land for public toilets (with or without infrastructure) are also being auctioned out but there is no system of checking or star awarding. Thus, it could well be that after a year, in the place of the public toilet, there is a store selling DVDs because the person who won the auction found it to be a more profitable business opportunity.

To create incentives for a more active market

- (i) *Give research contracts to public lab-NPO-firm consortiums*

NPOs are business entities, even if they are motivated by a developmental objective. They are interested in maximizing their revenue through provision of services in which they offer their 'expertise' on local contexts. Therefore, NPOs have no incentives to invest in innovation creation unless they have a contract to carry out R&D and so we cannot expect NPOs in general to generate BOP innovations.

Research is ideally performed by public laboratories, though firms are active partners in research in most knowledge intensive industries today. What is worrying is that while the firm-public laboratory nexus is firmly established in the hi-tech sectors, there seems to be a lacuna in research endeavors that are low-tech and specifically targeting the BOP group, like toilets. Since, researchers from public laboratories may be more preoccupied in getting publications in scientific journals on topics of larger interest, unless specific incentives are provided, the public laboratory is going to be least involved actor in the game of BOP innovations and this simply does not make economic sense, wherein the *raison d'être* for targeted incentive provision.

(ii) *Use tournaments on both demand and supply side to generate innovations at the grass roots level*

BOP toilets are considered as 'de-skilled' work and 'workmanship' is not given enough importance. This means that the quality of construction is extremely heterogeneous and it is taken for granted that toilets for the poor should be necessarily ugly as well (as it is with other structures for the poor). By having tournaments for masons and builders to introduce innovations, we give value to 'workmanship' in BOP architecture and we also embody them with pride (both the builders and the recipients). Similarly, innovative ideas can come from the recipients. Again, because BOP architecture is accessible, owners can also add their additions and by having tournaments that highlight these achievements, we can set 'standards' in BOP architecture.

(iii) *Create clearing houses for NPO services and real demand at the village level*

An obvious use for the databases recommended earlier is to use it as 'clearing houses' where demand for toilets and supply of toilet building services can be matched to enable transactions.

(iv) *Create clearing houses for 'individual toilet finance donors' and 'recipients'*

In a recent article Roth⁴² argues that markets may fail to develop because of 'repugnance', citing it as the main reason for the lack of a market for horsemeat in California (where its sale to humans is banned anyway). However, with the toilets story, we can argue the contrary, that 'repugnance' can be a motivator for the development of a market, if it is backed up by an efficient clearing house. For instance, most Indians feel 'repugnance' at the sight of their compatriots attending to their needs at street corners or along roads. Many Indians who have the money would gladly donate so that a family can get a toilet, if they are sure that the money is actually going to be used for that purpose. Therefore, a clearing house, say by internet that matches donor families with recipient families for a toilet, where the donor families can meet the recipient and ensure that they are using it can be very effective.

⁴² Roth AE, 'Repugnance as a constraint on Market Design' forthcoming in the Journal of Economic Perspectives.

9. Conclusion

Economists have long established that technological innovations have led to increases in productivity and have significantly contributed to the growth of the developed countries in the last 100 years. Creation of technological competence has also proved to be an important avenue for ‘catching-up’ by developing countries. While we understand more and more about the role of innovation for economic growth and development, there are still many questions which have multiple answers such that it is not evident to choose among them. For instance, one of the questions that still puzzles economists is: Why are the frequency and size of innovations different among different kinds of agents, different kinds of markets, different industries and different countries? In this article, we turned this question around slightly and asked: why are there so few innovations that have impacted those at the bottom of the economic pyramid ?

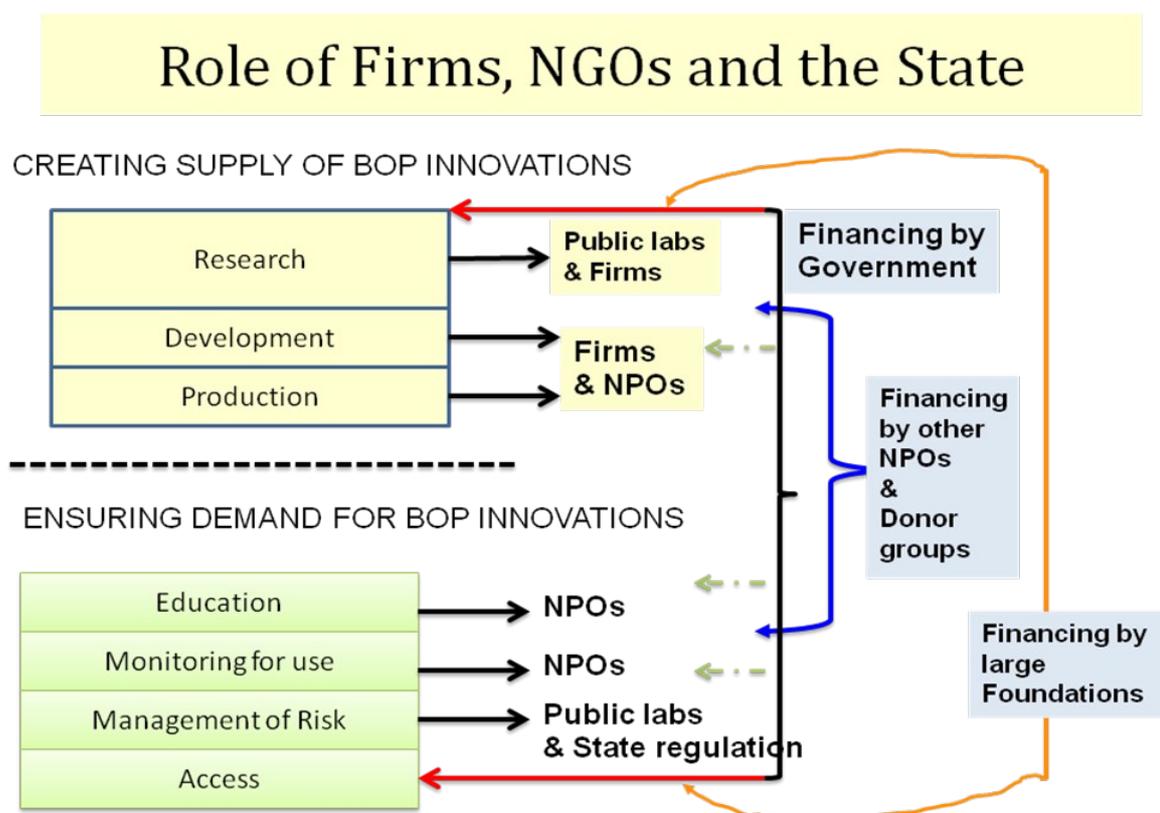
To give some insight on the above problem we studied the market for toilets targeting the BOP group. We found that there were two market segments, ‘individual household toilets’ and ‘public toilet services’. We demonstrated that the present sanitation crisis is not only due to behavioural inertia and low preferences for toilets on the demand side but also due to inefficient functioning of both public and private BOP toilet markets. The origins of such problems are well known in economics and there are tools to tackle them. A number of recommendations have thus been proposed, including a better realignment of the different actors along the value chain of the toilet market and the inclusion of public laboratories at the research level.

What are the returns if there is a real investment in improving the BOP toilet market? Last November, a ‘World toilet summit’ was held in New Delhi and in the inaugural speech, the former President of India, Abdul Kalam, noted that complete sanitation coverage could save at least Rs.5 billion every year, as the monetary costs of treating health problems related to sanitation is reckoned to be Rs. 2 billion and the loss of working days due to associated illnesses is worth about Rs 3 billion⁴³. Similar positive returns should be valid for other developing countries as well.

From the above arguments and the results presented earlier, the role of the State, firms, NPOs and ordinary citizens become clear and are summarized in the following figure.

⁴³ <http://www.medindia.net/news/Better-Sanitation-can-Help-India-Save-Five-Billion-Rupees-Every-Year-APJ-Abdul-Kalam-28819-1.htm>

Figure 1



The government has to continue its role as chief financier (albeit with less corruption), and also initiate NPO-firm-public laboratory networks for research, introduce new fines, introduce differential pricing with quality control on public toilets and act as a police to ensure compliance.

NPOs have an intimate knowledge of local contexts and would be the best to deliver BOP innovations and ensure optimal adoption.

Firms are the motors of change in any society and the principle creators of innovations, but most firms regard the BOP group as wards of the State. Furthermore, most commodities sold by firms to the BOP group are not only low priced but also of low quality. There is little investment on innovation specifically aimed at the BOP group as R&D costs are unlikely to be recuperated. 'Corporate Social Responsibility' functions that include good mode of governance (production as well as financial management) and corporate philanthropy are considered to be the firm's only other possible contribution to the BOP group. However, there is increasing evidence (beyond the scope of the present paper to present) contradicting this widely held belief. They confirm that firms with a diversified portfolio can invest in BOP innovations and reap benefits in terms of reputation and thereby increases sales on their other products as well. Thus, it can be beneficial for firms to invest in the creation of BOP innovations.

Finally, as ordinary citizens, we are increasingly solicited by more and more organizations for donations. In the face of such requests, and against the background of the actual context, the optimal strategy would be to give a little to many charities rather than to give a lot to one charity. This seems to be the best way to support an active market for innovations and product delivery to the BOP group.

We can go even further on harnessing BOP innovations for economic growth and development. Think about the following. India has the second biggest population in the world and will move to first position overtaking China very soon. Thus, India will also produce the maximum amount of human waste in the world daily, which means that this will be a factor of India's comparative advantage vis-a-vis the rest of the world ! Following Ricardo's law of specialization according to comparative advantage, it is in the interests of India to exploit this output, namely human waste, which is most freely available in India and not frittered away into centralized sewer systems as in Western countries. Effective recuperation of human waste through implementation of appropriate autonomous toilet units, like ecosan toilets, can lead to the emergence of a market for human-waste based compost. An effective development of a market for compost made from human waste, with clear norms for safety (to ensure non-contamination) can reduce dependence on fertilisers and generate revenue through domestic sales and even exports.

Indeed such thoughts were planted in my head, after Mr.Subburaman of SCOPE, who is not an economist, quipped to me, after I had explained to him in great detail the innovation strategies of leading Indian pharmaceutical companies and the ways in which they are conquering the world, "Madam, if only we can effectively recuperate the daily output of the Indian population, we can close all our fertiliser factories and put India on the world map for exporting ammonia and compost along with software and pharmaceutical products".

Charles Cooper would have also agreed with most of the above ideas as he recognized that the selection criteria for a technology to be transferred and the mode of transfer itself should depend on the sector chosen and the local context. However, what the above writers did not think about, as it was too premature at that time, is how developing country innovators can create innovations to help BOP groups all over the world, in collaboration with partners from the developed world. The ecosan toilet is certainly a model that can be diffused in other developing countries, with the help of developed country partners.

The case study serves to reiterate another point raised by Charles Cooper for technology transfer in general, namely that technology and even financial investment are only two components of the solution for successful innovations for the BOP group⁴⁴. For appropriate commercialization, three more elements are necessary. First, education, and motivation; second appropriate delivery mechanisms to ensure accessibility; and third, appropriate business models to ensure maintenance (or sustainable production) are required. Only with an optimal combination of the five components: adequate financing, appropriate technology, appropriate education and motivation, appropriate delivery mechanisms and appropriate business models can innovations harness the economic power of the poor.

Whither to now? Soete (2007)⁴⁵ observes that to provide incentives for the generation of BOP innovations, research centres themselves must be close to the users or the beneficiaries, so that feedback from users can blend with ideas of researchers to design an appropriate innovation, and he adds that the real challenge would be to link it with core science groups, perhaps even in developed countries, so that the variety of feedback loops is maximized to create innovations that are appropriate and accessible. I share that dream and this is what I am trying to do in the little fishing village, with the very limited human, material and financial resources that I can manage to raise and all that I say is that so far there haven't been any major complaints and we've had fun ! So you are welcome to join us!

⁴⁴ See Mani, S, "Charles Cooper: Institution Builder, *Development and Change* 36(6): 1209–1214 (2005).

⁴⁵ Soete, L. *Science, Technology and Development: Emergent concepts and visions*, Atlanta Conference on Science, Technology, and Innovation Policy 2007, Global Learning Center, Georgia Institute of Technology, Atlanta, Georgia, USA

The UNU-MERIT WORKING Paper Series, 2008

- 2008-002 *Reframing technical change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity: Part 1. A Review of Historical and Recent Experiences* by R. Sulaiman, Peter Bezkorowajnyj, Andy Hall, Mona Dhamankar & Leela Prasad
- 2008-003 *Reframing technical change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity: Part 2. A Framework for Analysis* by Andy Hall, R. Sulaiman & Peter Bezkorowajnyj
- 2008-004 *Reframing technical change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity: Part 3. Tools for Diagnosis and Institutional Change in Innovation Systems* by Andy Hall, R. Sulaiman & Peter Bezkorowajnyj
- 2008-005 *Is Inter-Firm Labor Mobility a Channel of Knowledge spillovers? Evidence from a Linked Employer-Employee Panel* (An identical version has also been published as ETLA Discussion Paper No. 1116) by Mika Maliranta, Pierre Mohnen & Petri Rouvinen
- 2008-006 *Financial Constraints and Other Obstacles: Are they a Threat to Innovation Activity?* By Amaresh Tiwari, S. Schim van der Loeff, Pierre Mohnen & Franz Palm
- 2008-007 *Knowledge-based productivity in 'low-tech' industries: evidence from firms in developing countries* by Micheline Goedhuys, Norbert Janz & Pierre Mohnen
- 2008-008 *The Voyage of the Beagle in Innovation Systems Land. Explorations on Sectors, Innovation, Heterogeneity and Selection* by Martin Srholec & Bart Verspagen
- 2008-009 *Crafting Firm Competencies to Improve Innovative Performance* by Boris Lokshin, Anita van Gils & Eva Bauer
- 2008-010 *The Economics and Psychology of Personality Traits* by Lex Borghans, Angela Lee Duckworth, James J. Heckman & Bas ter Weel
- 2008-011 *Embedding Research in Society: Development Assistance Options for Supporting Agricultural Innovation in a Global Knowledge Economy* by Andy Hall
- 2008-012 *Playing in Invisible Markets: Innovations in the Market for Toilets to Harness the Economic Power of the Poor* by Shyama V. Ramani