

Health impact of water and sanitation in the low income settlements of India and South Africa

P.H. Parikh

Centre for Sustainable Development, Cambridge University Engineering Department, Cambridge, United Kingdom

ABSTRACT: The concept of Slum Networking developed by Himanshu Parikh proposes comprehensive water and environmental sanitation infrastructure as the central and catalytic leverage for holistic development.

This paper examines Slum Networking as implemented in the slum settlements of Ramdevnagar and Sanjaynagar in Western India. The paper will explore the impacts of water and sanitation as perceived by the communities on health. It will then compare the impacts in the slums with a similar project implemented in the township of Imizamo Yethu in South Africa. The difference between the Indian and South African case studies is that the prime input in Imizamo Yethu was housing in addition to water and sanitation.

Data has been collected from individual households on family background, incomes and expenditure, infrastructure provisions, education, health and tenure. This is supplemented by secondary surveys and group discussions for quantitative and qualitative analysis. The paper will use the evidence from the house interviews and draw conclusions.

1 INTRODUCTION TO SLUM NETWORKING

Slum Networking was conceived and developed by Mr. Himanshu Parikh, an engineer based in Ahmedabad (Diacon 1997). It is an innovative concept which exploits the linkages between the slums and natural drainage paths to transform the infrastructure and environment of the city (Parikh 2006).

As slums are traditionally located along water bodies and natural drainage paths, they can be linked up to provide cost effective natural gravity infrastructure networks which serve not just the slums but the rest of the city. Thus slums, instead of being resource draining liabilities as in the conventional developmental approach, actually become opportunities of a quantum change in the infrastructure and environmental quality of the city as a whole (Parikh 1999).

At micro level Slum Networking provides a comprehensive range of physical improvements namely individual roads, water supply, storm drainage, sewerage, earthworks, electricity and soft landscaping. The key here is to provide quality individual (household) services to the slum dwellers at costs less than those of shoddy public facilities conventionally generated by the poverty mindset (Parikh 2004). This brings a sense of ownership and

pride leading to greater community participation and willingness to pay for services.

Slum Networking does not accept that the constraints, both physical and financial, are insuperable. It uses water and environmental sanitation to alleviate poverty cheaper and faster than other development strategies without dependence on aid. It is underpinned by a fundamental belief that slums need not exist in India and this massive transformation can be achieved in a short time span (Parikh 1995).



Figure 1. Before and after images for Sanjaynagar settlement

2 INTRODUCTION TO THE FIELD WORK

The researcher has been conducting house interviews in slum settlements in India and the townships of Cape Town as part of her PhD research. The aim of the PhD Research is to examine the impacts of provision of individual services namely water, sanitation and associated services like road, storm drainage, electricity, landscaping and waste management.

The researcher used face to face interviews with questionnaires to collect the data from the residents in slums. The data collected was both qualitative and quantitative in nature. The fieldwork was led by the researcher who recruited and trained graduates and students for the extensive surveys.

The questionnaires aimed to achieve the following:

1. Before and after comparisons for the slum settlements of Sanjaynagar and Ramdevnagar in the western state of Gujarat in India for the years of 1996 and 2006.
2. Before and after comparison for the township of Imizamo Yethu project with individual services and housing in Cape Town for the years of 2004 and 2006.

The questionnaire was piloted in one house for each case study before taking it to the entire sample population. Focus group discussions were also carried out before the house interviews. The outputs from the focus group discussions were used to finalise the questionnaires.

3 SUMMARIES OF CASE STUDIES

3.1 Sanjaynagar, Ahmedabad City, Gujarat, India:

Sanjaynagar is situated on a triangular plot of land, around two hectares in area (Tripathi 1998). The estimated population of Sanjaynagar is 1200 people with 181 dwelling units. Holistic physical infrastructure under the Slum Networking Project was implemented in Sanjaynagar in 1997 after discussions between Arvind Mills and Himanshu Parikh (Parikh 2005). The special features of this case study are the involvement of the corporate sector, provision of tenure rights and community ownership (Parikh 2006). Implementation of the project was carried out by the private sector. The Sanjaynagar case study i.e. the Slum Networking pilot project was recognized by the Habitat II Conference in Istanbul in 1996 as a "100 Best Global Practices" (Parikh 2006). The settlement which was previously known as Sanjaynagar na Chhapra (huts) is now registered as a housing society called Sanjaynagar (Tripathi 1998). The land is owned by the local government i.e. Ahmedabad Municipal Corporation (AMC) (Mehta. P).

3.2 Ramdevnagar, Baroda City, Gujarat, India:

The Ramdevnagar-project in Baroda City of the Gujarat State is a small demonstration of the 'Slum Networking' strategy (UNICEF Gandhinagar 1999). In 1993, Baroda Citizen's Council, a renowned local NGO invited Mr. Himanshu Parikh to make a presentation to the community leaders of the city slums on the Slum Networking strategy. After the first presentation of the Slum Networking Strategy in Baroda, the Baroda Citizens Council (BCC), who had a strong presence in the Ramdevnagar slum of the city, in consultation with the local community volunteered to undertake a demonstration project in 779 dwelling units. The units have been estimated on the basis of the final layout plan of the settlement as against the 823 dwelling units reported by UNICEF. The project was funded partly by UNICEF, the slum community and local government.

3.3 Imizamo Yethu, Cape Town, South Africa:

Imizamo Yethu is an informal township located in the Hout Bay area of South Africa (City of Cape Town 2004). The site is hilly with a level difference of 120 m from the top to the bottom with shacks at the top and the new housing and infrastructure at the bottom (City of Cape Town, 2004). The housing and infrastructure project in Imizamo Yethu is a joint venture between the government and an Irish NGO "The Niall Mellon Township Trust". The residents were displaced as a result of fire in 2004. The government constructed infrastructure and the Irish builders built the housing in 2004. The land is owned by the province and some of the houses have obtained title deeds after the project (City of Cape Town) (Thomas Edward). The government provides part subsidy for land and housing. The community is currently paying back the additional cost of housing via a 10 year loan offered by the Niall Mellon Township Trust.

4 SAMPLING

The sample unit for the interviews was a household than an individual or a family. There were instances where two families or more would share the same house and hence the need to record data for households rather than a family.

Random sampling method is one in which each household or member of the population has a known chance of being selected into the sample (Moser & Kalton 1971). The website www.randomizer.org was used to generate random numbers.

The following equation was used to determine the sample size for the three case studies:

$$\text{Sample size } n = \frac{Np(1-p)}{(N-1)D + p(1-p)}$$

Where D = Margin of Error/ $(z\alpha/2)^2$; N = total number of houses; $z\alpha/2$ = number of standard deviations relative to the mean of the standard normal curve = 1.96 for 95% confidence level; and p is the prior assumption of the population parameter = 0.5.

Table 1 shows the required sample size for 95% confidence level with a margin of error of 10%. An attempt was made to interview 100 houses for each case study but because of non responses and house owners being away the actual sample size ranged between 96 to 99 for the three case studies.

Table 1. Sample sizes for the case studies

Case study	Total houses N	Sample size needed	Actual sample size	Land ownership
Sanjay-nagar	181	63	96	-AMC
Ramdev-nagar	799	86	99	+Government
Imizamo Yethu	564	82	97	Province

*The document used for the calculation is Sample Sized Determination for Survey Design by Merrill Oveson from <http://surveyz.com/client/sampling.doc>.

^^ Source: Discussions with Thomas Edward in September, 2006 – City of Cape Town Southern Peninsula Offices

- Source: Discussion with Prashant Mehta, Inspector Slum Networking Project - AMC in March 2006

+ Source: Ramdevnagar: A Slum decides its Fate, Baroda Citizens Council

5 PERCEPTIONS BASED ON RANKING

The purpose of the ranking exercise was to make an assessment of community preferences for various components of services and housing versus the softer inputs in health and education. The respondents were asked to rank 10 items (water, sanitation, roads, electricity, storm water drainage, housing, education, health facilities, employment) before and after project implementation. The highest priority item would be ranked as 10 and the lowest priority item would be ranked as 1. This has been termed as backward ranking in the graphs as usually a rank 1 would be assigned to the most important item on the list. As the number of responding houses for each case study varied, the summation of ranks of each item from all the houses in each case study was divided by the number of responding houses to ensure an equal comparison.

The respondents ranked all the items before implementation of infrastructure but for the after project scenario they did not rank the services as they no longer thought that infrastructure was a priority.

So to ensure a non biased comparison the non responding items after project had to be assigned ranks. The sum of 1 to 10 is 55 so this number (55) was divided by the number of non responding item in each house to obtain a number which was then assigned to all the missing rank items in a house.

The following graphs show the priorities based on the communities perceptions in Ramdevnagar, Sanjaynagar and Imizamo Yethu.

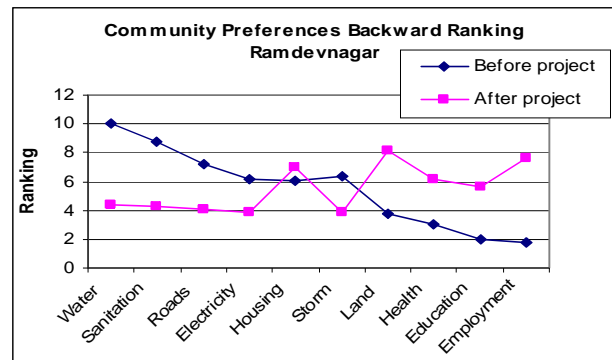


Figure 2. Community preferences for Ramdevnagar

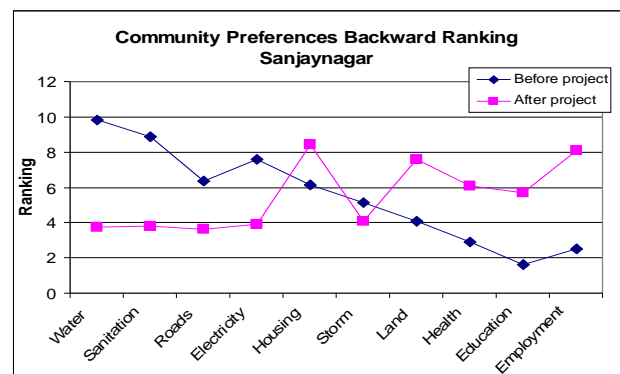


Figure 3. Community preferences for Sanjaynagar

The community rankings as represented by Figures 2-3 shows that initially water, sanitation, roads and electricity were very high on the priority list for the residents of Sanjaynagar and Ramdevnagar. After the implementation of slum networking the priority shifts to elements like health, education and employment. This means that in the first instance infrastructure is perceived by the community to be a primary input needed. After provision of services people's aspirations change and they start thinking about improving health, education and employment opportunities. So the conventional approach of addressing health, education and governance first needs to be challenged.

In the Indian settlements people rank housing as a medium priority in their lives as they do not necessarily see housing as a good to be provided by the government. This also challenges the notion of housing on its own being able to improve the environment and living standards. As a part of her

MPhil the researcher conducted interviews in Sanjaynagar settlement for a smaller sample size of 20 houses. The MPhil study shows that there has been a dramatic transformation in the housing stock of Sanjaynagar. The investments have been made by the residents themselves from loans, savings, extra labour or selling family jewellery after the project (Parikh 2005). The 'kutchha' houses (shacks) are now transformed into 'pucca' brick houses with corrugated sheet roofs and tiled floors (Parikh 2005). Hence by providing infrastructure the government generated resources in the form of housing activity from the community.

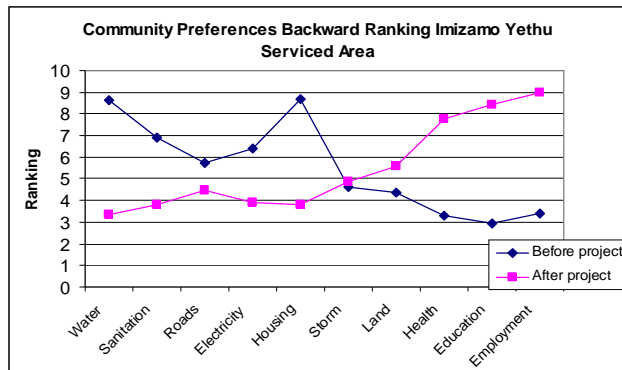


Figure 4. Community preferences for Imizamo Yethu

For the township of Imizamo Yethu the priorities before project were housing, water, sanitation, electricity and roads. After implementation health, education and employment once again becomes a high priority. So unlike the settlements in India the residents of Imizamo Yethu put the highest emphasis on housing. The mindset being that housing should be provided by the government. In fact the project brief in the township does include housing along with infrastructure. However, this means that the government is not using its resources efficiently as they could have generated the housing resources from the community instead of providing the part subsidy for housing. The part subsidy for housing instead could have been utilised in another township for the provision of services.

The common feature in the settlements of India and South Africa is that the low income communities are really seeking hard inputs to improve their lives. The phrase 'hard inputs' is used to represent water, sanitation, storm water drainage, roads, electricity and then housing stock in this paper. The phrase 'soft inputs' is used to represent education and health inputs.

6 IMPACTS ON HEALTH

The assessment of health improvements has been made by using the household survey data for the first three indicators discussed in this section. The last section broadly covers the perceived health im-

provements as discussed in the focus group discussions. Some of the benefits highlighted from the group discussion are difficult to quantify but still very relevant and tangible benefits.

6.1 Under five mortality

There are different methods for measuring health impacts. The human development index (HDI) is a composite index that measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, as measured by life expectancy at birth; knowledge, as measured by the adult literacy rate and the combined gross enrolment ratio for primary, secondary and tertiary schools; and a decent standard of living, as measured by GDP per capita in purchasing power parity (PPP) US dollars (UNDP 2005). It is difficult to calculate life expectancy at the settlement level which in essence forms the health indicator component. Hence the HDI or the life expectancy component has not been used for assessment of well being in this study.

Young children are more vulnerable to environmental factors and diseases and often do not survive beyond a few months or years. Another method commonly used by aid agencies is looking at the Infant Mortality Rate (IMR) and the Under Five Mortality Rate (U5MR). It has been acknowledged that child mortality rates are among the most sensitive indicators of human well-being (UNDP 2006). However the U5MR is the most widely used measure of child survival and is expressed as the probability of dying between birth and age 5 expressed per 1000 live births (Hill et al. 1998). The under-five mortality rate captures more than 90% of global mortality among children under the age of 18 (WB 2007).

For the study the under five mortality has been looked at for various case studies. Though, the methodology for estimating and comparing the values are slightly different due to the lack of accurate registers for births and deaths available for the three settlements of Ramdevnagar, Sanjaynagar and Imizamo Yethu. The information obtained from the house interviews has been used to compile the mortality figures as an indirect measure. For Ramdevnagar and Sanjaynagar the infant mortality under 5 from 1986 to 1996 has been added from the sample houses to obtain the 10 year duration of 'cumulative under 5' mortality and then was divided by the 0-5 age group population in 1996. Similarly for 2006 the infant mortality from 1996 to 2006 has been added and divided by the 0-5 age group population in 2006. The reason for adding up the under five mortality for 10 years is that otherwise for one year the figures obtained are too small to compare effectively. The reason for comparing percentages is that in some of the settlements the under five population

has increased substantially over 10 years so comparing the mortality on its own would not give a true picture of improvement or deterioration in health conditions. For Imizamo Yethu the child mortality for 2002 to 2004 was added up and divided by the infant population (0-5) to obtain the percentage infant mortality before 2004 and similarly for the after scenario of 2006.

This differs from the Brass method which looks at the probability of a child dying between birth and exact age x , from the proportion of children dead among those ever born to women in different age groups by allowing for differing exposures to the risk of dying (Brass 1964 cited in Kabir 1993). The Brass method is based on the assumption that the child mortality risks are uniform across the age of the mother being used to proxy exposure to the risk of children (Hill & Figueroa 1997). This assumption is not always valid and does not take into account external changes caused by projects like Slum Networking.

Table 2. Cumulative under five mortality (CUFM) for the case studies

Case study	Time span	CUFM before project	CUFM after project	% CUFM before project	% CUFM after project
Sanjay nagar	10 years	20	10	42.56	10.53
Ramdev nagar	10 years	8	3	22.86	6.82
Imizamo Yethu	2 years	3	0	16.667	0

*Based on information collected as part of the researchers ongoing PhD field work

In Sanjaynagar the cumulative under five mortality reduces to half when looking at numbers but as soon as the percentages are compared the reduction appears to be much more substantial. For Ramdevnagar the % reductions are also more than 50%. In the settlement of Imizamo Yethu in Cape Town as the measurement is based on a two year interval the numbers are not really big enough especially in the after scenario to make the final judgement. Though, in all the three case studies mortality has reduced in numbers as perceived by the communities.

6.2 Perceived reason for health improvements

The house interviews also had a question on general health improvements and all the sample houses had to list out their perceived reasons for the health improvement. In all the three case studies the majority of respondents perceive an improvement in health. However the reasons cited for health improvements differ in the settlements in India and South Africa. In the Indian settlements the overwhelming view is

that the improvements in health are due to the provisions on services (house to house water, sanitation, roads, electricity, storm drainage).

Table 3. Perceived health improvement and causes for the case studies

Case Study	House	Perceived health improvement	Infrastructure leads to health improvement	Housing leads to health improvement
Sanjay Nagar	92 out of 96	80	78	0
Ramdev Nagar	97 out of 99	92	87	0
Imizamo Yethu	94 out of 97	89	24	52

*Based on information collected as part of the researchers ongoing PhD field work

For the settlement of Imizamo Yethu in Cape Town the perception is that housing and infrastructure both play a role in improving health. The main benefit of housing as perceived by the community in Imizamo Yethu is of warmth during the cold season thereby leading to health improvement.

6.3 Household medical expenses

Another method of assessing the health condition is to look at the household expenditure on medicine. This is an indirect measure but does clearly indicate if there has been a change in the monetary effort required by the families to stay healthy.

So for the three case studies information on monthly household spending on medical treatment was collected for the before and after scenario.

The household spending for the before scenario was inflated in all the three case studies to compare with the current monthly spending on medical treatment.

In all the three case studies the medical spendings have reduced after project implementation. Paired T Test was used to test whether the difference before and after was significant for the case studies. For Ramdevnagar and Sanjaynagar the reduction in monthly medical spending is significant.

In Imizamo Yethu medical treatment is subsidised so that the community mostly gets free medicines. The relative spending on medicines is therefore low. There has been a slight reduction noted in the average medical spending for Imizamo Yethu in two years but the difference is not significant enough to make a conclusion. However the trend appears to show a reduction. The reason for the low difference in mean spending on medicine could be the fact that for Imizamo Yethu the difference is being compared over a 2 year span as compared to the 10 year span in Ramdevnagar and Sanjaynagar.

Table 4. Monthly household medical spending

Case study	Average monthly spending before project	inflated medical spending before project	Average medical spending after project	Land ownership
Sanjay-nagar	617.7Rs./house		323.2	1996 to 2006
Ramdev-nagar	675.7Rs./house		326.3	1996 to 2006
Imizamo				2004 to 2006
Yethu	26.33SAR/house		25.26	2006

*Based on information collected as part of the researchers ongoing PhD field work

** Exchange rates as accessed from <http://www.xe.com/ucc/> on 26/05/2007

1GBP=80.57Rs (Rupees)

1GBP=14.1 SAR (South African Rand)

But for Ramdevnagar and Sanjaynagar the reductions are substantial. The money saved on medicines can now therefore potentially be used for savings, housing upgradation and other activities. So the reduction in medical spendings has a flow on effect to other sectors.

6.4 Group Discussions

Water and sanitation is crucial for improving health in low income settlements. The group discussions in the settlements of Sanjaynagar and Imizamo Yethu brought out a lot of interesting benefits which could not be quantified.

Tripathi(1998,2001) has written two books about the Slum Networking project in Sanjaynagar in which the opinions of the recipient community have been highlighted.

“Today we have running water in the house. I bathe everyday with soap and take a head-bath every alternate day. Previously I used to bathe once in 10 days in the open fields using coir cots as a cover.” *Source: Change After Alliance (Tripathi & Jumani 2001)*

It is difficult to quantify added dignity but household water does allow people more dignity and privacy.

As a part of her MPhil research the researcher conducted her first focus group discussion in Sanjaynagar and one of the quotes suggests:

“Girls had to spend time disposing waste water from the house as boys wouldn’t do this work. They can now wake up late and sleep more”

Source: Group Discussion 2005

There is a gender implication here as women and girls spend more time and effort on water collection and disposal. Additional sleep for girls is a benefit but once again difficult to quantify.

During her PhD fieldwork the researcher conducted another focus group discussion in Sanjayna-

gar. Another interesting comment coming out was also about how water could add to the perception of belonging to middle class i.e. the “white collar” group in society.

“We can bath and clean at our own time. Previously we used to wear unclean clothes but now we are ‘white collar’ people with clean clothes. Now we bathe everyday.”

Source: Group Discussion 2006

Focus group discussions with men in Sanjaynagar highlighted the issue of equality and how low income settlements also have a right to water and sanitation within their houses.

“Water and drainage is a necessity for not only a king but also a pauper.”

Source: Group Discussion 2006

Similar focus group discussions were also conducted in the Township of Imizamo Yethu in South Africa.

“Most people have stomach ache because of dirty water at public taps. Public tap point is unhealthy as people play with dirty things, used condoms and other items disposed nearby. So taps at home (private taps) would improve health. At moment women do not go to toilets at night as they are outside and it is unsafe on the streets in night. If we have toilets at home then we would use the toilets more during the nights and stay healthy.”

Source: Group Discussions in Imizamo Yethu, 2006

The first important point raised here is about stomach ache which has been picked up as a consistent problem with women living in low income settlements. In the quote from Imizamo Yethu the respondent blames the grim water for stomach ache though the settlements in India have attributed the stomach aches to the lack of toilet provisions in the house. These are the hidden benefits of household water and sanitation which are difficult to measure.

The discussion in Imizamo Yethu also raises a pertinent point about the benefits of private or household services viz-a-viz public facilities. The conventional notion is to provide public facilities due to either lack of resources, technology, space or other constraints. But then it is worth investigating whether those solutions are addressing the longer term problem of improving people’s lives. For instance in Imizamo Yethu safety is a serious issue and providing toilets outside in vulnerable locations is not an appropriate policy. It does not address the issue of safety for women in nights outside their houses. In India having toilets outside raises the issue of the lack of dignity and pride for women.

Slum Networking proposes individual ie household services and thereby effectively addresses the issue of safety, pride and dignity.

7 CONCLUSIONS

Water and Sanitation provisions have been appreciated by low income communities in India and South Africa. The perception studies do show that the communities perceive infrastructure and housing to be high priority for changing their lives. In India the communities construct housing themselves after the government provides infrastructure whilst in South Africa the residents are provided with housing. In both cases though, the communities perceive an improvement in health after the respective projects. Projects providing hard inputs of water and sanitation can indirectly improve the health, housing and living conditions of the residents at costs lower than the conventional approaches. The conventional approaches are based on either providing housing and health clinics or concentrating on just softer inputs. A holistic approach is required to have a long term impact on the living environment.

When working on infrastructure projects in low income settlements one should always ask the question “how can we provide safe, affordable water services for all people?” (Wolff & Palaniappan 2004). Also another design point to keep in mind is about the nature and quality of infrastructure provided to low income settlements and whether it is possible to match up to the quality infrastructure offered to the middle and high income groups by partnerships and cost effective solutions.

8 ACKNOWLEDGEMENTS

Thanks to Allan McRobie for his support in this research and paper. Also thanks to all the communities for their frank responses and support during the field work phase.

REFERENCES

- Baroda Citizen's Council (BCC). n.d. *Ramdevnagar: A Slum decides its Fate*, Part of the data compiled for repayment patterns study for the World Bank's Water and Sanitation Programme.
- City of Cape Town. 2004, Imizamo Yethu: Existing services investigation, Cape Town Administration
- Diacon, D. 1997. *Slum Networking 'An Innovative Approach to Urban Development'*, Building and Social Housing Foundation.
- Hill K et al. 1998, *Trends in Child Mortality in the Developing World, 1960-1996*, UNICEF
- Hill, K, & Figueroa, M. 1997. *Child Mortality Estimation by Time Since First Birth*, Paper presented to British Society for Population Studies Annual Conference, Exeter, U.K.
- Kabir, M. & Amin, R. 1993. *Factors Influencing Child Mortality in Bangladesh and Their Implications for the National health Programme*, Asia-Publication Population Journal, Vol. 8 No. 3, pp 31-46.
- Moser, C. & Kalton, G. 1971. *Survey Methods in Social Investigations*, Second Edition, Dartmouth Publishing Company Limited.
- Oveson, M. n.d., Sample Size Determination for Survey Design, Available from <http://surveyz.com/client/sampling.doc>, [cited on 02 June, 2006].
- Parikh, H. 1995a. *Slum Networking of Ahmedabad City, A Proposal for 'Slum Networking' of Ahmedabad City*, For Ahmedabad Municipal Corporation, 1995.
- Parikh, H. 1999. *Slum Networking- An Alternate Way to Reach the Urban Poor, Using Slums to Save Cities*, Ahmedabad.
- Parikh, P. 2004. *Development of Village Physical Infrastructure in Ghogha Region of Western India - Case study of 'Bapada Village'*. Technical Report Submitted to the Institution of Civil Engineers for the Professional Review.
- Parikh, P. 2005. *An innovative approach to physical infrastructure as a means to overcoming poverty in developing countries*, MPhil thesis submitted to Cambridge University, Cambridge.
- Parikh, P. 2006. 'Impact of Water and Sanitation Infrastructure on Poverty Alleviation in Low Income Settlements', Draft first year PhD thesis submitted to Cambridge University, Cambridge.
- Tripathi, D. 1998. Alliance for Change – Slum Upgrading Experiment in Ahmedabad, Tata McGraw Hill.
- Tripathi, D. & Jumani, J. (2001). *Change After Alliance*, Sequel to Alliance for Change. Tata McGraw Hill
- UNICEF. 1999. *Urban Initiative – Slum Networking Strategy, A Community Based Water And Environmental Sanitation Demonstration Project In Ramdevnagar, Baroda, Gandhinagar*.
- United Nations Development Programme (UNDP). 2005. Human Development Report (HDR), *International cooperation at a crossroads: Aid, trade and security in an unequal world*, Oxford University Press, New York.
- Wolff, G. & Palaniappan, M. 2004. *Public or Private Water Management? Cutting the Gordian Knot*, Journal of Water Resources Planning and Management, ASCE, January/February 2004.
- World Bank WB. 2007. Millennium Development Goals, Accessed on 25th May 2007 from [http://ddp-ext.worldbank.org/ext/GMIS/gdmis.do?siteId=2&contentId=Content_t13&menuId=LNAV01HOME1]