Report

WaterAid learning for advocacy and good practice

Water and sanitation mapping in Pakistan

WaterAid

A WaterAid report

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Based on field visits to OPP-RTI and ASB, Pakistan

June 2006

Acknowledgements

My thanks go to all the individuals who took time to answer my questions during interviews in the UK and Pakistan and to explain and demonstrate their mapping methodologies and outputs to me. I'm especially grateful to OPP-RTI and ASB in Pakistan. This report would not have been possible without their professional and dedicated organisation of my itinerary in Karachi and in Faisalabad and Jaranwala and their openness to all my questions and comprehensive explanation of their work. I am also thankful to Roya Jodieri who wrote the Annex describing ASB's approach to GIS mapping in Jaranwala in more detail.

Acronyms

ADB	Asian Development Bank
ASB	Anjuman Samaji Behbood
CBO	Community-Based Organisation
CDGK	City District Government of Karachi
CDN	Community Development Network
GIS	Geographical Information System
KA	Katchi Abadi (informal settlement)
KCR	Karachi Circular Railway
KMC	Karachi Metropolitan Corporation
KWWMP	Korangi Waste Water Management Project
KWSB	Karachi Water and Sewerage Board
MoE	Ministry of Environment
NGO	Non-Governmental Organisation
OPP-RTI	Orangi Pilot Project – Research and Training Institute
SACCOSAN	South Asian Conference on Sanitation
SKAA	Sindh Katchi Abadi Authority
TMA	Tehsil Municipal Administration
TTRC	Technical Training Resource Centre
UC	Union Council
URC	Urban Resource Centre
WASA	Water and Sewerage Authority
YTP	Youth Training Programme

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Local vocabulary

katchi abadi	unauthorised low-income settlements on government land
nala	natural channel
tehsil	sub-district in Pakistan

Executive summary

This report is part of WaterAid's project on Learning for advocacy and good practice – water and sanitation mapping. The purpose of the project is to create a better understanding of the processes, methodologies, outputs and impacts of mapping carried out by different WaterAid country programmes and its local partners so as to encourage learning around water and sanitation mapping across WaterAid's country programmes and partners. The project comprises case studies from six different countries: Malawi and Tanzania in East/Southern Africa, Nepal and Pakistan in South Asia, and Ghana and Nigeria in West Africa.

The present report focuses on the experience of WaterAid's partner in Pakistan: the Orangi Pilot Project Research and Training Institute (OPP-RTI) based in Karachi. It also draws on experiences from one of OPP-RTI's partner organisations: Anjuman Samaji Behbood (ASB) in Faisalabad.

The **purpose** of this report is twofold. On the one hand the report documents how OPP-RTI applies sanitation mapping, particularly in Karachi. This includes the objectives, target groups, inputs, methods and processes of mapping in-country. On the other hand the report assesses how OPP-RTI has used mapping to influence decision-making processes around the local level delivery of sanitation services in Karachi.

The **main features** of OPP-RTI's sanitation mapping are summarised in Table 1 below.

OPP-RTI has practiced sanitation mapping for over 25 years. The organisation has been very successful in using mapping evidence as a tool to influence decision making around urban sanitation in Pakistan.

Its **main achievements** include: mapping of Orangi Town in Karachi (over 1 million inhabitants) and, based on that, implementation of OPP-RTI's component sharing model across Orangi; adaptation of OPP-RTI's internal-external sanitation model across all informal settlements in Punjab Province and, most recently, as a principle in Pakistan's national sanitation policy.

The major **factors for OPP-RTI's success** in using mapping are linked to

(1) the production of maps themselves, which is oriented at the capabilities of mapping agents in informal settlements,

(2) the advocacy strategies employed including multiple channels of dissemination such as academia, media, CBO networks, informal contacts with government officials etc and

(3) to OPP's philosophy, which encourages critical assessment of past mistakes and internal learning processes.

Table 1: Summary of main mapping features of OPP-RTI in Pakistan:

	Pakistan
Features of mapping	
History of mapping	Mapping under the Orangi Pilot Project in Karachi began in 1981 to help people design local sewerage systems. It has since been extended to mapping all major drainage channels and the entire sewerage system of Karachi. In total, around 650 maps have been produced by OPP's Research and Training Institute (RTI) and its partners. They include 206 maps within Orangi Town, a town of more than one million inhabitants of informal settlements within Karachi; 332 maps in Karachi but outside Orangi, covering roughly 60% of all informal settlements and all major drains flowing through the city of Karachi; and 106 maps in towns and villages outside Karachi.
Objectives	Through mapping OPP intends to document the reality on the ground, and to reduce the cost of laying pipelines by developing low-cost designs. OPP also aims to influence the government so that it supplements, rather than ignores, people's initiatives, and to reduce the corruption and waste of resources in infrastructure projects
Target groups	The immediate target groups of OPP's mapping are the people living in Orangi and in other low-cost housing areas. In addition, OPP targets Union Council mayors, engineers at the City District Government of Karachi and representatives of the International Financial Institutions.
Implementing partners	OPP has established its own mapping department in order to carry out mapping in Karachi.
Inputs	
Costs	Based on the calculation of time and material, OPP estimated in 2006 that the production of a typical map displaying different types of infrastructure at Union Council level with a population of approximately 75,000 people cost around PKR 10,000 (~GBP 100). This includes staff time and material needed for the production of the related maps and statistics.
Technical inputs and methodology	For producing a basic settlement map only a drawing board, scales, paper and pencil are needed. For more sophisticated maps of drains or larger proposals, plain tables and level machines are used to accurately measure angles and levels of the drainage system. Since 2004, OPP increasingly digitises hand-sketched maps with Autocad, a database software that can be obtained free of charge. OPP has also started to use satellite images as a means of documenting neighbourhoods.
Time and	The whole process of producing a map, which indicates the basic services of a settlement of around 500 houses,

human resources	takes six to eight weeks. With the use of satellite images, the duration of this process can be reduced. OPP's mapping department employs 15 persons. Some of the mapping staff supported through a Youth Training Programme (YTP) of one to two years and the remaining persons are employed on a permanent basis.

The mapping process	
Surveying and drafting	The mapping process always starts with the survey of a given settlement. On average, a settlement comprises of 60-70 lanes with around 500 houses. The survey is done by a pair of students, taking measurements and sketching a proxy-map by hand. During this process, interested community members are informed about the rationale and process of mapping. Then, back at the office, the proxy-map is drafted and put into scale.
Documentation of existing services	In the second stage, the students return to the settlement - this time documenting all existing water supply and sanitation services, their technical specifications, costs, state of functionality and who constructed them, based on information by local community leaders or CBOs. Back at the office, the existing sewerage lines are included into the map.
Proposal development	For the maps which OPP-RTI uses in order to work with government agencies, a proposal is developed based on the existing map. This proposal consists of a number of suggestions for improvement of sanitation infrastructure, sourced on the status of the documented infrastructure. This is accompanied by a cost estimate for the suggested improvements, based on current market prices of labour and material.
Updating and institutionalisingmapping	Regular updating of existing maps is not crucial to OPP-RTI's mapping approach as the objective of mapping is to support implementation of services and to document what is on the ground. At the time of the visit in 2006, OPP-RTI and its partner, the Urban Resource Centre, planned to digitise all maps the organisations had produced over the last 25 years, and to document all remaining areas of Karachi which have so far not yet been covered. This information would then be outsourced to an independent mapping unit in order to make mapping information more easily accessible to the public.
Source: Interviews in Pakistan	

1 Introduction

This report[1] documents water and sanitation mapping examples from Pakistan, based on a field visit in February/March 2006. It draws on interviews with government officials, local politicians, donors, academia, the Orangi Pilot Project – Research and Training Institute (OPP-RTI) and one of its partners, the community-based organisation Anjuman Samaji Behbood (ASB)[2], and on the review of background literature including newspaper articles, published and unpublished reports and studies.

In Pakistan, OPP-RTI and its partners use mapping predominantly in informal urban settlements. Mapping is part of OPP-RTI's wider approach to development, based on research and extension applied to support people in the informal settlements of Orangi Town in Karachi. Mapping started in 1981 to help people design local sewerage systems and has since been extended to mapping all major drainage channels and the entire sewerage system of Karachi. The production of maps is kept in-house at OPP-RTI and carried out by youths from informal settlements with low-tech and low-cost technologies. Apart from helping one million people in Orangi and elsewhere in Karachi gaining access to safe sewage disposal, mapping has had profound repercussions on sanitation policy and practice in Karachi and elsewhere in Pakistan. The major factors for OPP-RTI's success in using mapping are linked to (1) the production of maps themselves, which is oriented at the capabilities of mapping agents in informal settlements, (2) the advocacy strategies employed including multiple channels of dissemination such as academia, media, CBO networks, informal contacts with government officials etc and (3) to OPP's philosophy, which encourages critical assessment of past mistakes and internal learning processes.

The report is divided into 6 chapters. Section 2 describes the context in which mapping takes place. It outlines the decision making processes and responsibilities around sewerage disposal in the urban areas of Karachi, and the obstacles to coherent infrastructure development. In section 3, OPP-RTI's approach to sanitation mapping is described, including the inputs, process and various outputs of mapping. In section 4, the use and impacts of OPP-RTI's mapping work are laid out. Examples are given of how community members, NGOs and government agencies at various levels make use of OPP-RTI's mapping and the repercussions this has had on sanitation infrastructure planning, implementation and management. Section 5 summarises OPP-RTI's experience in supporting community-based and non-governmental organisations (CBOs and NGOs) in replicating its approach. In the final section, the factors leading to the success of OPP-RTI's approach to mapping in Pakistan are analysed to provide lessons for others interested in developing mapping to influence policy processes.

[1] The report presents one out of six case studies of water and sanitation mapping implemented by WaterAid. The other case studies are based on WaterAid's experiences in Ghana, Nepal, Nigeria, Malawi and Tanzania.

[2] 'Anjuman Samaji Behbood' means Social Welfare Organisation

2 Urbanisation and its repercussions

Since its foundation in 1947, Pakistan has undergone a rapid process of urbanisation. The proportion of the urban population increased from 14.2% in 1941 to 32.5% in 1998 (Hasan and Mohib, 2003). In the same period, the population of Karachi, where OPP-RTI is active, has grown from around 436,000 to 9.8 million inhabitants (Hasan and Mohib, 2003) and to approximately 13 million in 2005 (Hasan, 2005).

With the rapid population increase a housing crisis emerged in Karachi that the government was unable to resolve. In the 1970s, an informal system of acquiring land evolved in Karachi. This involved so-called professional land grabbers, who parcelled out vacant state land on the periphery of the city, based on the official pattern of planning. They sold small plots of land to low income people for cash, without providing official documentation. As a result, all urban dwellers who acquired land informally do not have a legally recognised ownership of their plots. With the growing occupation of these informal settlements, services such as roads, electricity, street-lighting, water supply and sewage disposal were partially extended to the areas through political "gifts" on an ad hoc basis. Yet, the majority of theoretically "public" facilities, including sewage disposal, water supply, schools and clinics, have been developed through self-help initiatives by the inhabitants of katchi abadis themselves.[3] These unplanned urban areas –katchi abadis – today accommodate approximately 6 million people, a little under half of all Karachi's inhabitants. Since 1975, a policy of katchi abadi regularisation was adopted, aiming to formalise the leasehold of occupied plots and upgrade services. The Sindh Katchi Abadi Authority (SKAA) was created to facilitate the process but, despite temporary successes, regularisation remains cumbersome and slow with only 1.5% of katchi abadis being regularised per year (Siddiqui, 2004; Hasan, 2005).

2.1 Devolution and responsibilities for sewage disposal in Karachi

Pakistan is a federal state divided into provinces, rural districts/urban city-districts, rural and urban sub-districts/towns, and urban and rural union councils (UCs). A UC, the lowest administrative tier of an urban administration, covers between 25,000 – 100,000 persons. Since 2001, Pakistan is undergoing a process of devolution whereby the mayors, deputy mayors and 21 councillors of the union councils are directly elected.[4] In Karachi, the city government has been subdivided into 18 towns comprising 178 UCs. One town has between 9 – 13 UCs and comprises of up to one million inhabitants (OPP, 2005).

[3] In those 334 *katchi abadi*s in Karachi surveyed by OPP-RTI (out of a total of 539 *katchi abadis*), documentation shows that 1041 clinics have been established by local charities and individuals compared to 12 government clinics and 773 schools were built and are run by private initiatives in comparison to 143 government-run schools (Rahman, 2004).

[4] In theory, non-party based candidates present themselves for election. However, growing pressure from dominant political parties at the local level has intimidated many independent citizens who, consequently, have not run for the latest local elections in autumn 2005 (Interviews).

When it comes to sewage disposal in Karachi, the co-existence of formal and informal settlements and the use natural channels for sewage disposal in many areas have led to confusion over responsibilities between different government agencies. This resulted in a general negligence of sewage disposal in the past. The official responsibilities of the different agencies, their sources of funding and the discrepancies and problems in fulfilling their roles are summarised in Table 1. However, many of the past confusions are gradually being resolved now.

Officially, responsibilities for sewerage and drainage are distributed in the following way in Karachi. Storm drains and natural channels (nalas) are taken care of by the city, town and UC governments, while the sewerage system has been outsourced to the semi-autonomous Karachi Water and Sewerage Board (KWSB).

The City District Government of Karachi (CDGK), the highest tier of local government, is responsible for "planning, development and maintenance of storm drains, special development programmes and any other function which the Government may assign".[5] These responsibilities are carried out by the Department of Works and Services, the administrative unit responsible – inter alia – for storm drains at city-district level. The CDGK generates between 60 and 70% of its budget from a matching grant of the federal government and from a number of different taxes and levies. Besides, there is also a budget for special development projects.

The intermediate level of local government – in the case of Karachi, the town councils – has the same responsibilities as the CDGK within their respective jurisdictions. The town councils deal with drainage systems that cut across different Union Councils under their jurisdictions and are assisted by the town municipal administration, including a representative from the Department of Works and Services, to carry out their work. They receive their budget from CDGK.

At the lowest level of local government, the Union Council, the mayors are responsible for the identification and overseeing of drainage project executions within their jurisdictions. They also receive a budget from CDGK, but pass on those projects that go beyond their scope to the town and city district governments. The capacity at UC is often very limited with scarce financial resources and no qualified technical staff to support the political representatives.

The disposal of sewage in Karachi has been outsourced to the Karachi Water and Sewerage Board, a semi-autonomous body under CDGK. The KWSB is responsible for the construction, improvement, maintenance and operation of sewage works and industrial waste disposal systems in Karachi. The agency is divided into a sewerage maintenance wing and a sewerage development

[5] Sindh Local Government (Amendment) Act 1996 in: OPP-RTI, 2000

wing. The maintenance wing's budget is generated through service delivery charges and a subsidy from CDGK. Until 2000, development wing financed its operations mainly through IFI-funded projects. Now it is mainly funded through grants from the provincial and federal government (OPP-RTI, 2000).

2.2 Obstacles to coherent infrastructure development

There are a number of issues hindering the coherent planning, development and maintenance of sewerage and drainage infrastructure in Karachi.

Encroachment by other agencies: There is a tendency of agencies and individuals to intrude into the CDGK's and KWSB's responsibilities leading to overprized, ineffective infrastructure development and to inefficiencies in management. For example, higher levels of government, i.e. military and provincial government representatives, tend to interfere with the responsibilities of the CDGK, thereby creating confusion and inefficiencies in service delivery. Concerning the development of infrastructure, there is also substantial pressure from IFIs and bilateral donors wishing to carry out major infrastructure development projects. In previous cases, such projects have proven to be based on unnecessary expensive designs and overprized contracts leading to substantial increases in foreign debt according to OPP-RTI's assessment (Interviews; Daily Dawn, 19th February 2006).

Lack of sanitation infrastructure information: Urban infrastructure maps, the essential basis for any coherent infrastructure planning, are generally lacking. The Survey of Pakistan, a federal government institution, provides aerial maps of Pakistan. The last update of these maps was carried out in the 1970s and since then the population of Karachi has more than doubled. A national Land Use Project uses remote sensing data to produce maps in collaboration with the Survey of Pakistan. However, these maps are generally not used by the planning departments at federal and district level. In Karachi, the UNDP has supported the updating of mapping under the Karachi Master Plan from 1975 onwards but since 1985, when the project ceased to be operative, the institutional knowledge has been lost (Hasan, 2005). In addition, informal settlements are generally neglected when it comes to infrastructure planning, and are not coherently captured in maps produced by government agencies (Interviews).

Table 2: Responsibilities for drainage and sewerage by agency

	Areas of responsibility	**Budget sources**	**Inconsistencies and problems**
CDGK	- development of storm drains - any other functions that the government may assign	- taxes and levies - budget for sewerage passed on to KWSB	- dispute with KWSB on who is responsible for drains used for sewage disposal (until 2000)
Towns	- the same responsibilities as	- CDGK	- lack of coordination with UCs and CDGK

	CDGK, within their geographical boundaries		
UCs	- identification of infrastructure development and maintenance within their jurisdictions, including sewerage and drainage	- CDGK, towns	- lack of technical capacity, human and financial resources and of information - weak coordination with higher tiers of local government
KWSB (former KMC)	- water and sewerage infrastructure development and maintenance across Karachi	- CDGK, service charges, special funds from provincial and national governments, foreign loans (until 2000)	- insufficient revenues - dispute with CDGK (see above) - dependence on federal/ provincial government grants
SKAA	- training and support to town staff on infrastructure services in katchi abadis	- own resources	- still implementing rather than supporting infrastructure development in katchi abadis
Sources: OPP-RTI 2000, Interviews			

Lack of accountability: In the absence of information, clear responsibilities and funding, sewerage and drainage infrastructure development and maintenance in Karachi has been ad hoc and piecemeal. The lack of information about existing infrastructure, in particular, has opened the doors for corruption and a waste of resources in large sewerage and drainage infrastructure projects. A powerful partnership between government officials, engineers and contractors resulted in substandard, yet expensive work. Proposals were regularly over-designed and over-priced, whereas implementation was generally of poor quality and time consuming, without proper technical supervision. The absence of coordination between UCs, towns and CDGK in sewerage development and maintenance further encouraged these practices. The problem underlying poor sanitation infrastructure in Karachi is thus not a financial one but rather the lack of transparent processes and systems.

3 Mapping

3.1 The Orangi Pilot Project and a brief history of its sanitation mapping

OPP's sanitation mapping needs to be understood within the wider context of the Orangi Pilot Project (OPP). OPP was established in 1980 in Orangi, one of the 18 towns, which form Karachi. Orangi is a katchi abadi of approximately 1.2 million inhabitants. The philosophy behind OPP is based on the concept of research and extension of OPP's founder, A H Khan[6], and consists of four steps: seeing, observing, learning and teaching. The objective of OPP is to:

- Understand the problems of Orangi and their causes;
- Through action research develop solutions that people can manage, finance and build;
- Provide technical guidance and managerial support for implementation; and
- Overcome constraints that governments face in the upgrading of katchi abadis.

In other words, OPP does not itself carry out development work but promotes community activities and provides technical support to such initiatives, and to government bodies, in overcoming constraints to development. It acts as a resource and training centre that is open for community activists and government officials alike.

In 1980, participatory research identified sanitation as the most important problem in Orangi. Based on this, OPP has developed a low cost sanitation programme.[7] The methodology is divided into internal development built by communities (sanitary latrines in the house, underground sewers in the lane, neighbourhood collector sewers); and external development (main sewers, treatment plants) carried out and financed by the government (Hasan, 2005a; Rahman, 2002; Interviews). This model, called internal-external component sharing, forms the basic principle of OPP's approach. It is further explained in Box 1 and Figure 1 below. Since the division of OPP into three different organisations in 1988, the OPP Research and Training Institute (RTI) has been responsible for the low-cost sanitation programme.

Over the last 25 years, OPP-RTI's approach has achieved enormous successes. In Orangi, nearly 100,000 households (representing approximately one million people) have now developed their own sanitation systems. Outside Orangi, another 40,000 houses in 11 Pakistani towns have built their internal sanitation systems (Hasan, 2005a).

[6] Akhtar Hameed Khan was a Pakistani well reputed social scientist. His concept of research and extension, which became the main principle of OPP, had already been successful in a major rural community development project during the 1960s (Hasan, 2005b).

[7] OPP supports the urban poor in improving their livelihoods. In addition to the low-cost sanitation programme, the organisation has developed four other basic programmes of housing, health education and credit for micro-enterprise (Rahman, 2002).

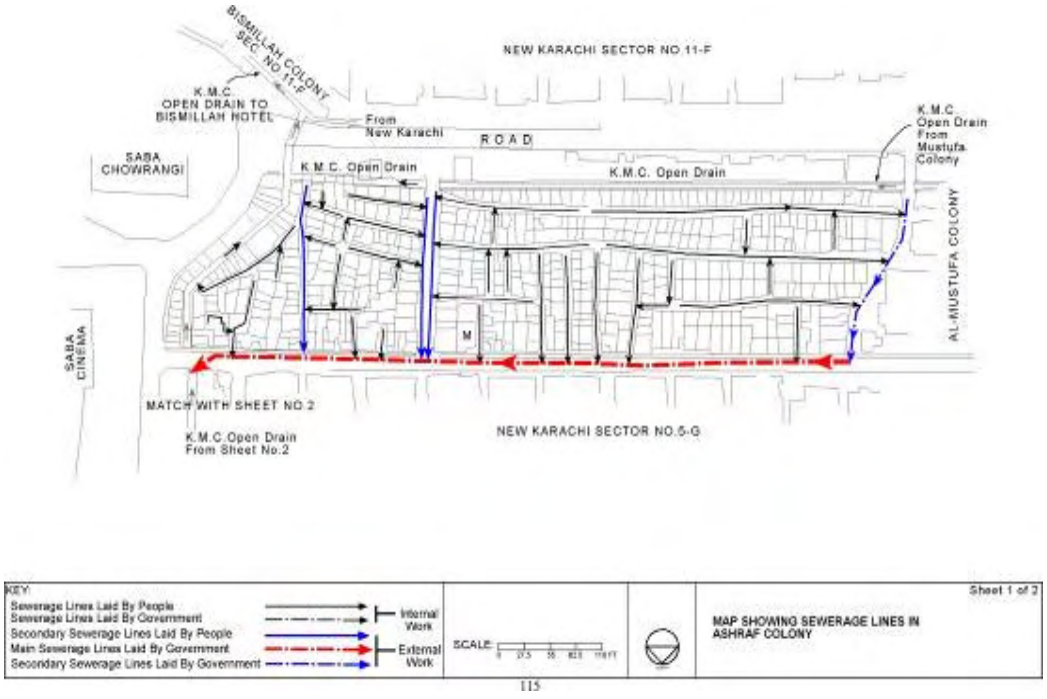
Box 1: OPP's internal-external component sharing model

In OPP's model, the internal component for sanitation and sewage disposal stands for the construction and maintenance of sewage lines in primary and secondary lanes. As shown in Figure1, a primary lane is a street of around 16 – 20 houses, which, at both ends, leads into a secondary lane. The secondary lanes connect to the main streets. Neighbours, with the help of community organisations and local social activists, organise themselves to finance, construct and maintain these sewerage systems. The internal component covers 70% of the total sewerage system. Figure 1 shows that, from secondary lanes, sewage is directed into main streets or natural channels and drainage systems. The sewage system at this level is called the external component by OPP. It needs to be developed and maintained by the government.

The internal-external component sharing model is based on an understanding that the development of service provision in any given settlement does not start from a blank sheet. A certain level of service provision has usually been built up through self-help initiatives and ad hoc government interventions. People are willing to contribute to an improvement of service provision in their immediate neighbourhood but need technical and organisational guidance in order to make their efforts sustainable. Their work needs to be complemented by the government in those areas that cannot be sustained by individual efforts.

Source: Interviews with OPP-RTI

Figure 1: Map of a settlement showing sewerage lines



This has been possible because OPP-RTI's approach has been replicated by CBOs and NGOs outside Karachi. Today, OPP-RTI has over 30 partner organisations, which are linked through the Community Development Network (CDN), a regular forum to exchange experiences. OPP-RTI's model of internal-external component sharing has also been taken up by international donors working in Pakistan and by one government agency, the Sindh Katchi Abadi Authority (SKAA). Over the years, the OPP-RTI model has been adopted as a policy by two of the four provinces and, most recently, has been included in the draft national sanitation policy. The main breakthroughs of OPP's sanitation mapping over the 25 years of its existence are summarised in Box 2 below.

Box 2: Major steps and breakthroughs of OPP-RTI's sanitation mapping

1981	Sanitation mapping starts in Orangi with the support of a small number of students.
1983	OPP's approach becomes increasingly replicated by CBOs and NGOs from informal settlements inside and outside Karachi, who progressively take over the role of advocates on behalf of OPP.
1987	International agencies get interested in OPP's model and start to replicate it by integrating it into projects with government agencies that they are implementing.
1990/1	OPP becomes a consultant to KMC (former CDGK) for the ADB-financed Katchi Abadi Urban Development Programme in Orangi, for the UNICEF-supported Urban Basic Services Programme in Sukkur, Sindh Province and to the WB-supported project on Shelter for Low-Income Communities in Hyderabad. All agencies accept the main principles of OPP's approach. Yet, apart from the KMC in Orangi, where relations with OPP have been built up over time, the government agencies do not fulfil their roles adequately and the projects come to a standstill.
1994	SKAA is the first government agency to adopt OPP's approach of internal-external component sharing. With the support of OPP-RTI, SKAA staff document 150 katchi abadis. Based on the mapping information and on a new relationship of trust created between SKAA and katchi abadi dwellers, the process of regularisation is speeded up. As a result, SKAA becomes solvent and dwellers get secure land tenure. The funds are used to implement infrastructure projects in katchi abadis in line with peoples' priorities.
1996	OPP-RTI starts to advocate for an alternative Karachi-wide sewerage plan. Contrary to the city government's Greater Karachi Sewerage Plan – a major sanitation infrastructure development plan supported by the international financial

	institutions – OPP-RTI's plan foresees that the city's sewage be disposed of into natural nalas/drains. The sewage is canalised by developing nalas into (covered) box trunks and connected to sewage treatment plants where the nalas join the sea.
1999	The ADB-supported Korangi Waste Water Management Project (KWMMP), Korangi being a town of 500.000 inhabitants within Karachi, is stopped. The early project termination is strongly influenced by OPP-RTI's mapping evidence showing that the project is technically not viable and ignores existing infrastructure. The Greater Karachi Sewerage Plan, which is based on the same principles as KWWMP, starts to be questioned. OPP's alternative proposal, which uses the existing natural nalas and drains as the main basis for a Karachi-wide sewerage system, enters the debate.
2000	OPP-RTI's institutional study of the city government's agencies' responsibilities reinforces the debate around covering main natural channels and using them for sewage disposal.
2002	The Punjab provincial government adopts OPP-RTI's sanitation component sharing model for the upgrading of all katchi abadis.
2004	OPP-RTI is invited by CDGK to form part of a focal group on nalas and drains in Karachi. Based on OPP's designs and documentation, GDGK manages to obtain a total of USD 33.68 million for the development of nalas and drains from the Government of Sindh Province.
2005	KWSB starts to accept OPP-RTI's idea of using the main natural channels and drains as sewage disposals and developing these as box trunks with treatment plants where the nalas/drains join the sea.
	OPP's chairman, Arif Hasan, is asked to become the consultant for the development of a national sanitation policy. The draft strategy contains the main principles of OPP-RTI's internal-external sanitation model.
Sources: Hasan, 2005a, 2005b, 2000; OPP, 2005 and Interviews	

3.2 Objectives and target groups

As explained above, OPP's sanitation mapping is part of a wider process of scaling up people's initiatives. The purpose of mapping is twofold. The first objective is to document the reality on the ground, and to reduce the cost of laying pipelines by developing low-cost designs and by linking up peoples' own efforts at the lane and neighbourhood level. The immediate target groups for this are the people living in Orangi and other low-cost housing areas.

The second objective is to influence the government so as to supplement, rather than ignore, people's initiatives, and to reduce the corruption and waste of resources in infrastructure projects. With the establishment of the internal-

external model, complementing people's efforts with government interventions has moved to the fore. Mapped areas have expanded from maps of settlements to maps of Union Councils, towns and the entire sewerage system of Karachi. Accordingly, UC mayors, CDGK and KWSB engineers and the International Financial Institutions (IFIs) are the other target groups of OPP's mapping activities.

3.3 Inputs

It is difficult to accurately break down OPP-RTI's **costs of mapping** because mapping at OPP is an ongoing process, a service provided to katchi abadis and to the wider city for the development of a Karachi-wide sewerage system. The mapping department at OPP-RTI is the backbone of the organisation. OPP's sanitation mapping is a low-cost activity because the development of maps also serves as a training activity for young people in katchi abadis, and salaries at OPP are modest. OPP-RTI finances its core expenses through a yearly grant provided by international charities on an open-ended basis. Based on the calculation of time and material, OPP has recently estimated that the production of a Union Council Plan Book, covering a population of around 75,000 people and providing maps displaying different types of services, costs around PKR 10,000 (~GBP 100). This includes staff time, as well as all material needed for the production of the related maps and statistics.

The **technical inputs** for OPP's sanitation mapping are oriented on the capabilities and conditions in the unplanned settlements where OPP is working. For producing a settlement map, all work is done by hand and only requires a drawing board, scales, paper and pencil. For more sophisticated maps of drains or larger proposals, plain tables and level machines are used to accurately measure angles and levels of the drainage system. This equipment is very low-cost. A plain table and measuring stick amounts to around GBP 20 and a level machine costs GBP 250. Since 2004, OPP increasingly digitises hand-sketched maps with Autocad, a database software that can be obtained free of charge. Most recently, OPP has also started to use satellite images as a means of documenting neighbourhoods. Satellite images have been downloaded for free using Micro media Freehand software from Google Earth[8]. Because of the low resolution of some of these maps, though, OPP is now considering purchasing a more sophisticated software.

The low technical inputs required for OPP's mapping methodology mean that the **human resources** required during the process are high. OPP's mapping department employs 15 persons. Of these, six to eight mappers are supported through a Youth Training Programme (YTP) of one to two years and the remaining persons are employed on a permanent basis. The whole process of producing a map, which indicates the basic services of a settlement of around 500 houses, takes six to eight weeks. With the use of satellite images, the duration of this process can be reduced. Producing a Union Council Plan

[8] http://earth.google.com

Book takes around three months. The development of OPP-RTI's training programme is explained in more detail in Box 3 below.

Box 3: OPP-RTI's development of training in mapping skills

In the beginning of the Orangi Pilot Project, university students were encouraged to support OPP in the sanitation mapping process. In 1991, OPP started to coherently document katchi abadis. At that time, the organisation began to train young people from the settlements themselves in order to provide them with the opportunity to gain additional skills and move on thereafter. By the end of 1993, OPP-RTI had documented 50 katchi abadis with the help of youths. In 1994, when OPP became a consultant to Sindh Katchi Abadi Authority, a government institution responsible for regularising and upgrading katchi abadis, OPP-RTI established a Youth Training Programme (YTP) supporting students for a period of one to two years. By 2006, the number of documented katchi abadis has grown to 356 covering between 65-75% of all Karachi's katchi abadis.

One of the students from the YTP, Sirath Sirajuddin, who was trained on surveying at OPP starting from 1994, set up his own organisation, the Technical Training Resource Centre (TTRC) in Orangi Town, which takes on three to four students from among unskilled young people in his neighbourhood, as well as university students. He has developed a number of courses, one of which serves as a four-week preparation course for students who want to join the OPP-RTI fellowship programme. During this course, students acquire basic skills in surveying, sketching, drafting, documentation and supervision of construction, all needed for sewerage and drainage mapping.

Lately, OPP-RTI has also requested TTRC to provide training to other organisations in Sindh Province that intend to replicate OPP-RTI's sanitation model. Under the Sindh Mapping Unit, which maps settlements in rural areas, TTRC will provide training to six local organisations and monitor their first actions.

Source: Interviews

3.4 Sanitation mapping methodology and process

In OPP's model, sanitation mapping is the first step of a wider process leading to the development of a sewage disposal system in a settlement, a town or city. The detailed steps of the entire process can be accessed from OPP-RTI's website.[9] Below, the focus will be on the mapping component.

Surveying and drafting: The mapping process always starts with the survey of a given settlement. On average, a settlement comprises of 60-70 lanes with around 500 houses. The survey is done by a pair of students[10] through

[9] http://www.oppinstitutions.org/

[10] Students may come from a variety of backgrounds. They include university civil engineering or architecture students but have in recent years predominantly been drawn from young boys

"walking houses and lanes", taking measurements and sketching a proxy-map by hand. During this process, interested community members are informed about the rationale and process of mapping. Then, back at the office, the proxy-map is drafted – it is put into scale (Interviews).

Documentation of existing services: In the second stage, the students return to the settlement - this time documenting all existing water supply and sanitation services, their technical specifications, costs, state of functionality and who constructed them, based on information by local community leaders or CBOs. At this stage, the map and additional documentation is also double-checked by a supervisor. Back at the office, the existing sewerage lines are included into the map. As shown in Figure 1 above, the map shows the flow of the drain and who provided it in accordance with the internal-external model. Additional technical and statistical information is kept separately. Since 2004, maps are being digitised (Interviews).

Proposal development: For those maps which OPP-RTI uses in order to work with government agencies, a proposal is developed based on the existing map. This proposal consists of a number of suggestions for improvement of sanitation infrastructure, based on the status of the documented infrastructure. This is accompanied by a cost estimate for the suggested improvements, based on current market prizes of labour and material.

3.5 Various mapping outputs

The basic output of mapping is **a map of a settlement** and detailed maps of individual lanes displaying technical details for the construction of sewerage lines. This map is used as guidance for constructing the internal and external components of sewerage systems. An example for such a map is shown in Figure 1. In 2002, 334 out of 539 katchi abadis had been surveyed by OPP-RTI (Rahman, 2004) and a comprehensive publication of all maps is currently underway.[11] As sewerage systems in katchi abadis built through people's initiatives expanded, the need arose to focus on wider problems such as improving the **main drainage systems** cutting across different settlements, Union Councils and towns within Karachi. Accordingly, OPP started to map major drains and natural channels cutting across Orangi and other katchi abadis in Karachi. The documentation of these drains is based on the same methodology as described above, but requires very accurate measurements. Therefore, additional instruments are used, assisting the mappers to be precise in their measurements. A plain table is used to derive exact angles and a levelling instrument serves to measure the different levels of the drain or natural channel. Three stages of cross-checking are in place to ensure accuracy of information, including the satellite image, which helps to cross-check angles and distances. Based on the map, a proposal is then prepared

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in the settlements themselves. The programme has thus provided these young people with skills for future employment.

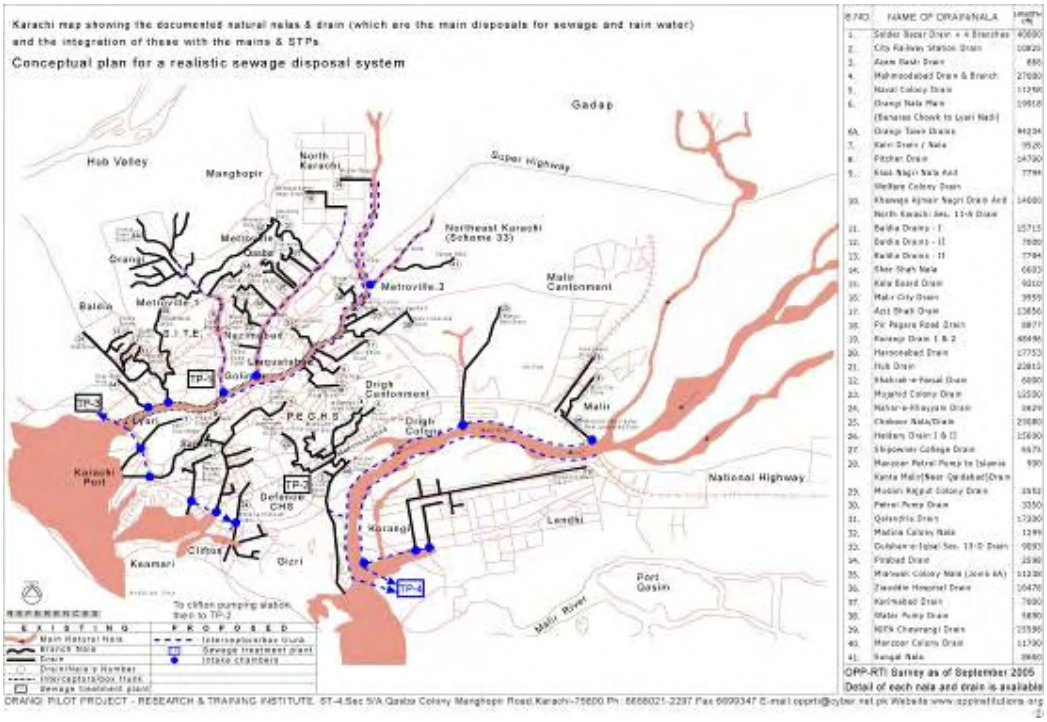
[11] The surveys of the first 100 *katchi abadis* have been published in 2002 and the publication of the second 100 *katchi abadis* is currently being finalised.

by OPP with suggestions for the technical improvement and accompanying cost estimates.

The improvement of major drains brought the entire sewerage system of Karachi into the picture. OPP-RTI felt that, without the documentation of all natural channels and drains, which are the main means of disposal for sewage and rainwater in Karachi, it would be impossible to develop a realistic concept of a city-wide sewage disposal system.[12] OPP-RTI therefore produced **city-wide maps showing all existing main channels and drains** and, based on this, developed detailed proposals with conceptual plans for Karachi's future sewage disposal. One such conceptual plan is shown in Figure 2 below. With the devolution plan introduced in 2001, OPP-RTI felt the need to support Union Councils in the katchi abadis of Karachi with their new planning and development tasks, through the production of detailed maps showing the settlements and different types of social services in their jurisdictions. These so-called **Union Council Plan Books** contain seven maps showing (1) sewerage systems, (2) water systems, tanks and pumping stations, (3) schools and training centres, (4) maternity homes, health centres, clinics and hospitals, (5) playgrounds and parks, (6) solid waste disposal points and (7) religious spaces. The UC Plan Book also contains detailed statistical and technical information, and a proposal for each UC concerning possible repairs and upgrading of the sewerage system.

Figure 2: OPP-RTI map showing natural nalas and drains in Karachi

[12] The model of converting open storm drains and natural channels into covered box trunks carrying sewage was highly disputed on technical grounds when first proposed by OPP-RTI. However, over time, OPP-RTI has been able to convince the different government agencies of the technical soundness of its approach by providing examples from other countries (i.e. Japan) where this system is common practice.



In addition, OPP-RTI has produced maps of various towns in Karachi, and OPP-RTI's partner organisations have developed maps of other towns in Pakistan. The latest plan is to digitise all maps produced by OPP and its partner, the Urban Resource Centre, (URC) over the last 25 years, and to document all remaining areas of Karachi which have so far not yet been covered, by the beginning of 2007. This information will then be outsourced to an independent "Mapping Unit" in order to make mapping information more easily accessible to the public (Interviews).

In total, around 650 maps have been produced by OPP-RTI and its partners, with OPP-RTI's guidance. They include 206 maps within Orangi Town, a town of more than one million inhabitants of informal settlements within Karachi; 332 maps in Karachi but outside Orangi, covering roughly 60% of all informal settlements and all major drains flowing through the city of Karachi; and 106 maps in towns and villages outside Karachi. The maps outside Karachi are mainly situated in Sindh and Punjab provinces, where OPP-RTI is implementing its approach in partnership with the provincial governments, as well as in other major towns where OPP-RTI's partner organisations are active (OPP's Mapping List and Interviews).

4 Use of mapping and its political repercussions

The internal-external component sharing model, which OPP-RTI advocates, has had repercussions on the planning, operation and maintenance of infrastructure, and on the relationships between local communities, NGOs and the government throughout Karachi. Using maps has played a crucial role in this process. In general, maps documenting the existing infrastructure and

people's efforts have brought to the fore what was previously invisible and therefore convenient to be ignored by government officials and contractors.

OPP-RTI has identified a variety of stakeholders at different levels for exerting political influence through the use of maps. These are the communities and organisations from katchi abadis with whom OPP-RTI work; the individual agencies and political representatives responsible for sanitation infrastructure at union, town, city, provincial and national level; and, at the international level, the International Financial Institutions and donors. In the following, examples will be given for the uses of maps by these different stakeholders and the repercussions their use has had on a number of specific political processes.

4.1 Use by communities and NGOs

When working with communities, OPP-RTI has mainly used settlement maps (see Figure 1) illustrating the individual lanes and infrastructure specifications (material inputs and designs) to assist them with the development of the internal sanitation component. Starting from the early 1990s, the maps have mainly been produced by youths from these settlements. The mapping process itself thereby also has the positive side effect of providing many local youths with additional skills and livelihoods (see also Box 3).

In addition to the settlement maps, OPP-RTI provided the communities with maps depicting the design and specifications of main sewer lines. These maps enabled community members and CBOs to monitor the construction of the external sanitation component in their neighbourhoods. Muhammad Shamsuddin, an area activist from Ghaziabad who was involved in this monitoring exercise, remembers that the maps and infrastructure specifications helped him and other community members a great deal in identifying faulty construction work because they could be used as guidance[13]. When they pointed out the substandard work in constructing manholes, the project manager ordered the contractors to replace all faulty work. According to Shamsuddin, this first positive interaction with government was very important for him and gave him the confidence for his future interactions with government officials (Interviews; Rashid, 1998). The experience of this community activist is, according to Hasan (2004), shared by many others and has, over the years, made the relationship between dwellers in informal settlements and local government representatives more equitable.

An interesting case of NGOs using maps innovatively is the ongoing campaign against eviction in relation with a currently planned expansion of the Karachi Circular Railway. Expanding the railway, which is situated in an area of Karachi with high-value land, potentially provides a lucrative business for a number of government stakeholders if occupied land can be reclaimed and

[13] For example, these maps specify the quality and design of materials and the length, width and depth of pipes and manholes.

sold. The Karachi Circular Railway redesign envisages a right of way[14] of 100 – 120 feet leading to the demolition of all katchi abadi buildings along the track. The general assumption put forward by government officials and planners, echoed by the media, was that only katchi abadis are situated along the railway track. CBOs from the affected areas then approached the Urban Resource Centre, a partner of OPP, with the claim that also other buildings were built within the envisaged right of way. Together with the CBOs, URC carried out a survey to comprehensively assess the distances of all built-up areas from the track and to document the different uses of those areas. The survey showed that 72% of the area along the track is currently occupied by commercial, residential and institutional buildings, and only 28% is inhabited by katchi abadis and other low-income settlements. A map linking pictures of different types of buildings and their distances from the existing track (see Annex 1), and a short video, were produced as evidence. The community-activists used these tools to lobby with the media, their local councillors and the mayor of Karachi. As a result, the media changed their reporting; now presenting the evidence produced by URC and local CBOs. The project has currently come to a standstill, but the wider debate about the Karachi Circular Railway is ongoing (Interviews, Citizens' Forum on KCR, 2005).

4.2 Use by different government agencies

The Sindh Katchi Abadi Authority: The Sindh Katchi Abadi Authority was the first government agency that took on OPP's approach. It adopted the internal-external component sharing model as a policy in 1994. The authority was created in 1987 in order to coordinate the process of regularisation and upgrading of infrastructure in katchi abadis. Yet, from 1987 until 1991, no regularisation certificate had been issued and only very limited upgrading had taken place. At the same time, SKAA, who was supposed to recover its expenses through rents obtained from katchi abadi dwellers after regularisation, had become completely dependent on funding from the Asian Development Bank. In 1994, SKAA hired OPP-RTI as a consultant in order to document the existing sanitation and water supply infrastructure in the settlements and to supervise the process of upgrading. In the process, as many as 150 katchi abadis were documented, which represents more than a quarter of all katchi abadis within Karachi (Hasan, 2005b). The link with OPP-RTI was made because the then Director General of SKAA, Tasneem Siddiqui, was well acquainted with OPP-RTI's work and a strong supporter of its model. According to Siddiqui, maps have played a crucial role for the work of the authority. With the help of maps provided by OPP-RTI, the authority was able to identify particular areas for regularisation and to set priorities – in cooperation with the communities – in upgrading based on the already existing infrastructure.

[14] This is the minimum distance from the railway track to the built-up area.

Based on mapping information and on a new bond of trust between katchi abadi dwellers and SKAA, the agency has been able to substantially speed up the upgrading process. As a result, SKAA has become solvent, city dwellers have secure tenure and a number of infrastructure projects have been implemented. In addition, the existing maps of katchi abadis have provided their inhabitants with a negotiation tool for future infrastructure development (Interviews; Ismail, 2004; OPP, 2005).[15]

The Karachi sewerage agencies: As outlined in Section 2, the agencies responsible for sanitation infrastructure at city-level are the City District Government of Karachi[16] (CDGK) and the Karachi Water and Sewerage Board (KWSB), to which sewage disposal has been outsourced. According to various chief engineers at CDGK and the deputy Managing Director of KWSB, both agencies use OPP-RTI's maps regularly. They mainly rely on OPP-RTI for maps of katchi abadis, of which they have no documentation of their own, and for maps of the major natural channels and drains, as well as the entire drainage system of Karachi. All engineers from the government emphasised their high regard for OPP's maps, which, according to them, are more detailed, up-to-date and coherent than their own recording system. Engineers from CDGK, in particular, stated that they would always consult OPP-RTI before taking on a new major project, including from international financial institutions. The close collaboration between OPP-RTI and the city government is best illustrated by the recent invitation of CDGK for OPP to become part of a focal group on the development of natural channels and drains throughout Karachi. This cooperation is the result of a long and persistent lobbying process by OPP-RTI (see also Box 2 for an overview of OPP-RTI's mapping history). It is based on a proposal for a Karachi-wide sewage disposal system by OPP-RTI taking existing natural channels and storm drains as a starting point. Converting these channels into covered box trunks rather than creating a parallel system has considerably reduced the total cost of sewerage development thereby making CDGK less dependent on foreign loans. In the opinion of a chief engineer in CDGK, the professional assistance of OPP-RTI in developing and presenting the proposal helped the agency to obtain funds for its implementation from the government. This project is now carried out in partnership with OPP-RTI, which is acting as an adviser as well as monitoring the quality of work undertaken by contractors (OPP, 2005; Interviews).

Yet, the relationship between OPP-RTI and the major agencies responsible for sewerage and drainage across Karachi has not always been so good. Rather, it has developed very slowly over time. Originally, KMC – the former CDGK – and KWSB ignored OPP-RTI's proposals for a city-wide sewerage system based on the use of natural drainage channels, and the mapping documentation of existing infrastructure supporting it. OPP's alternative Greater Karachi Sewerage Plan was officially dismissed for various technical reasons. But, OPP-RTI's growing documentation of the success of its own

[15] Yet, this process has slowed down again since SKAA has a new director. In addition, the role of the organisation has changed with the recent decentralisation process in Pakistan.
[16] Before devolution: the Karachi Metropolitan Corporation (KMC)

approach in working in katchi abadis, and its documentation of failures of IFI-supported projects, slowly built up a body of evidence that could not be overlooked any more.

One crucial step in getting OPP-RTI's alternatives for the Greater Karachi Sewerage Plan accepted by government agencies is the flawed Korangi Waste Water Management Project (KWWMP). The KWWMP formed part of a wider project called the Greater Karachi Sewerage Plan, a major infrastructure project supported by international loans. Its design, based on insufficient information about ground reality, ignored the existing infrastructure and was technically flawed. OPP-RTI, who had the full documentation of existing infrastructure in Korangi, challenged the original design of KWWMP. In order to demonstrate the likely impacts of KWWMP, OPP presented mapping evidence from an already implemented project in Baldia Town, which was based on the same design. OPP's mapping evidence showed that, in the case of Baldia, only 1744 out 25.000 houses could connect to the sewerage lines constructed by the Greater Karachi Sewerage Project. Apart from ignoring existing sewerage lines, the maps showed that, in some cases, the original design required sewage to be pumped uphill rather than flowing naturally downhill.

In its alternative for Korangi, OPP-RTI suggested that all existing sewerage systems should be documented and accepted, and that the natural channels (generally used for sewage disposal) should be converted into box trunks, meaning concrete covered channels, with a treatment plant where the sewage is discharged into the sea. This proposal reduced the original costs from USD 100 million to USD 15.2 million, a sum which made an international loan redundant. After numerous presentations at various government levels, to the ADB, and substantial lobbying of neighbourhood organisations in Korangi, the Governor of Sindh decided to abandon the international loan and follow OPP's design instead (Hasan 2005a; Interviews).

The discussion generated by OPP-RTI's alternative to the Greater Karachi Sewerage Plan triggered a debate among government agencies. The Governor of Sindh supported OPP's line by issuing a directive that "KMC should develop and upgrade main nalas/drains as sewage and rain water drainage channels" (Hasan, 2005a). Over time, OPP's model became more accepted with the agencies, most recently resulting in the above mentioned invitation to take part in a focal group on drainage development.

Union Councils: With the implementation of a devolution policy in 2001, union councils have become the basic tier of local government responsible for infrastructure development and management within their jurisdictions. In Karachi, UCs have very limited technical personnel/support and information about their newly created governance areas. To support the newly elected local mayors, OPP has developed -the UC Plan books described in Section 3.5. Some mayors have used the mapping and statistical information in order to make decisions about infrastructure projects in their areas. Mr Shakeel

Ahmed, ex-mayor of UC 6 in Orangi, for example, found that the UC Plan book was “his other pair of eyes” in planning coherently for his area. Although he knew the problems in his UC, he did not know how to resolve them because he was not a technician. The UC plan book helped him to understand the existing water supply and sewerage system and to set priorities accordingly (Interviews). However, other problems, such as illegal connections to water mains, prevented his work from bearing fruits in the beginning.

Not all mayors are genuinely committed to serving their communities and therefore do not make use of UC Plan Books. OPP is currently taking a “wait-and-see” approach, supporting only those mayors that show an interest.

The development of a national sanitation policy: An important demonstration of OPP-RTI’s subtle influence on sanitation policies in Pakistan is the current formulation of a national sanitation policy. The Government of Pakistan appointed Arif Hasan (Chairman of OPP-RTI and URC) as the national consultant to draft the document. The revised draft, which has been published by the Ministry of the Environment in March 2006, relies heavily on OPP’s model for implementing sanitation (MoE, 2006). This includes mapping as a fundamental step before any intervention, and the sharing of internal and external infrastructure development between citizens and the government. While this does not mean that the OPP model will automatically be adhered to in the future, this is an important step to further strengthen the influence of OPP-RTI’s approach to sustainable sanitation development.

4.3 Policy repercussions in summary

The different uses of OPP-RTI’s mapping information have had profound policy repercussions. Hasan (2005a) summarises them in the following four concise points. (1) Documenting of katchi abadis brought people’s involvement and investment in sanitation development to the fore. As a result, planning agencies and local government respond to the need to support the people’s efforts rather than duplicating them. (2) People have acquired skills and knowledge that allow them to engage in a more equitable relationship with government agencies, to improve their settlements and to build local institutions. (3) The documentation of infrastructure provides the foundations for bringing into question government and IFI planning policies and development projects, and for promoting viable alternatives based on a sound knowledge of ground realities. (4) Through the extensive documentation of sanitation infrastructure throughout Karachi, OPP-RTI’s concepts have been reinforced by statistics and maps. This has increased OPP-RTI’s standing and credibility over the period of 25 years. Today OPP-RTI’s guidance on sewerage and katchi abadi upgrading is sought after at the national, provincial, city and community level.

5 Replication of OPP-RTI's component sharing model

The OPP-RTI sanitation model has been replicated by many CBOs and NGOs inside and outside Karachi, as well as by various donor and government programmes in Karachi and throughout the country.[17] Not all attempts have been successful, and OPP-RTI has learned a number of lessons concerning which factors are likely to lead to successful replication. This chapter will summarise OPP-RTI's own lessons with CBOs and NGOs, in particular, and explore one concrete example of a successful replication, the experience of ASB in Faisalabad.

5.1 Factors for successful replication

OPP-RTI continuously assesses its activities and experiences. Lessons for successfully passing on its own experience to other CBOs/NGOs are no exception to this. The main factors for success laid out below are derived from Hasan (2000), OPP (2005) and from interviews. In general, it is important to remember that the replication of OPP-RTI's approach to mapping implies taking on OPP's wider philosophy of development outlined in section 3.

Supporting organisations with local roots: For any organisation that wants to take on OPP-RTI's sanitation model, it is important for it to have close relationships with the community it aims to serve, as well as an ability to establish dialogue with local government. Therefore, OPP-RTI has seen most successes with neighbourhood-based organisations, initiatives and activists that want to bring about changes to their areas and have already an experience in dealing with local government bureaucrats and politicians.

Building a team with social organisation and technical skills: It is important to develop social organisation, technical mapping, construction supervision and accounting skills within the team that approaches OPP-RTI. Hiring a technically skilled person has led to high turn-over in staff with the organisation repeatedly having to start from scratch again. A crucial skill that the organisation needs to develop in-house over time is the preparation of maps. In this sense OPP-RTI has also found it important to match the technology used with the skills of the people employed.

Allowing for institutionalisation based on a continuous engagement with OPP-RTI: The process of developing a programme based on OPP-RTI's component-sharing model can be cumbersome, and requires patience and the commitment to a long-term engagement by any CBO/NGO. During this process, it is important that the organisation regularly documents and reviews progress, assesses weaknesses and how to overcome them. OPP-RTI can best support the organisation in this process if it stays in close contact with OPP-RTI for advice and training on accounting, reporting, research and monitoring.

[17] CBOs and NGOs replicating OPP-RTI's water and sanitation model, generally receive financial support for their administration and overhead costs from WaterAid.

Transparency in account keeping and resistance to large donor funding: Over the years, OPP-RTI has seen a number of NGOs collapse after the acceptance of substantial donor funding at a stage when the organisation is still immature. On a similar line, transparency in account keeping has proven to be a major factor for trust in the organisation. Once the organisation loses the trust of the community it intends to serve, it becomes difficult to re-establish again.

Dealing with the conditions of the sewerage systems in place: When OPP-RTI started sanitation mapping in Orangi Town, the conditions of the existing sewerage systems were such that new lines could easily be connected to the existing main sewers. In other towns, though, this is not always the case. Where disposal points for sewage are not available through natural drains or existing sewers, "external" development by the government needs to precede "internal" development. This is a more difficult task since it requires negotiation with the local government before commencing work with communities.

Based on the experiences described above, OPP-RTI has developed a process for any CBO/NGO that approaches the project. Its main steps are outlined in Box 4 below.

Box 4: The process of facilitating replication

OPP-RTI has, over time, developed a strategy to guide those CBOs and NGOs outside Karachi that wish to replicate its model. The following steps form part of this process, which takes at least two to three years in OPP-RTI's experience.

- CBO/NGO or community activists contact OPP-RTI for replication and are invited to OPP-RTI offices or to one of the partners for orientation.
- CBO/NGO/activists convince their communities to adopt the programme. If the mobilisation is successful, they create a team including a social organiser and a technical person to be trained at OPP-RTI and/or on site through OPP-RTI staff.
- This training consists of the different mapping steps outlined in 3.4, as well as construction supervision, documentation and accounting. It continues throughout the existence of the project and an extensive period of regular exchanges goes on at least during the first two to three years.
- OPP-RTI provides financial support to the team through WaterAid. This support may grow gradually but is initially very modest so as to allow the organisation to develop at its own pace without being influenced by large inflows of funds in the beginning.

Sources: Hasan, 2005;, Interviews

An example of an NGO replicating OPP-RTI's model is given below. It demonstrates that any replication is not so much a mechanical duplication of OPP-RTI's model but rather a process of internalising OPP's approach to development, with the necessary adaptations to its individual situation.

5.2 ASB as an example of successful replication

Anjuman Samaji Behbood (ASB) is a community-based organisation that is situated in Dhuddiwala, formerly an agricultural village and now part of Faisalabad. ASB's history is closely linked to Mr Nazeer Ahmed Wattoo, one of the founding members of the organisation. Mr Wattoo set up ASB with a few like-minded people in the late 1960s in order to improve the conditions in his community. Yet, over the years, the organisations' activities became entangled with local political affairs and its development activities remained ineffective. By the 1980s, ASB had lost the trust of the community (Alimuddin 2000; Interviews).

Getting to know OPP: In 1987, Mr Wattoo got to know the Orangi Pilot Project. Initially, he was disappointed because OPP's approach did not match his expectation that OPP would provide him with funding for sanitation projects. Yet, OPP's approach intrigued him and, so, Mr. Wattoo continued to visit OPP-RTI's offices as well as people in Orangi, who had successfully implemented their own sanitation systems. All in all, it took Mr. Wattoo seven years of numerous discussions from first getting to know OPP-RTI to finally being convinced of its approach. In 1993, a technical advisor from WaterAid, together with the OPP principal consultant, travelled to Faisalabad to review the infrastructure situation and discuss prospects for establishing a water and sanitation pilot project with ASB.

Implementing OPP's model: Starting from 1994, Mr. Wattoo underwent formal training with OPP. After consulting with a social activist from OPP, he initiated a small credit programme in his neighbourhood. The credit programme acted as a means to build trust between ASB and the community on the one hand and between ASB and OPP on the other. As the credit programme became more promising and demand increased, ASB decided to launch a water, as well as a sanitation programme. Despite various difficulties during the process, such as internal conflicts in the water committee and temporary loss of interest by community members, the project took off and became very successful.[18]

One important aspect for ASB's success was that it modified OPP-RTI's model. For example, when the morale got low during the laying of the first sanitation lines, ASB decided to provide the lane with credit to speed up work.

[18] Since 1996, 1000 houses have been able to connect to water mains through the support of ASB. Under the sanitation programme, 10,000 households have been able to lay their own sewerage connections so far and work has been extended to 70 other settlements in Faisalabad (OPP, 2005).

With the help of the credit, lane members were able to finish the work and the first connection to the main sewer line was successfully made. This encouraged other members of the community to come forward with their applications. Another important aspect for ASB's success is Mr. Wattoo's personality and long experience in engaging with communities and local politicians. In addition, Mr. Wattoo has taken his time to get to know OPP's approach to development and has changed his attitude towards money as a source for development. He has rejected a number of funding proposals, which would have made him more dependent on outside funds and personnel through a substantial increase in staff and work.

Since 2002, ASB has been supporting the Tehsil Municipal Administration (TMA) of Jaranwala, situated 20 km outside Faisalabad, in applying GIS mapping in order to improve tehsil-wide planning processes. The process and methodology, as well as some early lessons from this experience, are summarised in Box 5 below.

Box 5: ASB and GIS-based mapping in Jaranwala

Jaranwala is a Tehsil Municipal Administration (TMA) outside Faisalabad with a population of 1.34 million. The TMA undertakes innovative approaches to improve planning and implementation of service delivery including the use of GIS and satellite images. These innovations are being piloted in close cooperation with ASB and are technically and financially supported by DFID.

In 2001, ASB and TMA Jaranwala undertook a joint visit to WWF in Lahore for a demonstration of GIS-based mapping for spatial planning. Based on their visit, they decided to trial the use of GIS and satellite images for planning and implementation of service delivery in five out of the 57 UCs in Jaranwala. The overall purpose was to improve efficiency in delivering services but also to make the process more transparent and sustainable.

The methodology that ASB and Jaranwala TMA are currently trialling combines a number of different tools. 'Walking maps' and satellite images serve to create a baseline map displaying streets, houses and major services. These are then complemented by various layers of information provided by GIS (technical specifications of the water-, sewerage-, drainage-, telecommunications- and gas systems) and by a household survey for socio-economic information.

According to the TMA officer, the GIS-based mapping system has been very useful for the administration because it helped them to deal with service delivery in a more strategic manner and is likely to generate additional income. For example, triangulating mapping and household survey

information revealed that 50% of all surveyed water connections were illegal. They are now being disconnected and a registration process has been introduced.

However, the TMA also experiences a number of challenges. Most importantly, the administration finds it difficult to retain technically qualified staff. Out of the six persons trained on GIS, four have left the administration for more lucrative job opportunities. Apart from that, TMA core staff also find it difficult to promote the new tool among staff in the wider administration. Whether more expertise can be built up in-house or with ASB will be crucial for the future sustainability of GIS-mapping technology in Jaranwala.

Sources: Batley et al, 2004; TMA presentation, March 2006; Interviews

6 Lessons from OPP-RTI's approach to mapping

As described in section 4, OPP-RTI's mapping documentation is being used by community activists, CBOs and NGOs, mayors and government agencies alike. The documentation of existing infrastructure has led to significant policy repercussions including the government's withdrawal from IFI-funded sanitation infrastructure projects in Karachi. Most impressively, OPP-RTI has, at least in some cases and increasingly so, managed to change people's mindsets about development and the informal institutions governing these processes until then. It has been instrumental in making apparent the reality on the ground – in this case the existing infrastructure created by people's efforts – and in building on this existing reality rather than ignoring it. Through its development proposals, OPP-RTI has not only managed to get this alternative reality accepted by all major government agencies, but has also been able to considerably improve the process of development. Based on OPP-RTI's proposals, corruption is reduced and through a process of continuous monitoring of works through CBOs, sub-standard construction is diminished. In a mega-city counting approximately 13 million inhabitants in 2006, this is a considerable achievement. The changes brought about by OPP-RTI's mapping are well summarised in the phrase used recently by a high ranking government official in Karachi that "a map is for a planner what an x-ray is for a doctor" (Interviews).

There are a number of reasons that explain OPP-RTI's success in sanitation mapping, which can serve as lessons for other organisations wishing to replicate its model. The factors leading to OPP-RTI's achievements will be discussed under the three aspects of the production of evidence, the links and relationships between different stakeholders and the impact of the wider policy context.

6.1 Evidence

The production of evidence is a basic ingredient to change a policy process. For evidence to be taken up, it must be trustworthy, readily understandable and easy to produce by those who intend to use it. The following examples

highlight some factors that have made OPP-RTI's mapping process very successful.

Technology compatible with capacities: The technical inputs used by OPP for mapping are low-cost and low-tech. They therefore stand in a direct relationship with the skills available in the settlements where the organisation works. Anybody can acquire OPP-RTI's mapping methodology without having to invest in high start-up costs. OPP-RTI's model of training young people from informal settlements in mapping increases the ties between OPP and the neighbourhood it works in. In addition, it opens up new opportunities for those young people who have been trained by OPP-RTI. The organisation is very cautious when it comes to introducing new methodologies but does not close its eyes to new developments. The recent introduction of satellite images, which considerably shortens and simplifies the mapping process, is an example of this.

Who creates maps, matters: In Karachi, various government agencies have produced maps showing sanitation infrastructure. Yet, maps produced by KWSB for the Korangi Waste Water Management Project in the 1990s only showed the infrastructure put in place by KWSB. Infrastructure put in place by local people and other agencies, in contrast, was completely ignored. This means that 'who maps, matters'. A map will always reflect the concern of the mapping agent. OPP-RTI, therefore, produces all its maps in-house and has introduced a thorough process of cross-checking all information documented to ensure that mapping information is accurate and comprehensive.

Time and consistency is important: OPP-RTI has gained trust and strength through a coherent approach that it has continued to promote for over 25 years. The internal-external component sharing model itself has taken on an internal dynamic where the people that OPP mobilised have become promoters of OPP's approach. This started with the conviction of local masons, and community leaders who realised that OPP's approach brought them additional income and political influence.

Through mapping, OPP-RTI brought people's efforts in their own services to the surface. Through its technical advice, it helped to expand these services, which it then documented again. Over time, this alternative reality has grown immensely. In Karachi alone, 60% of all informal settlements and all major drains and natural channels have been documented. Now, OPP-RTI's documentation has increased so much that it cannot be overlooked any more. In addition, it has become much easier for OPP-RTI to reach government officials over in recent years. This development has been facilitated by the fact that a number of engineers, who have been working with OPP-RTI for more than 15 years, have now been promoted to high ranking positions in government. They promote OPP-RTI's strategies without the organisation itself having to be involved. This fact illustrates OPP-RTI's success of its long term commitment to improving the quality of planning processes.

Continuous and thorough documentation: Apart from its extensive map production, OPP-RTI has, since its foundation, consciously engaged with the process of its development. In thorough quarterly reports, OPP has documented all its steps, reflections, failures and achievements of over 25 years of its existence. These reports provide a rich source of information about the entire process surrounding the component model, including mapping. In addition, OPP-RTI and others have published numerous reports dealing with different aspects of OPP-RTI's approach and people's engagement in their development. This documentation has not only contributed to the popularisation of its approach but also been a source of pride and inspiration for those people whose actions have been documented by OPP-RTI.

6.2 Links

Communicating evidence to target audiences and stakeholders is another important element for changing policy processes. Established practices are generally supported by special interests and changing them involves attacking existing preferences. Thus, communicating evidence effectively, and creating networks of support for new practices, is crucial in this process. OPP-RTI has been very effective in doing so.

Building up support networks: In the beginning of its engagement in sanitation, OPP mainly collaborated with engineers working in Orangi settlements. With the two main government agencies responsible for sanitation, KWSB and CDGK, it first established contact with the sewerage and drain maintenance wings. Personnel in these departments were confronted with the same shortcomings of the existing infrastructure as the people living in katchi abadis and were therefore more ready to listen. In addition, OPP-RTI also built up its own support networks from among CBOs and NGOs working on similar issues. It was, for example, instrumental in establishing the Urban Resource Centre, a watchdog institution that investigates and provides information on city-wide issues ranging from sanitation to transport and the defence of public spaces.[19] The URC was thus consciously established by OPP-RTI in order to address a wider audience at the city-wide and international level. For specific campaigns, such as the protest against the Karachi Circular Railway described in 4.1, a new forum was established. In this case, the intention was to voice protest, while avoiding any direct reference to the URC or OPP-RTI in this potentially risky situation. The Community Development Network, in turn, which is made up of OPP-RTI's partner organisations, serves to exchange experiences and to create a public space for those CBOs and NGOs supported by OPP-RTI.

Using multiple channels for communicating information: OPP uses a variety of communication channels in order to promote its messages. Apart from using different networks as platforms for its messages and upholding direct contacts with government officers, OPP-RTI also makes effective use of

[19] http://www.urckarachi.org/home.htm

the local and national media. OPP's chairman and befriended journalists regularly publish opinion pieces revealing shortcomings of infrastructure projects etc in major national newspapers.[20] In addition, the director and chairman of OPP promote OPP-RTI's approach through their university teachings and academic publications. Furthermore, OPP-RTI's director is regularly invited to present at the School for Public Administration where all government employees are trained. OPP-RTI also receives delegations of government representatives, NGOs, academia and donors from all over and beyond Pakistan. Through its ties with NGOs and academia abroad, OPP-RTI's approach has become well-known internationally.

Employing different means of communication: OPP-RTI is very conscious of the importance of presenting evidence effectively in order to make it understandable and accessible for different audiences. In the case of the campaign against the Karachi Circular Railway, for example, a pamphlet was designed, which combined pictures and mapping information with a map and figures depicting the various distances to the railway tracks.[21] A short video was also produced, with additional background information.

In order to communicate with community activists, OPP-RTI produces information leaflets and posters as well as holding meetings; it reaches out to government officials and professionals through presentations at their own training institutions and through university teaching, various publications and maps; the wider public is engaged through video production, pamphlets and newspaper articles; and in academic circles, articles and books reflecting on OPP's approach, as well as teachings, spur discussions.

6.3 Context

The wider political context greatly impacts on how readily new evidence is adopted. Some policy processes are defined as more 'closed' than others, thereby making it difficult for new evidence to be taken up. In the case of sanitation mapping, for example, the informal institutions surrounding the distribution of land and services in informal settlements serves important personal interests, and is therefore difficult to reform. This is why, in the case of the Karachi Circular Railway campaign, where the interests of so-called land-grabbers are involved, a fictitious name was chosen rather than a direct reference to established organisations such as URC or OPP.

Ability to adapt to changes: The latest local elections in Karachi, which form part of the official devolution policy in Pakistan, have brought militant groups into power in many informal settlements of Karachi. Since their election, mayors supported by these groups have strongly discouraged any independent interventions by CBOs and NGOs in their jurisdictions, which has considerably closed the political space where OPP-RTI is operating. Yet, OPP-RTI is able to take on a wait-and-see approach since it is not pressured

[20] See for example: Daily Dawn (19 February 2006): IFI Loans and the Failures of Urban Development. by Arif Hasan
[21] See also Annex 1

by short-term advocacy objectives. Furthermore, its function as a resource centre, and well established contacts, lead to UC mayors continuing to approach OPP for support.

6.4 OPP-RTI's approach to development

In addition to the above mentioned factors for OPP-RTI's success story, there are some aspects that differentiate OPP from many other development organisations.

First of all, OPP's approach of seeing, observing, learning and teaching differs fundamentally from the approach followed by the typical development organisation. OPP-RTI acts effectively as a resource centre and does not provide funding for development. This function puts it in an ideal situation for producing and providing mapping evidence. Because mapping is OPP-RTI's core activity, which is financed through core funding, updating information is not a problem for the organisation. OPP-RTI sees mapping as a long-term activity and has accordingly invested in human resources to uphold it.

Secondly, OPP-RTI's success is closely linked to the people working at the organisation. Most persons employed by OPP have never left the organisation, thereby accumulating an impressive wealth of information and skills, as well as contacts over the course of 25 years. This continuity is not typical for most posts in development and hints at the other characteristic defining OPP – namely its spirit. This spirit is based on the vision of its founder, Akhtar Hameed Khan, of development as a process of self-help, and his commitment to transparency and accountability towards the people. This spirit is being upheld among the staff at OPP, whose motivation to work is inspired by engaging with people in genuine development processes.

Last but not least, the process of continuous and self-critical engagement with its own work is a unique characteristic of OPP. Every week, the organisation holds a meeting reflecting on and reviewing its activities. Quarterly reports and other exercises further help the staff to continuously question and re-orient its practices so as to correct its path.

7 References

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Abdul Majid	Director, Water, WASA Faisalabad
Abdul Waheed Khan	Director, Bright Education Society
Amin Iqbal Sheikh	IT, TMA Jaranwala
Arif Hasan	Chairman, OPP and Chairman, URC
Ashraf Hussein	Mapper, OPP-RTI
Ashraf Sajar	Organiser of fellowship programme, OPP-RTI
Asim Lateef	IT assistant, TMA Jaranwala
Haji Auranjzed Khan Niazi	Nazim, Union Council 9, SITE Town, Karachi
Jumeid Khan	Assitant, mapping unit, OPP-RTI
Khaja Mahboob Elihi	Director, Planning and Design, WASA Faisalabad
Malik Maroof Khan	Mayor, UC 42, Jaranwala
Mirzamuhammad Ramzan	Strategic Policy Unit, DFID/TMA Faisalabad
Mohammad Iqbal	District Officer, Social Welfare, DG Faisalabad
Muhammad Shamsuddin	Community Activist, Ghaziabad, Karachi
Muhammad Yawaid Khan	Consultant, KWSB
Muhammad Younus	Director, URC
Nazir Wattoo	Director, ASB
Perween Rahman	Director, OPP-RTI
Rasheed Mughal	District Officer 1, Works and Services, CDGK
Saeed Anwar	Town Municipal Officer, Jaranwala
Salim Alimuddin	Joint Director, OPP-RTI
Shahed Hussein	District Officer 2, Works and Services, CDGK
Shahid Saleem	Deputy Managing Director, KWSB
Shakeel Ahmed	Former Nazim, UC 6, Orangi Town, Karachi
Sirath Sirajuddin	Director, TTRC
Syed Muhammad Taha	District Officer 2, Works and Services, CDGK
Tasneem Ahmed Siddiqui	Former Director General of SKAA

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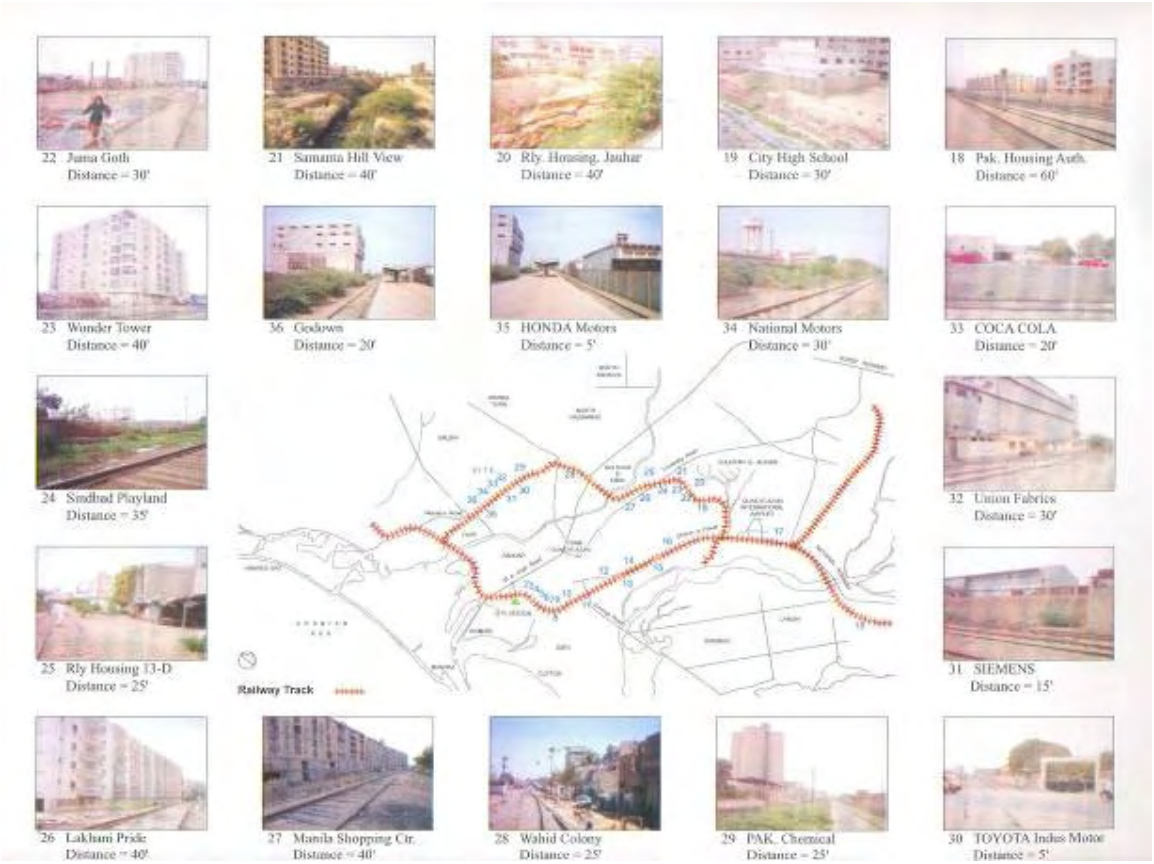
Annex 1: The Karachi Circular Railway



Annex 2: ASB's experience with GIS-based mapping in Jaranwala

Jaranwala is a town of 1.34 million inhabitants just outside Faisalabad (Batley et al, undated). After a successful replication of the OPP-RTI component sharing development model at Faisalabad, the Tehsil Municipal Administration (TMA) of Jaranwala requested for ASB's help in its planning of water and sanitation facilities (ASB and EDC, 2004; TUGI, 2004). ASB suggested to apply a city-wide mapping of sanitation works so as to develop a cost-effective sanitation system, improve the governments priority setting, and inform the TMA on how to improve the use of its human and financial resources (ASB, undated).The primary infrastructure would be constructed by the municipality, whereas the tertiary works would be the residents' responsibility.

The main aims of ASB within Jaranwala were as follows (Wattoo, undated)**:**

- To improve the access of the slum poor on a sustainable basis and provide them a better standard of living;
- To increase income levels through skilled training and the provision of credit;
- To bring about positive social change using participatory approaches; and
- To mobilise financial and human resources for development.

ASB's approach was to (Wattoo, undated):

- Work closely with Tehsil Municipal Administration Sahiwal (TMAS) and local communities so as to implement local development work;
- Provide advice on mapping, surveying and documentation work regarding the improvement of sanitation across Jaranwala city;
- Provide demonstrations and training to TMA staff, local NGOs, Community Based Organisations (CBOs), and Citizen Community Boards (CCBs) to create both community organisation and resource mobilisation around the internal development of tertiary and secondary sewage lines;
- Regularly monitor, document and report the progress of work at the community level; and
- Keep a close liaison with TMAS for planning, implementation and the review of project activities.

ASB' collaboration with Jaranwala TMA

ASB produced a GIS-based master plan in collaboration with the TMA. The TMA then spread awareness about this new initiative which in turn led to community cooperation. This was shown when the local citizens helped the infrastructure mapping team in identifying underground pipelines, and local residents remained cooperative during the street/house number demarcation and house hold surveys (ASB, undated).

Under the master plan, the primary infrastructure was constructed by the municipality; whereas all the tertiary works were the residents' responsibility. Therefore, ASB encouraged the neighbourhoods across Jaranwala to

construct their own tertiary and secondary sanitation works and link them to the municipal primary works, in order to decrease the over-reliance on the government to undertake these basic services (ASB, undated).

ASB's application of GIS

In December 2002, ASB organised a brainstorming workshop on the Jaranwala Sanitation Project (ASB, undated). The objective of this workshop was to establish the views of all the stakeholders involved, in order to incorporate their suggestions in the project formulation and implementation strategy. It was found that the need for a good quality base map of the town was pivotal for the planning and monitoring of activities. However, the previous aerial maps of Pakistan had been produced in 1969 (ASB, 2003), therefore there were no up-to-date maps showing existing physical and social infrastructure.

The ASB presented satellite image-based GIS mapping as a solution to this problem. The extended objective of the study was not only to provide a base map of the town but also to develop a comprehensive GIS-based inventory of existing infrastructure including underground and surface installation with their allied information. 70-80% of all the information required for local government operations could be depicted on a digital map (ASB, undated).

What has been achieved?

Through using a GIS system, various layers of physical and social infrastructure can be mapped and updated. Within Jaranwala, a GIS-based approach was used to digitally map and document existing infrastructure: showing the roads and streets, both with their names, numbers, widths, lengths and levels; as well as information regarding each household (ASB, undated).

ASB also helped establish a GIS lab at the TMA Jaranwala. Hardware had to be acquired and GIS software was installed on the system. This was done with the assistance of another technical assistance project at Jaranwala supported by a bilateral donor organisation. One weeks training was given to five people with different though valuable skills: three people from the computer department; a Tehsil infrastructure officer and a Tehsil planning officer (ASB, undated). The training was conducted on the real data sets with exercises set to update existing information collected by the ASB and TMA staff.

The GIS lab has had a variety of beneficial uses including better management of assets, strategic planning of infrastructure development, reduced survey and design costs, and the reduction of corrupt practices (ASB and EDC, 2004). An example of the GIS being useful is that easily accessible information concerning existing facilities helps to avoid the unnecessary complications of roads being dug up to lay sewage lines or the rupturing of existing lines due to intrusion by other infrastructural activities. Also, the GIS is able to generate calculations of the shortest route from one point to another which minimises the distance that has to be covered when laying pipes for water or sewage whilst constructing the roads according to ASB(CIDA-DSP, undated).

A substantial advantage of using GIS mapping within Jaranwala, is that it has allowed for the creation of city-wide planning as well as the integration of many different sectors, due to all the information being stored digitally. The electronic storing of maps also means that the updating of them is a lot easier compared to hand-written maps.

WaterAid's mission is to overcome poverty by enabling the world's poorest people to gain access to safe water, sanitation and hygiene education.

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