The Role of Social Capital and Further Assets for Collective Action and User Participation to Solve Water Resource Problems in Megacities

Results of a household survey on water use in Hyderabad

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Many large cities around the world face huge challenges of water scarcity. In the South-Indian emerging megacity Hyderabad, uncontrolled population growth and negative effects of climate change add to the existing water crisis. While the upper middle class, farmers around the city, and industries consume a lot of water, slum residents are left behind with inadequate water supplies. As successful cases from slums in other developing countries show, neighborhood organizations can help to improve upon the status quo of water service provision. The degree of collective organization in Hyderabad's slums is low, however. This paper hypothesizes that differences in assets are responsible for this gap. From a stratified survey of 500 households in Hyderabad we describe differences in endowments across neighborhoods and analyze the way in which assets in general and social capital in particular affect the willingness to address water-related problems collectively. We find that this willingness strongly depends on location – i.e. city zone and type of neighborhood –, having experienced water quality problems, and norm following. In slum neighborhoods also the level of education positively impacts the willingness to organize with one's neighbors. From these findings we conclude that endowments with social capital and other assets cannot satisfactorily explain the lack of organization. Further research should be directed towards the strong geographical differences in the willingness to organize.

Hyderabad; India; Slums; Social Capital; Urban Water Provision

1. INTRODUCTION

Worldwide, cities are growing and relative to rural areas are becoming more important as a living space. Asia is one hotspot of the world's urban growth and the majority of the world's urban population – a total of 1.6 billion people in 2005 – is living in Asia (Baud and de Wit 2008: 1). India plays a pivotal role in Asia's urban growth. Even though the general population growth in India is declining, the urban growth rate is still increasing due to migration from rural areas to cities (Pinto 2000: 8). Today only one third of the Indian population is living in urban areas. However, the population in Indian cities will increase from now 300 million to 800 million by the year 2045 and will then have a higher population than the whole of Europe. The

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number of megacities – cities with a population of more than ten million – will double. The current megacities Calcutta, Mumbai and Delhi will be joined by Chennai, Bangalore, and Hyderabad (Dhar Chakrabarti 2001: 260ff.).
The problems arising from rapid and often uncontrolled urban growth are manifold. In Hyderabad and other Indian cities, administrations are confronted with an ever increasing demand for land, goods, services and infrastructure, resulting in uncontrolled externalities of all kind. Changing lifestyles, resulting for example in the increasing use of cars, add to these problems. For many public infrastructures and the environment, climate change leads to the worsening of existing problems. One particular problem of many Indian cities is the low availability of water resources. In Hyderabad, for instance, the average daily available water quantities of about 58 liters do not meet the recommended 100 liters per capita and day (Huchon and Tricot 2008: 41). Seasonal and social differences leave some households with far less than the average, frequently resulting in a situation where "the choice faced by the less affluent members of society is often between drawing water from questionable sources or having none at all" (Dill 2010: 614).
One pressing problem of the water sector is the small degree of formal organization. In order to improve the status quo and achieve effective infrastructural planning and service delivery, entry points for participatory budgeting and planning on the neighborhood level are needed. Until now, the only functioning and wide-spread organizations in this regard are resident welfare associations (RWAs). These voluntary associations of single house's or apartment building's residents try to improve the living conditions of the neighborhood, e.g. by organizing trainings and addressing neighborhood problems such as water shortages by accumulating and channeling complaints towards water authorities and politicians. In Hyderabad, some RWAs are also involved into planning and budgeting of water infrastructures (Huchon and Tricot 2008). However, several RWAs seem to function like service agencies to whom residents pay charges and RWAs are almost exclusively a middle class phenomenon. The degree of formal organization in slum areas is much less developed. Representation in urban India is marked by a strong social divide and distinct and separated "policy circuits" for the rich and for the poor (Fernandes 2004; Benjamin and Bhuvaneshwari 2007). The poor are often excluded from access to basic services and they can exceed only little influence on the authorities by approaching their "community leaders" (Harriss 2005, 2007). Successful cases from other cities in developing countries, as for instance Dar-es-Salaam in Tanzania, however, show that collective action for securing water supply or road maintenance can work even in slum neighborhoods (Mhamba and Titus 2001; Dill 2010). While these approaches seem to work elsewhere, in mega-urban India success stories of collective engagements are observed predominately in the better-off neighborhoods (Huchon and Tricot 2008).
The paper analyzes the prospects for collective solutions to water-related problems across different neighborhoods. This research focuses on the individual pre-requisites for collective action strategies, particularly on the role of social capital compared to other assets, such as wealth or education. Additionally, the paper picks up the question of varying water-related distress levels and coping abilities along differently well-off neighborhoods in Hyderabad. We compare middle class and slum neighborhoods as living areas inhabited by distinct social classes.
The results from this study may help to address this question of neighborhood organization in the policy debate and to understand the low level of self-organization

among slum dwellers. If, for instance, existing network structures such as Self-help Groups would have a positive impact on preferences for participation, they could be used as entry points for organizing in the future.
The remainder of this paper is organized as follows. In the next section we will introduce the reader to some background on our case – Hyderabad – and its water resources. In section 3 we will discuss definitions of middle class and slum neighborhoods. Section 4 briefly reviews some of the important literature on social, capital, collective action, and the city. In sections 5 and 6 we present our model, survey design and data. Section 7 presents the results of the analysis and section 8 concludes.

2. HYDERABAD AND ITS WATER RESOURCES

The emerging megacity Hyderabad is the sixth largest urban agglomeration in India, with a population of 5.75 million in the year 2001. With a decadal growth rate of 50 percent from 1981 to 1991 and 27 percent from 1991 to 2001, it is one of the fastest growing cities in India and is rapidly moving towards the ten million megacity line (GHMC 2003). The city faces manifold problems with uncontrolled urban growth, such as heavy traffic jams, water scarcity, and frequent power cuts. Climate change will increasingly add to these problems.
Based on down-scaled IPCC data, Lüdeke et al. (2010) estimate different climate scenarios for Hyderabad. Most probably, the occurrence of heat waves and annual mean temperatures will increase. The estimates show a high standard deviation for aggregated yearly rainfalls with the means close to the current amounts. However, the intra-annual distribution of precipitation will most likely become much more volatile. With a high probability the number of days with heavy rainfalls may even double or triple (Lüdeke et al. 2010). Unless comprehensive action is taken by the civil society, policy makers, and citizens, all these phenomena would add to the existing environmental and infrastructure-related problems in Hyderabad, particularly to the sufficient provision of water services.
As can be seen from table 1, the city's authorities utilize ever more remote water sources and increasingly water has to be pumped into the city. The most recent Krishna project uses water from a distance of more than 100 km.

Table 1 Hyderabad's Water Withdrawals

Source	River	Year	Distance (km)	Installed Capacities (MGD)	Withdrawals (MGD)
Osmansagar	Musi	1920	15	27	18
Himayatsagar	Esi	1927	9.6	18	10
Manjira – Phase I & II	Manjira	1965 and 1981	58	45	45
Manjira – Phase III & VI	Manjira	1991 and 1994	80	75	75
Krishna Phase I	Krishna	2004-05	116	90	90
Krishna Phase	Krishna	2006-08	116	90	90

II

Source: HMWSSB, cited in Janetschek et al. 2009

Hyderabad's primary water source is a river, the Musi which is running through Hyderabad. It starts 90 km west of the city and then runs eastwards through Hyderabad for about 20 km. After the Musi leaves the town it joins the Krishna River. As illustrated by table 1, both rivers serve as an important source for water withdrawals to meet the city's water demands. Historically, there are also a lot of lakes and tanks (small ponds) in and around the city – with Himayat Sagar and Osman Sagar in the West of the city being the two biggest ones. With increasing urbanization, however, the number of these water bodies is steadily decreasing, the city's water demands are met by ever more remote water sources, water qualities are deteriorating and carrying capacities reduced, resulting in frequent supply gaps and an increase of floodings (Ramachandraiah and Prasad 2004; Ramachandraiah and Vedakumar 2007).
The water crisis is also reflected in the low service availability to citizens. Residents face inefficient and ineffective water services with frequent water shortages and insufficient sanitation infrastructures. The water sector is characterized by heavy overuse, poor demand-side management, poor infrastructures, and decision maker's preferences for unsustainable large-scale infrastructural programs. Often, piped water is available only a few hours per week. As can be seen from table 2, both in terms of available amounts per capita per day and average daily hours of water supply, Hyderabad is among the Indian cities with the lowest water available water quantities.

Table 2 Water Supply Duration and Amounts for Different Indian Cities

City	Supply in Hours per Day	Liters per Day per Person
Hyderabad	1	58
Delhi	3	100
Bangalore	6	135
Mysore	5	137
Calcutta	4	200

Source: Huchon and Tricot (2008:41), adapted

Presently, households react on this low availability by installing water tanks, utilizing ground water with bore wells, or calling in mobile water tankers. Service access, water availability, and coping mechanisms differ starkly across neighborhoods. Slum neighborhoods receive far less water and more frequently rely on public taps, water tankers, boreholes, and other insecure water sources. The average time spent for water fetching usually exceeds one hour per household and day (Rommel et al. 2010). On top of that, water-borne diseases are a frequent phenomenon and pose serious threats to public health in urban India. Due to limited knowledge and awareness, these problems are particularly prevalent among slum dwellers (Jalan and Somanathan 2008; Jalan et al. 2009).

3. ECONOMIC STRATA AND NEIGHBORHOODS

Middle class Indians have become a powerful player in Indian social and political life. This social group is located between "a small elite and a large impoverished mass group" (Sridharan 2004: 405). The combination of their economic power and size leads to their relatively strong societal influence (Mitra 2003: 646). The middle class' impact on the environment is steadily increasing due to changing consumption habits and living standards. Especially in urban areas this becomes increasingly observable (Mawdsley 2004: 81).

The identification and mobilization along class and neighborhood lines has for a long time not played a role in India, as other social categorizations such as caste, tribe, or ethnicity have been more important in the past (Mitra 2003: 646). Recently, these other categorizations have lost importance relative to class lines, however. Increasingly, social discourses and conflicts are carried along class lines and former categorizations such as caste become “de-ritualized” (Sheth 1999). In other words, in India “the quest today is not for registering higher ritual status; it is universally for wealth, political power, and modern (consumerist) lifestyles” (Sheth 1999: 2508). As it is the aim of this paper to compare slum and middle class households with respect to the way they organize to address water issues, it is important to define the underlying concepts of neighborhood and class. Apparently, there are several ways to define the terms middle class and slum and within each of these two categories we can find a large spectrum of different people. One common definition of middle class in India is based on a household expenditure or income level of more than Rs. 10,000 per month (Deshpande 2006: 220). If one looks at older income-based definitions – with households earning above 70,000 Rs. per year being the middle class –, it would consist of only 248 million people based on 1998/1999 data (Sridharan 2004: 414). This absolute figure may appear high, according to Deshpande (2006: 218), however, the Indian middle class still is a comparatively small group – even though rapidly growing (Beteille 2007; Reusswig et al. 2009). Another definitive approach uses occupation and employment status – with teachers, lawyers, doctors and bureaucrats being the typical representatives of the middle class (Mawdsley 2004: 86). The Delhi-based “Centre for the Study of Developing Societies” defines middle class along other criteria. Next to the self-perception of people, they use educational background (ten years of schooling or more), housing facility (brick and cement houses), occupational status (white-collar), and asset ownership (motorized vehicles, television, electric water pump) as indicators (Sridharan 2004). Recent research on urban lifestyle dynamics also points out that shared consumption patterns and the adaptation of consumerism are a common property of the Indian middle class (Mawdsley 2004, Reusswig et al. 2009: 27ff.). While these definitions of the middle class are not based on geographic location, for the less affluent classes we follow a geographical definition, i.e. being located in a slum. The range of settlements defined as slums is wide. Slums are normally characterized by a high population density, temporary housing structures, and inadequate sanitation and water services (UN-Habitat 2003). According to UN-Habitat (2003) a slum household is a group of individuals living under the same roof in an urban area that does not meet one or more of the following conditions: durable housing of a permanent nature that protects against extreme weather conditions (1), sufficient living space, defined as a maximum of three people sharing the same room (2), adequate access to drinking water (3), access to appropriate sanitation, either in the form of a private or public toilet (4), and a tenure status that prevents from uncontrolled spontaneous evictions (5). Not all settlements registered as slums by governmental agencies in India fit to this definition and not all settlements fitting to it are registered as slums (colloquially they are called squatter settlements).

For our empirical work we stratified our survey between slum and middle class neighborhoods, following a classification along the following criteria. We carefully identified slum neighborhoods based on the UN-Habitat definition, while middle class neighborhoods were defined one the basis of occupation (offices of lawyers and medical doctors), education (proximity of English schools), and infrastructure (super markets, shopping malls, permanent housing structures).

4. COLLECTIVE ACTION AND SOCIAL CAPITAL IN THE CITY

A collective action situation exists "[…] when a number of individuals have a common or collective interest—when they share a single purpose or objective—[and when] individual, unorganized action […] will either not be able to advance that common interest at all, or will not be able to advance that interest adequately" (Olson 1965: 7). From this definition it follows that collective action may mean anything from spontaneous actions and informal arrangements to formal organizations of people (Meinzen-Dick et al. 2002: 650). The academic literature on collective action for natural resource management is large and still growing.[4] Focusing either on collective action (e.g. Ostrom 2005; Ostrom and Ahn 2009) or on social capital (e.g. Putnam 1993 et al.; Putnam 1995; Putnam and Goss 2001), scholars emphasize the strong interrelation of these two variables. Networks of civic engagement advance trust and norms of reciprocity "facilitate coordination networks, facilitate coordination and communication, amplify reputations, and thus allow dilemmas of collective action to be resolved" (Putnam 1995: 67). Social capital may be a decisive factor for advancing collective action as it may reduce reciprocital uncertainty, incentives to defect, and transactions costs (Putnam 1993 et al.: 177; Putnam and Goss 2001: 21; Pretty and Ward 2001: 210; Baud and de Wit 2008: 17). Trust among actors enables collective action (Ostrom and Ahn 2009).

Putnam as the most recognized and at the same time perhaps the most criticized proponent of the social capital approach is following a collective perspective and advances a functionalist definition. His major thesis – social networks generate effects and "social networks have value" (Putnam 2000: 18) – make his approach appealing, as well as criticisable (Putnam and Goss 2001: 20; Field 2003: 29ff; Fine 2003). It is appealing as it is simple and comprehensible and is able to explain economic and political behavior and subsequent outcomes (Field 2003: 30; Putnam et al. 1993: 164; Putnam and Goss 2001: 21). It is criticisable as the simplicity of Putnam's argumentation is partly based on circular and tautological arguments (Field 2003: 36; Fine 2003; Haug 1997: 32).

Putnam sees social capital (trust, norms and networks) as "self-enforcing and cumulative" (Putnam 1993 et al.: 177), so that social capital increases with use and decreases with disuse. For our study, however, we follow the assumption that social capital is not generated deliberately but evolves as a by-product from other activities (Coleman 1988: 118; Coleman 1990; Putnam et al. 1993: 170). To avoid any circular argumentation this paper assumes causality running from social capital to collective action and not the other way round.

Urban areas are marked by some particularities with regard to social capital. Forrest and Kearns (2001), for instance, argue that individualism is increasingly replacing networks and alliances in urban areas. Growing social mobility may involve a decline

[4] For the foundations of this literature and some groundbreaking contributions see for example Wade (1988), Ostrom (1990), or Baland and Platteau (1996).

in social capital and civic engagement (Putnam 1995). Putnam underlines the meaning of neighborhood relations for communities' social capital and stresses simultaneously that civic engagement declines with growing social mobility (Putnam 1995: 73ff). Both factors are of high importance when looking at urban regions. Removal of alliances by individualism in cities is a highly contested issue (Forrest and Kearns 2001: 2125). For the USA, "a linear trend toward less socializing within the neighborhood and more outside it" is found (Guest and Wierzbicki 1999: 92). Those country-specific results are not transferable to the context of Indian cities but they evoke questions how neighborhood relations look like in urban India and which consequences they have for the ability of collective self-help. In India, for instance, formal associations have a weaker character relative to informal ones. Therefore, the importance of informal networks has to be considered when designing network survey questions for social capital research in India (Krishna 2002).
The multidimensionality of the concept impedes its operationalisation and for quantitative approaches complex research strategies have to be employed (Woolcock and Narayan 2000; Van Deth 2003).

5. METHOD

A simple logistic regression model was used to analyze the survey data. We assume that the expected utility from aligning with one's neighbors z_k depends on the *j* independent variables presented in table 7, so that:

$$z_k = \beta_o + \sum_{j=1}^{J} \beta_j \cdot x_{jk} + u_k \qquad (1)$$

where the x_{jk} denote the observed values of variable *j* from household *k*, u_k is an error term, and the j+1 betas are parameters to be estimated. As respondents could only answer the question in binary form, the observed value can either take the value 1 if the expected utility is positive or 0, if the expected utility is negative. This leads to the following formula:

$$y_k = \begin{cases} 1 & if \;\; z_k > 0 \\ 0 & if \;\; z_k \le 0 \end{cases} \qquad (2)$$

We suppose that the probability for the willingness to ally for household *k* can be estimated by a logistic function of the form:

$$p_k(y=1) = \frac{1}{1+e^{-z}} \qquad (3)$$

so that the probability for household *k* is given by:

$$p_k(y) = \left(\frac{1}{1+e^{-z_k}}\right)^{y_k} \cdot \left(1 - \frac{1}{1+e^{-z_k}}\right)^{1-y_k} \qquad (4)$$

The likelihood function then becomes

$$L = \prod_{k=1}^{K} \left(\frac{1}{1+e^{-z_k}}\right)^{y_k} \cdot \left(1 - \frac{1}{1+e^{-z_k}}\right)^{1-y_k} \qquad (5)$$

which by logarithmization can be transformed into the following log-likelihood function:

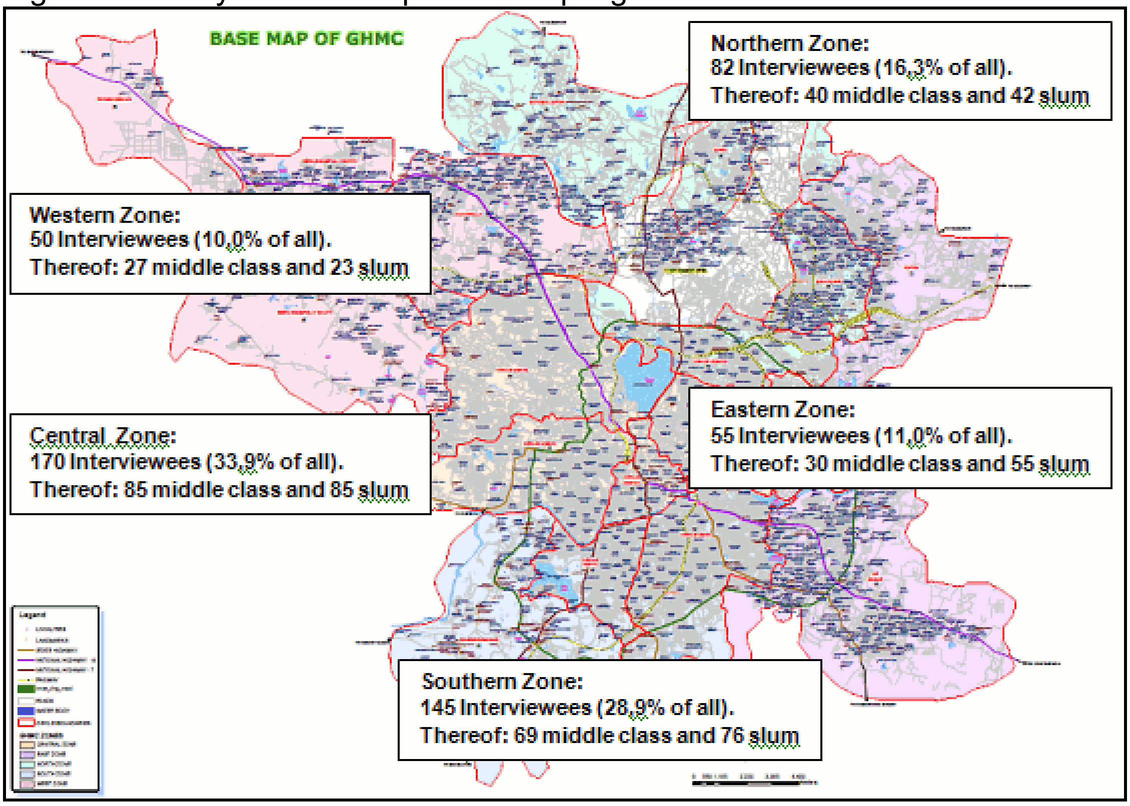
$$LL = \sum_{k=1}^{K} \left[y_k \cdot \ln\left(\frac{1}{1+e^{-z_k}} \right) \right] + \left[(1-y_k) \cdot \ln\left(1 - \frac{1}{1+e^{-z_k}} \right) \right] \qquad (6)$$

This function can easily be maximized by using the Newton-Raphson method with standard statistical software.

6. SURVEY DESIGN AND DATA

The general objective of the survey was to get an overview on water and sanitation services in urban Hyderabad. The specific objective was to elicit the willingness to organize with one's community. In this regard, respondents were asked whether they would be generally willing to organize with their neighbors and to contribute time or money for addressing water problems collectively. About one third of the respondents replied positively, the remaining two thirds answered with "No". Beside this, the 13-page long questionnaire contained general questions on the respondent and the household, utilized water sources, and water availability. The survey aimed at covering the whole city and was designed to compare slum and middle class neighborhoods.

Figure 1 Hyderabad Map with Sampling Stratification



A geographical stratification was employed for drawing the sample. Neighborhoods (wards) where randomly selected from a list of all Hyderabad neighborhoods (wards). These were then classified as either slum, middle class or upper class neighborhoods. The latter ones were dropped as they were not in the focus of the survey. On the neighborhood level, random numbers were attributed to the

neighborhoods in order to achieve a balanced number of 250 observations for each of the two neighborhoods types. Within neighborhoods simple random walk was used to approach households. The number of sampled households – disaggregated by zones and neighborhood types – is illustrated in figure 1.
Apparently, the sample design is not very advanced. In an extremely dynamic city such as Hyderabad, however, there are hardly other ways to conduct a household survey. The most recent available census data date back to 2001. In this situation, any census-based survey design would automatically be biased.

6.1 Operationalization of Social Capital

In our study we differentiate between four forms of social capital – namely trust, norms, formal networks, and informal networks. We operationalized these concepts with respective survey questions. The variable TRUST is a dummy variable taking the value 1 when the respondent replied positively to the general trust question typically used in social capital surveys, and the value 0 otherwise.[5] As stated above, following norms refers to assistance independent of direct rewards. Similar to TRUST the variable NORMS takes a value of 1 when the respondent replied positively to the respective question.[6] Formal networks refer to membership in organizations. People were asked whether they are members in neighborhood associations, self-help groups, cooperatives, political parties, sport clubs, professional associations, formalized religious groups and the like. The variable FORMAL NETWORKS takes the value 1 if the respondent stated membership in at least one of these mentioned organizations. The variable INFORMAL NETWORKS refers to joint activities with non-family community members. People could choose from the following five alternatives: “Looking after children”, “Celebrations and festivals”, “Puja/Prayers”, “Daily chats/Conversations”, “Grocery Shopping”, “Sports”. The variable states the number of shared activities.

6.2 Variable Description and Descriptive Statistics

In table 7 we describe the independent variables used in our regression.

Table 3 Description of the Independent Variables

Variable Name	Description
INCOME	Income in 1,000 Rupees
SEX	Sex (= 1 if male)
SLUM	=1 if located in slum
AGE	Age in years
EDUC	Education (ordinal, 1= no education, 2=some primary, 3=some secondary, 4= some college, 5=some post graduate, 6= post-graduate studies)
HHDHEAD	= 1 if Household head
ROOMS	Number of rooms
HHDSIZE	Number of household members

[5] Literally, it was asked „Generally speaking, would you say that most of your non-family members can be trusted or that you need to be very careful in dealing with neighbors?”.
[6] “If your non-family neighbor would run out of drinking water for a couple of days, and you would have sufficient but limited drinking water, would you offer him/her some water on your own initiative?”

HTYPE	Type of house (Kutscha=0, Pucca=1)
EAST	=1 if East
NORTH	=1 if North
SOUTH	=1 if South
WEST	=1 if West
WQUANT	Self-perceived water quantity (=1 if sufficient)
WQUAL	Self-perceived water quality (=1 if sufficient)
TRUST	Trust as described in section 6.1
NORMS	Norms as described in section 6.1
FORMAL NETW	Formal networks as described in section 6.1
INFORMAL NETW	Informal networks as described in section 6.1

We assume that the independent variables affect the willingness to ally with one's neighbor in the following way. Income and assets (here: type of house, number of rooms) are hypothesized to have a positive effect, as resources are important to exert influence in a collective action situation and may thus increase individual pay-offs from respective activities. In the same way education is assumed to have a positive effect. Being the household head may increase the willingness to ally as this may be perceived as a typical task of the head of the household. Age may shape expected pay-offs from engagement in different ways. A discount rate increasing with age, for instance, would exert a negative impact on the willingness to ally, as discounted pay-offs over time would be lower. On the other hand, elderly people may be more respected and their opinion may weigh more in a group. Here, we assume that the first effect is stronger. A respondent's sex may also effect expected pay-offs, for instance in the different way men or women can influence group discussions and subsequent decisions. City zone was added to control for geographical differences that cannot be captured by individual and household level information. Water supply or service accessibility may differ across city zones. The same logic is applied to the SLUM variable which is supposed to capture any individual/household level phenomena that are unobserved and follow from living in a slum. We also included two variables on the individual perception of the water situation. If water quality and quantity are not seen as a problem it is unlikely that the respondent is willing to something about it. The remaining four variables are related to social capital and were explained in sections 4 and 6.1. Table 8 presents summary statistics for the independent variables used in the regression.

Table 4 Summary Statistics for the Independent Variables

	Obs.	Mean	SD	Minimum	Maximum
INCOME	501	12.16	11.76	0.00	82.00
SEX	501	0.57	0.50	0.00	1.00
SLUM	501	0.50	0.50	0.00	1.00
AGE	498	36.45	11.57	18.00	84.00
EDUC	491	4.30	1.43	1.00	6.00
HHDHEAD	501	0.41	0.49	0.00	1.00
ROOMS	468	2.52	1.24	1.00	12.00
HHDSIZE	501	5.25	2.30	2.00	26.00
HTYPE	501	0.82	0.39	0.00	1.00

EAST	501	0.11	0.31	0.00	1.00
NORTH	501	0.16	0.37	0.00	1.00
SOUTH	501	0.29	0.45	0.00	1.00
WEST	501	0.10	0.30	0.00	1.00
WQUANT	501	0.20	0.40	0.00	1.00
WQUAL	501	0.35	0.48	0.00	1.00
TRUST	501	0.68	0.47	0.00	1.00
NORMS	501	0.83	0.38	0.00	1.00
FORMAL NETW	501	0.41	0.49	0.00	1.00
INFORMAL NETW	500	2.83	0.68	1.00	4.00

Own calculations

7. RESULTS

7.1 Descriptive Evidence

Based on our operationalisation, table 3 shows the average endowments of the different forms of social capital for slum and middle class neighborhoods. Except for trust, middle class households are on average endowed with a higher amount of social capital. These differences are statistically significant, however, only for trust and informal networks.

Table 5 Differences in Social Capital between Neighborhoods

Variable	Mean (SD) Sample	Mean (SD) Slum	Mean (SD) Middle Class	Z-Statistic	p-Value
TRUST	0.68 (0.47)	0.73 (0.45)	0.62 (0.49)	-2.512**	0.0120
NORMS	0.83 (0.38)	0.80 (0.40)	0.85 (0.36)	1.511	0.1307
FORMAL NETWORKS	0.41 (0.49)	0.38 (0.49)	0.43 (0.50)	1.219	0.2230
INFORMAL NETWORKS	2.83 (0.68)	2.75 (0.68)	2.92 (0.67)	2.852***	0.0043

Note: The asterisks *, **, and *** denote significance on the 10%, 5%, and 1% level for the Wilcoxon-Mann-Whitney Ranksum Test, respectively.

While trust is higher among slum dwellers, households in middle class neighborhoods are characterized by a significantly larger engagement in informal networks. As can be seen from table 4, differences in assets and income are much higher between neighborhoods. Middle class households have more income, more frequently own cars, less frequently own bicycles, and have much higher water tank capacities. Astonishingly, there are no statistically significant differences in the daily time spent for water fetching. On average, for both types of neighborhoods more than one hour per day is spent for organizing water. About a fifth of the whole sample owns a car. While more than a third of the middle class dwellers own a car, only 3% of the slum dwellers do so. The average household in middle class areas owns tanks with an overall capacity of more than 1,600 liters. The average slum dweller's tank has a capacity of about 500 liters. If cut off from network supply, a typical slum household with five members has the recommended 100 liters per person and day for only one day. From the slum population only about 60% have a water tank at all, while about 90% of the people living in middle class neighborhoods own such tanks. The average daily fetching time for water is more than one hour and astonishingly not statistically different between neighborhoods. Both, inhabitants of slum and inhabitants of middle class areas spend about 70 minutes per day for water fetching.

Table 6 Differences in Income, Assets, and Water Fetching times

Variable	Mean (SD) Sample	Mean (SD) Slum	Mean (SD) Middle Class	Z-Statistic	p-Value
Income in 1,000 Rs.	15.00 (11.31)	9.19 (6.13)	21.90 (12.16)	11.89***	0.0000
Car	0.20 (0.40)	0.03 (0.18)	0.38 (0.48)	9.38***	0.0000
Bicycle	0.21 (0.41)	0.25 (043)	0.17 (0.37)	-2.30**	0.0213
Tank Capacity in litres	1092.05 (1976.31)	514.11 (702.05)	1667.67 (2579.53)	9.87***	0.0000
Fetching Time in min/day	74.16 (74.04)	72.75 (65.60)	75.58 (81.72)	-0.560	0.5752

Note: The asterisks *, **, and *** denote significance on the 10%, 5%, and 1% level for the Wilcoxon-Mann-Whitney Ranksum Test, respectively.

In table 5 we present some summary statistics on the water availability disaggregated by neighbourhoods. The average water availability across neighbourhoods in the sample is less than two hours per day. With an average availability of less than ten hours per week, water availability is particularly low in summer time. We also find highly significant differences between neighbourhoods. In all seasons slum dwellers have significantly shorter times of available pipe supply.

Table 7 Comparison of Means for the Duration of Supply and Sufficiency of Supply

Variable	Mean (SD) Sample	Mean (SD) Slum	Mean (SD) Middle Class	Z-Statistic	p-Value
Hours Supply per Week Summer	9.28 (20.34)	5.48 (5.17)	12.92 (27.54)	6.984***	0.000
Hours Supply per Week Winter	12.64 (22.99)	7.74 (6.64)	17.35 (30.83)	7.254***	0.000
Hours Supply per Week Monsoon	12.54 (22.97)	7.74 (6.61)	17.17 (30.84)	7.185***	0.000
Self-reported Sufficiency	1.58 (.73)	1.35 (1.37)	1.80 (.56)	7.204***	0.000

Note: The asterisks *, **, and *** denote significance on the 10%, 5%, and 1% level for the Wilcoxon-Mann-Whitney Ranksum Test, respectively.

The table clearly shows that households in slum neighbourhoods have significantly less water available. However, even in middle class neighbourhoods the average daily water supply is less than two hours. Self-reported sufficiency (with zero representing the lowest and two representing the highest possible ranking) is much lower in slums than in middle class neighbourhoods. While the richer neighbourhoods are mostly satisfied with the status quo, slums on average state more problems. In table 6 we have summarized the ranks respondents attached to five options (five representing the highest urgency and one representing the lowest).

Table 8 Comparison of Means by Neighbourhood for the Reported Problems

Problem	Mean (SD) Sample	Mean (SD) Slum	Mean (SD) Middle Class	Z-Statistic	p-Value
Insufficient Water Supply	3.03 (1.51)	3.30 (1.54)	2.76 (1.42)	-4.076***	0.0000
Sewerage System	3.03 (1.19)	3.24 (1.24)	2.83 (1.10)	-3.941***	0.0001
High Number of Power Cuts	2.52 (1.14)	2.49 (1.10)	2.56 (1.19)	0.605	0.5454
Poor Health Status	3.63 (1.33)	3.35 (1.30)	3.92 (1.31)	5.193***	0.0000
Polluted Environment	2.77 (1.61)	2.61 (1.60)	2.93 (1.60)	2.220**	0.0264

Note: The asterisks *, **, and *** denote significant differences on the 10%, 5%, and 1% level for the Wilcoxon-Mann-Whitney Ranksum Test, respectively.

The major problem, faced by the sample's respondents is health. Health-related problems are ranked highest for both slum and middle class neighbourhoods. However, there is still some significant difference between the two neighbourhood categories, with the respondents from middle class neighbourhoods reporting a much higher urgency of health-related problems. The lowest ranked problem for respondents from both types of neighbourhoods is the high frequency of power cuts. In this case there are no significant differences between slum and middle class neighbourhoods. Insufficient water supply and problems with the sewerage system rank two and three in the most urgent problems. In both cases the problems are ranked higher in slum areas than in middle class areas. While water supply is ranked two in average in slum areas, sewerage is ranked at position two in average in middle class areas. Environmental problems and pollution are ranked at position four from respondents from both neighbourhoods, with middle class neighbourhoods ranking it a little higher in average (significant on the 5% level) than slum neighbourhoods.

7.2 Regression Results and Discussion

The following tables present the logistic regression estimates one the dependent variable for the slum sub-sample (table 9), the middle class sub-sample (table 10),

and the full sample (table 11).[7] We did this to test whether there are differences in the underlying mechanism between neighborhoods. The variable HTYPE was dropped in the four models of table 10, as there were no “Kutscha” houses in the middle class neighborhood.
To test the robustness of the results, we added variable blocks stepwise for each of the (sub-)samples. Only very few of the estimated coefficients are statistically different from zero consistently in all twelve models. Except for education and income there seem to be no differences of the determinants when comparing the divided sample between slum and middle class. While these two variables have a significant positive effect in the slum sub-sample, they are statistically zero in the middle class models.

Table 9 Logit Estimates for the Slum Sub-sample

	(1)	(2)	(3)	(4)
INCOME	0.0416	0.0813**	0.0470	0.0928***
	(0.0311)	(0.0318)	(0.0340)	(0.0355)
SEX	0.1350	0.3945	0.4677	0.7376
	(0.5050)	(0.5790)	(0.5513)	(0.5634)
AGE	-0.0298	-0.0047	-0.0169	0.0110
	(0.0193)	(0.0215)	(0.0194)	(0.0220)
EDUC	0.4070***	0.4743***	0.3343**	0.4230**
	(0.1444)	(0.1565)	(0.1549)	(0.1677)
HHDHEAD	0.5057	0.0999	0.1256	-0.3769
	(0.5051)	(0.5724)	(0.5529)	(0.5655)
ROOMS	-0.1645	0.0405	-0.0067	0.3669
	(0.2201)	(0.2336)	(0.2249)	(0.2529)
HHDSIZE	0.1656*	0.1056	0.1445	0.0961
	(0.0968)	(0.1169)	(0.0951)	(0.1077)
HTYPE	-0.2863	-0.3780	-0.1839	-0.3754
	(0.4195)	(0.4644)	(0.4226)	(0.5164)
EAST	-1.8291**	-3.8515***	-1.0991	-2.2218
	(0.8721)	(1.4623)	(1.1457)	(1.6659)
NORTH	-1.5910***	-1.8639***	-1.6542***	-2.0640***
	(0.6053)	(0.6835)	(0.5935)	(0.6816)
SOUTH	0.0718	-0.7588	-0.0990	-0.8971
	(0.3865)	(0.4795)	(0.4792)	(0.5717)
WEST	-3.1170**	-3.7017**	-3.6702**	-4.1603***
	(1.2703)	(1.4559)	(1.4476)	(1.5628)
WQUANT		0.6542		0.6154
		(0.5583)		(0.5077)

[7] For all calculations a simple logistic regression model with robust standard errors in STATA 10.1 was used. For each of the samples the significance of the ZONE dummies was tested. With non-robust standard errors the full model (4) was tested against the respective model without the ZONE variables. In all three cases the likelihood ratio test revealed that the ZONE dummies were jointly significant on the 1% level. All independent variables were tested for multicollinearity by calculating variance inflation factors in a linear regression. In none of the models the variance inflation factor exceeded 2.5. For some variables (especially education and rooms), there were missing observations. As it is possible that these observations are not missing randomly we tested for a selection bias. The alternative hypothesis of non-random missing observation can be rejected.

WQUAL		2.3007***		2.7154***
		(0.4612)		(0.5277)
TRUST			0.5858	0.2667
			(0.4538)	(0.5189)
NORMS			1.4381**	2.3935***
			(0.5636)	(0.7501)
FORMAL NETW			0.1055	-0.2443
			(0.4539)	(0.4924)
INFORMAL NETW			0.3428	0.4860
			(0.3445)	(0.3965)
Constant	-1.5165	-3.5808***	-4.6105***	-8.2601***
	(0.9859)	(1.2105)	(1.5990)	(2.2359)
N	222	222	222	222
pseudo R^2	0.228	0.347	0.262	0.399
Log lik.	-113.6214	-96.1329	-108.6213	-88.4322
Chi-squared	36.7721***	48.9734***	43.9122***	58.0552***

Robust Standard errors in parentheses
Own calculations
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10 Logit Estimates for the Middle Class Sub-sample

	(1)	(2)	(3)	(4)
INCOME	0.0002	-0.0011	-0.0115	-0.0123
	(0.0126)	(0.0132)	(0.0143)	(0.0152)
SEX	-0.3979	-0.5395	-0.6516	-0.7508
	(0.4390)	(0.4518)	(0.4743)	(0.4776)
AGE	0.0101	0.0205	0.0150	0.0241
	(0.0146)	(0.0153)	(0.0155)	(0.0160)
EDUC	-0.1168	-0.2197	-0.0554	-0.1631
	(0.1689)	(0.1971)	(0.1799)	(0.2042)
HHDHEAD	0.3415	0.5002	0.5987	0.7410
	(0.4518)	(0.4674)	(0.4905)	(0.4919)
ROOMS	0.1981	0.2024	0.3330*	0.3284*
	(0.1582)	(0.1608)	(0.1833)	(0.1813)
HHDSIZE	0.0535	0.0350	0.0212	0.0051
	(0.0894)	(0.0905)	(0.0949)	(0.0991)
EAST	-0.9245*	-0.9857*	-1.3037**	-1.2960**
	(0.5251)	(0.5784)	(0.5916)	(0.6459)
NORTH	-3.1259***	-2.8692***	-3.0797***	-2.8367**
	(1.0394)	(1.0720)	(1.0822)	(1.1355)
SOUTH	0.4731	0.4416	0.3566	0.3039
	(0.3847)	(0.4120)	(0.4173)	(0.4570)
WEST	-2.1201**	-1.4767*	-2.3489***	-1.6963**
	(0.8647)	(0.8206)	(0.7807)	(0.7420)
WQUANT		-0.3045		-0.4235
		(0.5751)		(0.6024)
WQUAL		1.3766***		1.3939***
		(0.3581)		(0.3763)
TRUST			0.7033	0.7367

			(0.4346)	(0.4670)
NORMS			0.9704**	0.8474*
			(0.4833)	(0.4934)
FORMAL NETW			-0.4919	-0.5286
			(0.3558)	(0.3875)
INFORMAL NETW			0.2665	0.1929
			(0.2886)	(0.3101)
Constant	-0.9338	-1.2672	-3.2188**	-3.1582**
	(1.0265)	(1.1692)	(1.3451)	(1.4936)
N	228	228	227	227
pseudo R^2	0.166	0.220	0.205	0.256
Log lik.	-119.7923	-112.0669	-113.8658	-106.6060
Chi-squared	29.9852***	39.4652***	36.1908***	50.2879***

Robust Standard errors in parentheses
Own calculations
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11 Logit Estimates for the Full Sample

	(1)	(2)	(3)	(4)
INCOME	0.0050	0.0064	-0.0035	-0.0002
	(0.0118)	(0.0128)	(0.0121)	(0.0136)
SEX	-0.1258	-0.1407	-0.0757	-0.0371
	(0.3105)	(0.3285)	(0.3278)	(0.3469)
SLUM	0.5056*	0.5954*	0.5165*	0.6108*
	(0.2940)	(0.3226)	(0.3053)	(0.3403)
AGE	-0.0088	0.0029	-0.0040	0.0078
	(0.0111)	(0.0122)	(0.0112)	(0.0123)
EDUC	0.2295**	0.2286**	0.2241**	0.2339**
	(0.1007)	(0.1102)	(0.1100)	(0.1186)
HHDHEAD	0.3831	0.3833	0.3477	0.3269
	(0.3202)	(0.3384)	(0.3381)	(0.3582)
ROOMS	0.1021	0.1314	0.1906	0.2232
	(0.1207)	(0.1333)	(0.1313)	(0.1491)
HHDSIZE	0.1219**	0.1044*	0.1002*	0.0781
	(0.0585)	(0.0622)	(0.0599)	(0.0629)
HTYPE	-0.2575	-0.2205	-0.2482	-0.2490
	(0.3479)	(0.3485)	(0.3596)	(0.3578)
EAST	-1.0572**	-1.6004***	-1.0516**	-1.4248**
	(0.4534)	(0.6161)	(0.4741)	(0.5909)
NORTH	-2.0457***	-1.9473***	-1.9944***	-1.9999***
	(0.4591)	(0.4742)	(0.4742)	(0.5055)
SOUTH	0.3877	0.2250	0.3234	0.1732
	(0.2644)	(0.2886)	(0.2899)	(0.3149)
WEST	-2.5962***	-2.2901***	-2.7676***	-2.4363***
	(0.6772)	(0.6705)	(0.6574)	(0.6431)
WQUANT		0.1725		0.2135
		(0.3556)		(0.3479)
WQUAL		1.4222***		1.4975***

		(0.2563)		(0.2602)
TRUST			0.5248*	0.4028
			(0.2865)	(0.3135)
NORMS			0.9555***	1.0657***
			(0.3299)	(0.3703)
FORMAL			-0.1903	-0.3834
NETW			(0.2592)	(0.2861)
INFORMAL			0.2432	0.2062
NETW			(0.2074)	(0.2286)
Constant	-2.0389**	-3.0610***	-4.0010***	-4.9346***
	(0.8095)	(0.8686)	(0.9824)	(1.0898)
N	450	450	449	449
pseudo R^2	0.165	0.228	0.195	0.260
Log lik.	-243.4218	-225.2288	-234.5413	-215.5310
Chi-squared	61.7107***	83.5951***	81.9628***	108.2221***

Robust Standard errors in parentheses
Own calculations
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

When we look at the results of model 4 in table 11, apart from the strong influence of location (ZONE and SLUM) it can be seen that the stated will to ally increases with being educated, having experienced water quality problems, and following norms of reciprocity. For all other variables there are no robust results, even though in some many cases the expected sign is correct. Surprisingly, the effect of *where* a household is located is very strong. In all models, the ZONE dummies are jointly significant and consistently have the same signs, indicating that relative to living in the central parts of the city, only respondents from the South have a higher likelihood of having replied positively to the willingness to ally question. In all other three zones the likelihood ratio is substantially reduced. This goes down to a factor of approximately 0.016 for being located in the West in model (4) of the slum sub-sample – indicating that the likelihood ratio for replying positively is more than fifty times higher in the central parts of the city. Apart from that, being located in a slum also positively effects the stated will to organize with one’s neighbors (p<0.1). Apparently, there is some “slum factor” for collective action that has nothing to do with financial resources, self-perception of water problem, or social capital. The only significant asset variable is education. Here, there is also the major difference between the models on the separated samples and the full sample. While in the slum sub-sample education is highly significant and positive, in the middle class sample it is even negative – though not significant. In the full model education is again significant (p<0.05) which does not mean that education has a positive effect independent of being located in a slum or middle class neighborhood. The “smart people in the slum” are obviously more ambitious to collectively address water problems than their middle class counterparts.
Surprisingly, having experienced problems with water supply quantities does not have a significant positive effect on being willing to address such problems collectively. The occurrence of water quality problems is a strong predictor of being willing to organize collectively to address water problems. In all models the estimated coefficients are significant on the 1% level. Obviously, respondents expect more utility from collective improvements in water *quality* issues. The cleaning of drainage and sewage channels is a typical example were collective action could provide water

quality-related public goods that are typically under provisioned in Hyderabad. Another phenomenon that has an effect on water quality is the common practice to leave all water taps open with a bucket underneath in order to assure water access once the pipe is serviced by the water authorities. Especially in the monsoon season, the resulting under-pressure soaks sewage water and rainwater into drinking water pipes and eventually poisons the water.

Regarding the social capital variables, only NORMS have a significant (and positive) effect on the willingness to ally across all models. Those people who are willing to help their neighbors also would like to join them for collective efforts to address water problems. All other social capital variables cannot significantly explain preferences for allying with one's neighbor.

8. SUMMARY AND CONCLUSION

In the pace of rapid urbanization and increasingly harmful effects of climate change the water sector of Hyderabad faces multiple challenges. Ever scarcer water quantities and deteriorating qualities will most likely exacerbate existing problems. One particular problem in mega-urban India is the low level of organization in slums and the strong rich–poor divide with regard to collective organization and subsequent benefits. While in the better-off neighborhoods RWAs are involved into water infrastructure planning and budgeting, this is not the case for the less affluent parts of the city.

This paper has tried to address the question of neighborhood organization from an asset perspective with a focus laid on social capital endowments. We have asked which facets of social capital matter most for stated preferences for organizing with one's neighbor.

Our study's findings show the different dimensions of water stress between more and less affluent neighborhoods in the city. Slum residents suffer more from water scarcity than middle class residents. They have less supplied water available during the whole year and lack individual coping mechanisms like water tanks relative to their middle class neighborhood counterparts.

For preferences to collectively address these problems in slums, education is one decisive factor. Apart from that, a household's location, occurrence of water quality problems, and norm following have a positive impact on the willingness to ally – independent of neighborhood type. However, further research is required to validate these results. Particularly the strong impact of location and having experienced water *quality* problems, create the need for a deeper analysis of our first findings.

The policy implications of this study are related to the aforementioned results. As the effect of education was particularly prevalent in slum neighborhoods, trainings on water-related planning – catalyzed, for instance, either by NGOs or policy makers – could be a first step to bridge the organizational divide between the rich and the poor in urban India. Such teaching and community building activities in slum areas may then either result in formal organizations like RWAs or informal joint activities among neighbors.

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