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Potential Benefits and Earnings from Improving the Hussain Sagar Lake in Hyderabad: A combined revealed and stated preference approach

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Abstract

Hussain Sagar, a lake constructed in 1562, joins the twin cities of Hyderabad and Secunderabad in India, and is used for a variety of recreational purposes. Like many lakes in urban India, this lake is threatened by its increasingly polluted waters. In this study, we seek to estimate demand for improvements in the lake's environmental quality. We adopt a combined revealed and stated preference approach to measure gains in welfare as a result of changes in environmental quality. Most studies that combine stated and revealed preference methods confine themselves to an on-site sample survey. Our study improves on this approach by interviewing off-site citizens as well. Our estimates indicate that the park provides recreational benefits or consumer surplus of INR 2,082 (USD 35) for on-site respondents and INR 965 (USD 16) for off-site respondents per visit to the park. Furthermore, improvements in environmental quality will likely increase these benefits, on average, by 9% for on-site visitors and significantly more for off-site residents. We recommend that park authorities increase the access fee from the current INR 10 (USD 0.16) to at least INR 20 (USD 0.33) per visit. With an entry fee of INR 20, the government can potentially earn INR 22-89 million (USD 0.36 – 1.48 million) in revenues per year, which will make it possible to improve the quality of the lake and its surroundings.

Key words

Hussain Sagar Lake, Travel Cost, Contingent Behavior, WTP, Hyderabad

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1. Introduction

Hussain Sagar, a lake constructed in 1562 AD to meet irrigation needs, now serves as source of recreation for the citizens of the thriving twin cities of Hyderabad and Secunderabad. The lake was used for drinking water between 1884 and 1930, but has since been used only for recreational purposes (EPTRI, 1996). The lake adds to the historical and aesthetic dimensions of the twin cities in Central India.

With many parks and recreational spots, a large monolithic Buddha statue and boating facilities, Hussain Sagar attracts many tourists as well as residents. For instance, just one of the surrounding parks, Lumbini Park, receives some 1 million visitors every year. Yet, over the years, the lake area has shrunk from more than 1000 hectares to about 550 hectares due to encroachment by residents and industries. The lake is also now severely polluted from continued discharge of untreated domestic sewage and toxic industrial chemicals (Hussain, 1976; Ramachandraiah and Prasad, 2004; Rao, 2008a). Currently, five drains from different parts of the city flow into the lake, contributing to eutrophication, algal bloom, growth of water hyacinth and bad odor. Regular immersing of clay *Ganesh* idols during the annual *Ganesh* festival has only exacerbated this problem.

While visitors to Hussain Sagar only use the lake for boating purposes, a number of surrounding parks offer many forms for recreation. Increasingly, however, visitors to neighboring parks complain of the foul smell from the lake (Rao, 2008b). Thus, it is quite likely that visits to the area would increase and recreational experience would improve if the lake was cleaned up. Improvements in water quality would also open the door to other recreational activities such as fishing, swimming and pisci-culture. This begs the question whether the benefits of cleaning up the lake would outweigh the costs associated with reducing pollution.

The demand for recreation in the Hussain Sagar area crucially depends on water quality (Rao, 2008b). While local administrators are aware of this, they lack information on how visitors demand and activities at a recreational site may change with different levels of environmental quality. Also missing is evidence on how visitors may assign value to recreational quality under various management options. Our study aims to address these issues in order to provide urban development authorities information that will allow them to make better decisions related to park management.

Worldwide, a number of studies have used environmental valuation methods, such as the Travel Cost Method (TCM) and Contingent Valuation Method (CVM), to examine the effects of a change in water quality on demand for recreation (Bockstael et al. 1987, 1989; Parsons and Kealy, 1992; Needelman and Kealy, 1995; Kaoru, 1995; Pendleton and Mendelsohn, 2000). Many of the TCM studies, however, estimate benefits from recreation considering only the current level of water quality. This is mainly because the single site TCM does not allow for shifts in the demand curve from an improvement in water quality. There are, however, newer studies that combine Stated Preference (SP) and Revealed Preference (RP) approaches (Cameron, 1992; Adamowicz et al, 1994; Kling, 1997; Whitehead et al., 2000; Hanley et al. 2003) to get to an understanding of how welfare changes with quality changes. The main benefit from these combined studies is that while they are revealed preference based, they are also able to present less biased and more precise welfare measures of quality changes (Kling 1997).

Our study attempts to estimate the recreational benefits from controlling water pollution in Hussain Sagar by combining revealed and stated preference approaches to valuation. For the stated preference application, we use a contingent behavior approach, while the revealed preference application is the travel cost method. The analysis is based on a primary dataset exclusively collected for the purposes of this study in 2011.This combined approach allows us to widen and evaluate management policies that are yet to be implemented (Layman et al., 1996). Another unique aspect of our study is that we have included on-site and off-site respondents in our survey. Most studies that use a combined SP and RP method confine themselves to on-site sampling. Thus, our study offers a methodological improvement by estimating off-site demand in addition to demand for recreation by on-site users.

A number of studies exist on pollution levels in Hussain Sagar (Hussain, 1976; Ramachandraiah and Prasad, 2004; Rao 2008a). However, ours is the first study to estimate the recreational benefits to visitors from reduced pollution. While a study by Rao (2008b) analyzed visitor feedback on a certain set of gardens, it did not emphasize the pollution aspects of the lake. Thus, our study is a first attempt to estimate what citizens are willing to pay for the recreational facilities offered by the lake, how this demand may change if water quality improves and what the park authorities may be able to charge in the form of fees to obtain revenues to clean up the lake and its surroundings.

2. Combining Stated and Revealed Preference Approaches: Experiences across Countries

In the non-market valuation literature, indirect methods (primarily travel cost models) and direct methods (e.g. contingent valuation) have been frequently used to value changes in environmental quality. Travel cost models are able to interpret variation in travel costs to a particular site to identify recreational demand. However, they are generally unable to estimate how the benefits from a recreational site vary with different levels of quality (Cameron, 1992; Layman et al., 1996). On the other hand, CV approaches are limited by a variety of biases and hypothetical questions and answers (Cameron, 1992; Mitchell and Carson, 1988). Since neither the TCM nor CVM approach is adequate to fully examine the case of environmental quality changes on recreational behavior, we decided on a combined revealed and stated preference method for our study.

Cameron (1992) was the first to combine travel cost and contingent valuation data to study recreational benefits. Her study demonstrated that a utility-theoretic framework could be used to blend the two types of information into a single joint model, offering a more comprehensive picture of preferences relative to what either source used separately could provide. Kling (1997) reinforced this notion by identifying improvements in precision and reduction in bias to welfare measures from combining contingent valuation and travel cost data. However, there are some who question the nature of the welfare improvements. Parsons et al. (1999), for instance, found little practical difference between the two approaches with very similar welfare estimates when they tested multiple models.

Several studies have combined RP and SP techniques to estimate changes in frequency of recreational visits as a result of price or management changes. For instance, Englin and Cameron (1996) combined SP and RP data to assess the change in trip frequency as the price changed. They found that consumer surplus varied considerably based on model specification. Similarly, Layman et al. (1996) used a hypothetical TCM to understand how the number of trips would change if alternative fishery management practices were imposed. Our study, builds on this literature, to identify changes in visitors demand as a result of changes in the facilities in and around the lake.

Most studies that combine SP and RP methods confine themselves to on-site sampling. An important exception is Whitehead et al. (2000), who combine SP and RP to measure recreational benefits from water quality improvements by taking into consideration both participants and non-participants. They conclude that excluding non-participants overstates the consumer surplus. Our study is partly modeled after Whitehead et al. (2000) as we examine demand for Hussain Sagar by on-site and off-site citizens.

There are three different econometric models that are generally used in the literature when revealed and stated preference data are combined (Whitehead et al., 2008). They are discrete choice models (Logit, Probit, e.g.), continuous choice models (Tobit, Poisson etc.) and mixed choice models. In discrete choice models, multiple choice revealed preference data are combined with con-joint analysis stated preference data (Whitehead et al.,2008). In continuous choice models, revealed preference data on continuous variables such as multiple recreational trips are combined with stated preference data, in which respondents make similar choices under hypothetical conditions. In mixed choice models, a discrete choice contingent valuation of a hypothetical scenario is jointly estimated with continuous choice travel cost data (Whitehead et al., 2008). We use the research methods of Whitehead et al. (2000) in our paper.

Another strategy is to combine revealed behavior with contingent behavior using random effects panel data (Henry et al 2003). Englin and Cameron (1996) were the first to use panel data by estimating contingent behavior (CB) related to changes in trip frequency as price changes. The CB method is a simple extension of travel cost methods and estimates values for hypothetical changes in the provision of recreational facilities (Huang et al., 1997; Whitehead et al., 2000; Ivanova and Rolfe, 2011). The CB approach can also be applied to scenarios where *environmental quality* changes (Eisworth et al., 2000; Hanley et al., 2003). Following this strategy, we combine a contingent behavior model with revealed preferences for recreation to study changes in trip frequency with hypothetical improvements in water quality.

3. Study Area and Data

3.1 Study Area and Visitors

Hussain Sagar is a lake that is surrounded by many parks and visitation areas. Around the lake are Lumbini Park, NTR Gardens, Necklace Road, People's Plaza, NTR Memorial, Sanjeevaiah Park, Lakeview Park, Lumbini Laserium and P.V. Gyan Boomi. Of these, the Lumbini Park has some major attractions such as boating, guided cars for children, interactive waterfalls and pop-up fountains. The NTR Gardens has a toy train, Japanese garden and a fruit restaurant. Necklace Road has landscaping on lake banks, food courts, walkways and boating; and People's Plaza can be rented for private events. Sanjeevaiah Park has a peripheral walkway, lawns, a floral clock, cafeteria, palm, rock and bamboo gardens and children's science park.

The government of Andhra Pradesh[1] has made many institutional and infrastructural changes to improve the lake. In 2000, the Buddha Purnima Project Authority (BPPA) was constituted to develop Hussain Sagar and its surrounding areas under the provisions of the Andhra Pradesh Urban Areas (Development) Act 1975.[2] The Government of Andhra Pradesh also constructed a 20 Million Liters per Day (MLD) Sewage Treatment Plant (STP) to treat the sewage before discharging effluents into the lake, but this has proved insufficient.[3] From 2006-12, the Government of India and the Japan Bank for International Cooperation[4] implemented the "Hussain Sagar lake and Catchment Area Improvement Project", focusing on preventing pollutants from entering the lake, catchment area improvement, construction of an additional STP and upgrading of the existing STP, dredging contaminated sediments from the lake bed, and increasing ecotourism potential. Thus, the lake and its surroundings are an important asset to visitors and the government and there is continuous interest in improving it.

Our study is based on secondary as well as primary data on visitors and their demand for recreation. First, we collected secondary data on the number of visitors coming to different parks near the Hussain Sagar lake from the Buddha Purnima Project (BPP) office. This office maintains data on three parks, i.e., Lumbini Park, NTR Park and Sanjeevaiah Park. According to the available data, of the three parks, the Lumbini Park has the highest number of visitors (see Figure 1).

Monthly data for visitors show that the number of visitors to the Lumbini Park is highest in May and June followed by December and January (see Figure 2). According to the BPP Authority, school holidays are an important factor during these four months. Numbers have remained unchanged over the years in Sanjeevaiah Park (nick-named 'Lovers Park'), a favorite destination for young couples who come there for long walks. Recently, BPP constructed a children's park adjacent to this park, which has become a major attraction for children throughout the year.

3.2 Sampling Strategy

The sample for our study is drawn from the city of Hyderabad (including its twin city Secunderabad).[5] The first step in our data collection strategy was to decide whether we needed to undertake only an on-site survey around

[1] The state of Andhra Pradesh has since been divided into Andhra Pradesh and Telangana.

[2] In August 2008, the Buddha Purnima Project (BPP) became a functional unit of Telangana the Hyderabad Metropolitan Development Authority (HMDA).

[3] This stopped water contamination from two drains. There are plans to extend it to cover the remaining drains.

[4] Now JICA – Japan International Cooperation Agency

[5] Initially, we were worried that this may be a cause for two concerns. First, by constraining the spatial area, we place limits on the maximum travel cost observed, which may understate willingness to pay if people from outside Hyderabad make single destination trips to the lake. However, tourists come to Hyderabad for many purposes, during which they may squeeze in a visit to the lake. We felt that this would partially take care of the size of the maximum recorded travel cost. Second, by focusing on within Hyderabad visitors, variation in travel costs could potentially be small, making it difficult to econometrically estimate the travel cost or price coefficient. Nonetheless, as there are many city dwellers that do not visit the lake in its present condition but are likely to become potential visitors once the lake is cleaned up, we anticipate reasonable variation in the travel cost.

Hussain Sagar or an off-site survey as well. To make this decision and in order to identify how large the visitation to Hussain Sagar was from areas further away from it, we first undertook a pilot survey.

We identified the sample for our pre-pilot survey by focusing on residents who go to bill payment centers in the city.[6] Almost all residents have an electricity connection. Most pay electricity bills at utility centers called "eSeva".[7] We selected a random sample of eSeva centers in each zone of Hyderabad. Out of the 56 eSeva centers in the twin city, we, thus, identified 37 centers for our pilot survey. We then undertook a survey of 512 randomly selected bill payers at the 37 eSeva centers in May, 2010.

In the pre-pilot, we administered a one-page questionnaire about visits to Hussain Sagar. The results of the survey showed that 76 percent of the respondents had visited the lake during the past 12 months (see Annex 1), which in turn indicated that almost three quarters of Hyderabad's residents had visited the lake at least once during the past 12 months. Hence, we felt that taking into consideration only on-site respondents would not be enough and that it was important to include off-site respondents as well.

For the final on-site survey, we selected Lumbini Park because it had the highest number of visitors in comparison with the other recreational pockets (1,608,965 in 2009-10). On average, 4000 visitors come to this park every day. For the detailed on-site survey, we decided on a sample size of 10 percent of the previous year's (2009-10) per day visits, i.e., 400. We administered the questionnaire by systematic random sampling, thus selecting every 10th visitor as a respondent. We collected data on all seven days of the week.

For the final off-site survey, we selected the same number of respondents as for the on-site survey (i.e., 400 respondents) again using the eSeva centers as our venue. We used a multi-stage random sampling method. We drew the off-site sample from among the residents of the Greater Hyderabad Municipal Corporation (GHMC) area. GHMC is divided into five zones (North, South, Central, East and West). These five zones are sub-divided into 18 circles which are further divided into 150 election wards. There are 56 eSeva centers in these 150 election wards.[8]

We selected the number of the respondents in each area in proportion to the zone and circle populations of that area. In the first stage, we divided the respondents according to the percentage of the zonal population. As the East Zone of the GHMC had 11 percent of the city's population, we took 11 percent of the respondents, i.e., 44 out of 400, from this zone (See Table 1). In the second stage, we divided the respondents according to the circle population (see Table 1). The data showed that the East Zone has three circles: Kapra (25 percent of zonal population), Uppal (20 percent) and LB Nagar (55 percent). Accordingly, we took 25 percent of the East Zone respondents, i.e., 11 out of 44, from Kapra circle. We followed a similar strategy with the other circles. As all the circles have more than one eSeva center, we divided the number of respondents equally among all the eSevas, taking care to cover all the 56 eSeva centers in the city.

3.3 Surveys and Environmental Quality Scenarios

We administered the same survey questionnaire to both off-site and on-site respondents during 2011. The questionnaire (see Annex 2) gathered information regarding socio-economic details, recreational activities, including travel cost, and planned trips in the next 12 months with various choices of entry fee and water quality.

The survey questionnaire asked how many trips visitors planned to make per year if the water quality of the lake and other recreational facilities was improved, with the entry fee remaining the same (INR 10) or with a gradual increase in the entry fee. The entry fee was varied randomly for different respondents with five possible bid values (INR 15, 20, 30, 40, and 50). We gave respondents one bid at random and asked them to respond to this.

The survey showed respondents three hypothetical environmental quality scenarios (current conditions plus two hypothetical situations – see Table 2). Scenario 1 was presented to all 800 on-site and off-site respondents, while Scenarios 2 and 3 were presented to all on-site respondents and only to those 309 off-site respondents who had visited the lake in the last 12 months.

[6] We ruled out the telephone survey method as it would miss out on a section of the residents who do not have a landline telephone connection as well as cellular phone users for whom there is no directory listing.

[7] These centers function as a bill payment gateway for water, electricity and telephones, thus saving consumers the trouble of going to each utility service provider separately to pay bills. Though an e-payment facility to pay electricity bills is also available, many citizens do not have access to internet.

[8] South Zone – 6, Central – 18, East – 11, West – 8, North – 13.

- Scenario 1 (T1) asked the revealed preference 'visitation' question, i.e. how many times have respondents visited the lake during the last 12 months.
- Scenario 2 (T2) asked the respondents how many times they would like to visit the lake if the water quality of the lake[9] and other facilities in the park improved with the entry fee remaining the same.[10]
- Scenario 3 (T3) offered stated participation with both improved quality and high entry fee. Respondents were asked how many times they would like to visit the lake if the water quality of the lake and other facilities in the Park were improved along with a hike in the entry fee.

In general, the purpose of creating these hypothetical scenarios was (i) to collect information about the demand for trips at the current level of water quality, and (ii) to estimate the shifts in the demand curves for trips in the presence of improved water quality and facilities for other recreational activities, such as fishing, swimming, pisci-culture and other water games, which are not available now because of the polluted water.

The nature of our dataset with two different 'environmental quality' scenarios raises two important questions for estimation. First, though the survey included off-site visitors, for the T1 scenario, we asked travel cost questions only from those respondents who had visited the lake during the past 12 months. Therefore, our sample is truncated at zero because it does not include non-visitors.

The second issue is that our on-site sampling for scenarios T1, T2 and T3 is also endogenously stratified, with over-sampling of those who visited the lake frequently. In this context, the zero-truncated endogenously-stratified model is a solution (Cullinan et al. (2007). It takes care of all three problems of count data of over-dispersion, truncation at zero and endogenous stratification.

4. Descriptive Statistics

Of the 400 off-site respondents, 77 percent reported that they had been to the Hussain Sagar during the past 12 months. The shared attribute between the on-site and off-site respondents is that all of them are residents of Hyderabad-Secunderabad. As the on-site respondents are from the Park, their minimum number of visits to the lake is one. Since the off-site respondents are taken from eSeva offices, there is a probability that they may not have visited the lake during the past 12 months. We report the descriptive statistics of the sample in Table 3.

Table 3 shows that the average respondent is about 38 years of age and married. The household size is about 4. Most of the respondents are graduates with an annual household income varying between INR 18,000 and 21,000 (300 to 350 USD).[11] The major professions among the respondents are employment with the government, followed by the private sector and businesses. A majority of the respondents, both on-site and off-site, replied that the main purpose of their journey to the Park was to visit the lake. The average journey time to the lake is about 45 minutes. On average, respondents spent 1½ to two hours at the lake-side park.

In the on-site survey, the highest number of respondents (48 percent) travelled by public bus followed by motor cycle (22 percent). In the off-site survey, the majority (49 percent) travelled by motorcycle followed by public bus (27 percent). The results of both surveys show that a majority of the visitors' spending goes towards entertainment such as boating, laser show, car riding, etc. In the on-site survey, 39 percent of the total spending of the visitors goes towards entertainment, followed by food and drink (27 percent). In the off-site survey, 36 percent of the total spending goes towards entertainment followed by private transportation costs (26 percent). While at the Park, the respondents said that they participated in a number of activities such as walking, boating, and playing with their children.

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[9] The reference to water quality in the survey however does not include a scientific assessment of the water quality, attention to its 'quality' is identified in terms that a layperson would understand. Also the trip response in the SP versions is a combined response to improving water quality and improving facilities.

[10] Other facilities in the Park includes water sports facilities, drinking water facilities (extra water fountains), improved food quality, good seating arrangements (i.e., extra benches under shelters or in the shade to protect the users from sunlight and rain), increase in the number of restrooms and trashcans, extra security with CC cameras, the banning of illegal activities and the declaration of the lake as a plastic-free zone.

[11] One USD equals nearly 60 Indian Rupee

The main improvements that visitors would like to see are the banning of plastic carry bags, improvement in water quality, and an increase in the number of trashcans and restrooms. However, there is a difference between the preferences of on-site and off-site respondents: while the on-site respondents give more importance to existing recreational facilities, the off-site respondents give more importance to security.

5. Methods

Our study uses a combined stated and revealed preference method to assess demand for water quality. We start with a simple model of demand for recreation and examine the different factors that may shift demand.

5.1 The Model

Theory and a large body of empirical literature suggest that basic factors, price, water quality and income, influence recreational demand (Whitehead et al., 2000).Thus, the "j"th individual's recreational demand function is written as follows:

$$X_j = x(p_j, q_j, y_j) \tag{1}$$

where,
x_j = the number of trips to the recreation site, which can take any value between 0 to k,
p_j = the travel and time costs to access the site,
q_j = quality of site, and
y_j = income.

The trip cost includes the travel cost (transportation cost and entry fee to the Park) and the opportunity cost of time. Measuring the opportunity cost of time, however, is difficult. We use here a simple procedure by multiplying the duration of the trip with per hour wages/salary of the respondents.[12]

Individuals derive benefits from recreation, represented by the consumer surplus associated with any single trip. The consumer surplus of trips to the site is equal to the area beneath the demand function and above the implicit price. With any improvement in quality from q to q', the demand function for recreation shifts to the right (Whitehead et al., 2000). Thus, the change in consumer surplus as a result of a change in environmental quality is given by:

$$\Delta CS = \int_{p^0}^{P_{c'}} x'(.., q')\, dp - \int_{P0}^{pc} x(.., q)\, dp \tag{2}$$

where
p^0 = the price to visit the site and
$p^{c'}$ and p^c = the choke prices of the demands under quality q' and q.
Δ CS = Change in Consumer surplus

In empirically estimating the above travel cost model (1), we need to note that the dependent variable, the number of trips made to the site, is not a continuous variable as visitors can only make a limited number of trips. Rather, the dependent variable is in the form of count data. Thus to obtain un-biased estimators of demand, we use a Poisson regression model, the simplest form of standard count data estimators (Cullinan et al. 2007).

One property of the Poisson model is equality of the conditional variance and conditional mean. This equality is problematic because real data frequently exhibits 'over-dispersion' when the conditional variance is greater than the mean (Grogger and Carson, 1991). In the presence of over-dispersion, the conditional mean is estimated using the Poisson model but the standard errors of β are underestimated. The generalization of the Poisson distribution, which is often used to model such over-dispersed counts, is the negative binomial distribution (Grogger and Carson, 1991). If the over-dispersion parameter in the negative binomial is equal to zero implying "no over-dispersion," then

[12] For this purpose, we asked the respondents about the monthly income of the households, the total number of earning members in the family, and the total working hours.

the negative binomial collapses to the Poisson distribution (Grogger and Carson, 1991). Thus, the choice between the negative binomial and Poisson regressions is based on the value of this over-dispersion parameter. In our data, because of over-dispersion, our estimations, as discussed below, are negative binomial regressions.

In our final analyses, we use different models for the on-site and off-site data analyses based on different scenarios.

- Scenario 1 presents demand for visits with current levels of environmental quality. For analyzing on-site survey data, the model considered is the zero truncated endogenously stratified negative binomial, as it simultaneously accommodates over-dispersion, truncation and endogenous stratification. For off-site data, the dependent variable is truncated at zero because we asked the questions only to those respondents who have visited the lake during last 12 months. Thus, we use a zero truncated Poisson model.
- Scenario 2 identifies demand for hypothetical changes in environmental quality. On-site respondents include all the respondents in the survey who replied that they would pay a visit to the lake at least once per year if there was an improvement in water quality. Therefore, the model considered is a zero-truncated endogenously stratified negative binomial because of the same reason cited for scenario 1. With off-site data, however, the dependent variable is not zero truncated and we therefore use a Poisson regression.
- Scenario 3 discusses demand with changes in quality and prices. In the on-site survey, 248 respondents out of 400 replied that they would pay a visit to the lake at least once despite an increase in the entry fee, if there is an improvement in the water quality. Therefore, the model considered is negative binomial. It takes care of endogenous stratification and the dependent variable is not truncated at zero. For off-site respondents, we use the Poisson model. Here the dependent variable is count data but are not truncated at zero because many respondents replied that they will not visit the lake with an increase in entry fee.

Because of the count data nature of our dependent variable, estimating consumer surplus is not straight forward. However, according to Hellerstein and Mendelsohn (1993), the conventional formula to find consumer surplus for a semi log model is the same as that for the integer constraint quantity demanded variable. The Poisson and negative binomial regressions are equivalent to a semilog functional form when there is a linear relationship with the explanatory own price variable. The expected value of consumer surplus derived from count data models, can, accordingly, be calculated as:

$$E(CS) = E(T_i \mid X_i) / \hat{\beta}_{TC} = -\hat{\lambda}_i / \hat{\beta}_{TC,} \tag{3}$$

where $\hat{\lambda}_i$ is the expected number of trips and $\hat{\beta}_{TC}$ is the estimated travel cost coefficient. The estimated *per trip* consumer surplus is thus equal to $-1/\hat{\beta}_{TC}$ and this holds for all the models estimated. The *per year* consumer surplus estimate is $E(r)/(-\beta)$, where β is the estimated travel cost coefficient $\hat{\beta}_{TC}$ and E(r) is average annual visits (Adamowicz et al. 1989).

6. Results and Discussions

6.1 Econometric Analyses of Demand Functions

Tables 4, 5 and 6 give the results of the regression models. While Table 4 gives the results for revealed preference with current quality (T1), Table 5 gives the results for stated preference with improved quality (T2) and Table 6 gives the results for stated preference with improved quality and a higher entry fee (T3). All three tables have two models: one with the on-site survey results and the other with the off-site survey results.

Table 4 shows the results for the dependent variable, number of trips, T1 (current quality). In Models 1(On-site) and 2 (Off-Site) in Table 4, the trip costs have the expected negative sign implying a negatively sloped demand curve for visits to Hussain Sagar Lake and its surroundings.

The income variable has the expected sign and is significant; proving that people visit more when there is an increase in income. Older people visit less because of physical constraints. “Education” is a categorical explanatory variable, which, as expected, suggests that the more educated have a higher rate of visits. Household size is also positively related to visitation in both models. “Purpose” is a dummy variable which has the value 1 if coming to the lake is the main purpose of the respondent's visit. This variable has a positive relationship with number of visits in Model 1, though it has a negative relationship with number of visits in Model 2. Amongst on-site visitors, respondents who said that either the water quality is bad or very bad make fewer visits to the lake.

Table 5 shows the results for Scenario 2, i.e., stated preference with improved quality. As evident in Table 5, all the variables in Model 3 (On-site) and Model 4 (Off-Site) have the same signs as in the case with Models 1 and 2. The only difference is in the case of off-site respondents who said that water quality is very bad, but indicated that they may visit more if its quality were improved.

Table 6 shows the results for Scenario 3, i.e., stated preference with improved quality and an increase in the entry fee. In Model 5 (on-site visitors) in the Table, the relationship between the independent variables and the number of trips is the same as Models 1 and 3, which also examine on-site data. Thus, for example, the variable income is positively associated with trip frequency when both water quality and entry fees are simultaneously raised.

We note first that only 129 out of 309 off-site respondents indicated that they would pay a visit if improved quality is accompanied by an increase in the entry fee. In Model 6 (off-site visitors), the direction of the effect of a few of the explanatory variables (age, purpose of visit, very poor quality of water) changes relative to Models 2 and 4. The fact that age has a positive relationship with visits suggests that higher-age-group visitors are more likely to visit more with improved water quality, even with a higher entry fee. Also, respondents who say water quality is very bad wish to visit more with improved quality of water – for which benefit they do not mind paying a higher entry fee.

Of note is the price elasticity of demand for recreational visits. Tables 4-6 indicate price elasticity varying from -0.04 (Model 1) and -1.28 (Model 6). Model 1 to Model 5 suggest that a 10 percent increase in travel cost would result in a 0.4 to 3.2 percent reduction in the visiting rate. However, in Model 6, visitation decreases to 12.8 percent. Model 6, which represents off-site respondents, suggests that off-site visitors will likely have a stronger negative reaction to a high entry fee.

6.2 Welfare changes from variations in price and quality

We asked the respondents an open question regarding what kinds of improvements they would like to see around the Hussain Sagar lake area and inside the park. In response, the major improvements suggested by the visitors were improvement in water quality of the lake, banning of plastic carry bags, installation of close circuit cameras, more trash cans and restrooms, increase in seating arrangements, prevention of religious statue immersion, increase in greenery, concessions for family groups, and increase in public awareness about pollution. We then asked the visitors about the number of visits they would make if all the suggestions for improvement were implemented. The final question combined improvements with an increase in the entry fee. Their answers help us to generate two hypothetical demand curves (Figure 3 and 4)

Table 7 shows the estimates of consumer surplus or recreational benefits from visiting the park. With the current level of water quality, the average consumer surplus per trip is INR 2082 (35 USD) for on-site respondents and INR 965 (16 USD) for the off-site respondents. With an improvement in quality (T2), on-site visitors hope to make significantly more trips to the park, but there is a drop in the *per trip* consumer surplus to INR 1562 (26 USD). The rate of visits of off-site respondents increases, along with their *per trip* consumer surplus, which rises to INR 2280 (38 USD). With environmental quality improvements, the average consumer surplus *per year* increases by 9 % for on-site visitors and is nearly four times more for off-site visitors. A hike in the entry fee (in scenario T3), as expected, brings the *per trip* consumer surplus down to INR 780 (13 USD) for on-site respondents and to INR 523 (9 USD) for the off-site respondents.

6.3 Simulating Changes in Revenue

In this section, we predict changes in total revenue to the park authority if different entrance fees were charged to visitors. For this analysis, we use data from the onsite visitor survey.[13] We simulate changes in revenues by examining on-site visitation with current environmental quality (T1) and improved environmental quality (T2).

[13] This analysis is only for on-site respondents as we do not have travel cost data for the complete set of off-site respondents.

We first predict changes in visitation if the entry fee was increased from INR 10 to different higher levels, i.e. INR 15, 20, 30, 40 and 50, and there was no change in environmental quality (T1). We obtained the predicted trips by re-running Model 1, keeping all independent variables the same, except for trip cost (Alberini and Longo, 2006; Morgan and Huth, 2011).[14] We obtained a new trip cost variable for each new level of entry fee by increasing its value by the amount of the increase in the entry fee. We repeated this regression and predicted the number of visits across a range of entrance fees. For each new entry fee, we calculated the average predicted number of trips. We then predicted the total revenue generated for each entry fee, by multiplying the number of predicted trips by a household with the number of household members who would pay the entry fee times the entry fee (Adapted from Kido and Seidl, 2008).[15] This is summed across all households to obtain aggregate predicted revenue for the sample. To obtain the predicted revenue for the entire population of visitors, we multiply our sample based estimates by 1250 (1/0.0008), as our sample represents 0.08% of the total number of visitors in a year (See Table A2 in Annex 3 for details).

Table 8 shows that a hike in the entry fee, as expected, results in a decline in on-site visits. However, the decline is not huge because the entry fee is a small portion of total cost. Table 8 also presents the revenue obtained as a result of changes in the entry fee. Assuming that 100 percent of visitors make the predicted trips in a year, the park authority can earn revenues from 49 million to 203 million with different entry fees. However, our sample suggests that not all households come to the park 3-4 times per year. Thus, we estimate revenues making different assumptions about the percent of visitors who will make 3-4 trips per year. Assuming that 50 percent of the visitors make the predicted trips, the park authorities can earn revenues from INR 25 million to 101 million based on the fee charged. Assuming 25% of visitors take the predicted number of trips, the authorities can earn INR 12 million to 51 million by varying entry fees (see Table A2 in Annex 3).

For an entry fee of INR 10, if the predicted number of trips is taken by the visitors, this will generate revenues of INR 12 to 49 million depending on the percentage of visitors. If the entry fee is getting increased to INR 20, the average predicted trip rate declines to 3.45. This will generate revenues of INR 22 to 89 million depending on the percentage of visitors. With a hike in entry fee to INR 50, the predicted trips decline to 3.37, but this can generate revenues of INR 50 to 203 million (See Table A2 in Annex 3).

Applying the same procedure, we used the stated preference Model 3 to simulate revenues in a scenario with improvements in quality. As in the previous case, changes in entry fee result in only small changes in the average predicted number of trips. Assuming that 100 percent of visitors make the predicted trips in a year, the park authority can earn maximum revenues from 71 to 288 million with different entry fees (Table 8). Assuming that 50 percent of the visitors take the predicted trips, the Authority can earn from INR 36 to 144 million based on the fee charged. Assuming 25% of visitors take the predicted number of trips, the Authority can earn 18 to 72 million (See Table A2 in Annex 3).

For an entry fee of INR 10, if the predicted numbers of trips are taken by the visitors, this will generate revenue of INR 18 to 81million depending on the percentage of visitors. If the entry fee is increased to INR 20, the average predicted trip rate declines to 4.95. However, this will generate revenues of INR 31 to 127 million depending on the percentage of visitors. With a hike in entry fee to INR 50, the predicted trips decline to 4.78, but this will generate a revenue of INR 72 to 288 million (Table A2, Annex 3).

This picture is clearly depicted in Figure 6, which shows that the predicted trips do not change very much as entry fees change in either Model 1 or Model 3. Figure 7 presents associated revenue curves, which are considerably higher in both estimations. As Figure 7 shows, with environmental quality improvements, Park authorities can hope to increase their revenues at all entry fees. Thus, from a revenue generation point of view, it makes sense for the Park authorities to make investments such as providing water sports and drinking water facilities, improved food quality, good seating arrangements, increase in the number of restrooms and trashcans and extra security, as long as they cost less than the additional revenue generated.

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[14] Predicted trips are obtained with estimated coefficients, new trip cost data and exp is the exponential: *Pred Trips* = exp ($\alpha - \beta1$ tripcost + $\beta2$income – $\beta3$age + $\beta4$education + $\beta5$hhsize + $\beta6$ purpose – $\beta7$ poor – $\beta8$ very poor)

[15] We assume that the number of visitors per household stays the same even with increases in the entry fee. This is because families come to visit the park and unless there is a change in the family demographics, it is reasonable to assume that the same number of members will visit even with changes in the entry fee.

The Buddha Purnima Project Authority currently charges INR 10 as the entry fee for adults and INR 5 for children to Lumbini Park. The fees were INR 5 for all visitors until December 2009, when the authorities hiked fees for adults, collecting INR 9.65 million (USD 160,883) in revenue during the 2009-10 period. We can assume that this fee is sub-optimal, given visitor willingness to pay much more. The percent change in revenue for both models in Table 8 shows that the visitors do not mind paying entry fees up to INR 30 (see Table A2 in Annex 3), after which revenue increases at a declining rate. However, we recommend doubling the entry fee from INR 10 INR 20 for Adults. For children, it appears that the Park Authority would like to keep the price constant at INR 5. Thus, we keep the price for children un-changed. At an entry fee of INR 20 per adult visitor and current levels of environmental quality, authorities can earn revenues from INR 22 to 89 million depending on the percentage of visitors. This increase in revenues could be used for investments that would improve the quality of the lake.

7. Conclusions and Policy Implications

In this study, in order to estimate citizens' willingness to pay for improvements in environmental quality in and around the Hussain Sagar Lake, we combined revealed and stated preference methods and measured gains in welfare to citizens from such improvements. The results of the study suggest that citizens are aware of the need for improvements in and around the lake and that they are willing to pay for these necessary improvements.

Under current conditions at the study site, on-site respondents reported an average of 3.5 trips to the Hussain Sagar Lake during the 12 months of the years preceding the study, while off-site respondents reported 1 trip. Under scenario two, which improves quality without a corresponding increase in entry fee, people generally stated that they would make more trips, increasing the average number of visits from 3.5 to 5 for on-site visitors and from 1 to nearly 2 for off-site visitors. Under scenario three, which posits both improved quality and higher prices, the average number of announced trips came down to 2.2 for on-site visitors and 0.63 for off-site visitors. These figures suggest that the responses to the hypothetical trip questions are reasonable and consistent with well-behaved demand functions. They also suggest that improvements in environmental quality will result in more visitors to the park.

One conclusion to be derived from this study is that off-site respondents respond differently relative to on-site respondents. With improvements in environmental quality, the increase in visitation is smaller among off-site respondents relative to their on-site counterparts. Further, price hikes contribute to a steep reduction in trips among off-site respondents, i.e. entry fees are price elastic when off-site visitors are considered and price in-elastic for the sample surveyed on-site. Further, the trip reduction rate is lower for on-site respondents relative to off-site citizens, even when improvements are coupled with an increase in the entry fee. These results are not surprising given that on-site respondents are more frequent users and know the lake better. However, this analysis makes the importance of including off-site respondents clear. Without including off-site respondents, we would incorrectly estimate consumer surplus as well as revenue possibilities.

On the basis of the findings of the study, we recommend that the Park Authority increase the entry fee from INR 10 to at least INR 20. This hike in fees will result in only a small decline in visitation but the potential revenue the government can earn ranges from INR 22-89 million (USD 0.36 to 1.48 million). This represents an approximately 80% increase in revenues from what is currently earned with INR 10 entry fee. Given the large consumer surplus and recreational facilities in and around the lake, these revenues could be used by the Park authorities to make investments in lake conservation and recreation.

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Tables

Table 1: Sampling Off-Site Respondents

Zone	% of City Population	Circle	% of Population	Number of Respondents	Number of eSeva
East		Kapra	25	11	2
		Uppal	20	9	3
		LBNagar	55	24	6
	11	**Total**	**100**	**44**	**11**
South		MCH 1	59	66	1
		MCH II	32	36	3
		Rajendra Nagar	9	10	2
	28	**Total**	**100**	**112**	**6**
Central		MCH IV	31	43	2
		MCH VI	7	9	2
		MCH III	31	43	8
		MCH V	31	42	6
	34	**Total**	**100**	**136**	**18**
West		S.L South	14	6	2
		S.L North	14	6	2
		PC&RC	16	7	0
		Kukatpally	55	22	4
	10	**Total**	**100**	**40**	**8**
North		Qutbullahpur	25	17	3
		Alwal	11	8	1
		Malkaj	21	14	1
		Secbad	44	30	8
	17	**Total**	**100**	**68**	**13**
Grand Total	**100**			**400**	**56**

Table 2: Survey Design

Scenario	Type	Entrance Fee	Description
1 = T1[16]	Actual	Actual (Current Rs. 10)	Revealed participation with current water quality
2 = T2	Hypothetical	Actual (Current Rs. 10)	Stated participation with improved water quality
3 = T3	Hypothetical	Higher price: selected at random out of (15, 20, 30, 40 and 50)	Stated participation with improved water quality and increase in entrance fee

[16] In the off-site survey, 309 respondents out of 400 (77percent) replied that they have visited the Hussain Sagar lake during the 12 months immediately preceding the time period of the study. Therefore, questions of scenario 2 and 3 apply to these 309 respondents only. However, environmental issues data and general data are collected from all 400 respondents.

Table 3: Variables and Associated Hypotheses

Variables	Site	+/-	Definition & Hypothesis	Mean	Std.Dev.	Min	Max
Dependent Variables							
T1	On-Site		Revealed Number of Visits (with current water quality)	3.48	1.41	1	8
	Off-Site			1.14	0.81	0	4
T2	On-Site		Stated Number of Visits (with improved water quality)	5.05	2.07	1	12
	Off-Site			2.34	0.93	0	6
T3	On-Site		Stated Number of Visits (with improved water quality and increase in entrance fee)	2.24	2.68	0	10
	Off-Site			0.65	0.91	0	5
Independent Variables							
Trip Cost	On-Site	-	Transportation Cost + Entry Fee + Opportunity cost of time (HA: Trip cost is inversely related to the number of visits)	349.84	297.07	82.5	3725
	Off-Site	-	Transportation Cost + Entry Fee + Opportunity cost of time (HA: Trip cost is inversely related to the number of visits)	353.04	200.22	94.55	1516.66
Household Income	On-Site	+	Monthly income of households (HA: Rise in income is accompanied by increased no. of visits)	21,296	11372.52	1800	1,20,000
	Off-Site	+	Monthly income of households (HA: Rise in income is accompanied by increased no. of visits)	18,162.5	8873.96	5000	80,000
Age	On-Site	-	Age in years (HA: Age is inversely related to visits)	38.52	8.77	20	65
	Off-Site	-	Age in years (HA: Age is inversely related to visits)	39.39	7.12	18	60
Household Size	On-Site	+	Number of Family Members (HA: HHSize is positively related to visits	4.27	1.35	2	10
	Off-site	+		4.28	1.18	2	11
Variable		+/-	Hypothesis	Description	Frequency	%	Cum.%
Gender		+	1 if male, 0 female (HA: males face fewer travel constraints)	Male	691	86.38	86.38
				Female	109	13.63	100.00
Education		+	1 if High School, 2 Inter, 3 Degree, 4 P.G (HA: Educated people visit more)	High School	85	10.63	10.63
				Inter	168	21	31.63
				Degree	376	47	78.63
				Post Graduate	171	21.38	100.00
Purpose		+	1 if coming to the lake is the main purpose of journey, 0 otherwise. (HA: They, whose main purpose is coming to lake, visit more than others	Yes	596	84.06	84.06
				No	113	15.94	100.00
Poor Water quality		+/-	1 if respondent replies water quality of the lake is poor (HA: those respondents visit the lake less; however they will visit more with an improvement in quality)	Yes	528	66	66
				No	272	34	100
Very bad water quality		+/-	1 if respondent replies water quality of the lake is very poor (those respondents visit the lake less; however they will visit more with an improvement in quality	Yes	703	87.88	87.88
				No	97	12.03	100

Table 4: Revealed Behavior with Current Quality

Variables	(Model 1) On-Site Dep.Var = T1	(Model 2) Off-Site Dep.Var = T1
Constant	0.79*** (0.242)	0.021 (0.676)
Trip cost	-0.00048*** (0.000)	-0.0010* (0.001)
Monthly Income	0.000010*** (0.000)	0.000025*** (0.000)
Age in Years	-0.0089** (0.004)	-0.022* (0.013)
Education	0.068* (0.040)	0.20* (0.111)
HH size	0.0080 (0.025)	0.0022 (0.081)
Purpose of visit	0.35*** (0.081)	-0.094 (0.210)
Poor Quality of Water	-0.29*** (0.076)	0.097 (0.195)
Very Poor Quality of Water	-0.63*** (0.174)	-0.0053 (0.296)
Price Elasticity	-0.04	-0.32
Observations	400	309

Standard Error in Parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: Stated Behavior with Improved Quality

Variables	(Model 3) On-Site Dep.Var = T2	(Model 4) Off-Site Dep.Var = T2
Constant	1.78*** (0.191)	1.11*** (0.323)
Trip cost	-0.00064*** (0.000)	-0.00043* (0.000)
Monthly Income	0.000010*** (0.000)	0.000010** (0.000)
Age in Years	-0.0094 (0.003)	-0.014** (0.006)
Education	0.045 (0.030)	0.047 (0.052)
HH size	0.0020 (0.019)	0.017 (0.038)
Purpose of visit	0.064 (0.069)	-0.020 (0.100)
Poor Quality of Water	-0.30 (0.059)	0.12 (0.096)
Very Poor Quality of Water	-0.65 (0.128)	0.08 (0.135)
Price Elasticity	-0.04	-0.07
Observations	400	309

Standard Error in Parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6: Stated Behavior with Improved Quality and Increase in Entry Fee

Variables	(Model 5) On-Site Dep.Var = T3	(Model 6) Off-Site Dep.Var = T3
Constant	-0.49 (0.508)	-2.93*** (0.567)
Visit 3 Trip cost	-0.0013*** (0.000)	-0.0019*** (0.000)
Monthly Income	0.000037*** (0.000)	0.000028*** (0.000)
Age in Years	-0.0072 (0.008)	0.018 (0.012)
Education	0.31*** (0.081)	0.50*** (0.108)
HH size	0.079* (0.047)	0.17** (0.070)
Purpose of visit	0.26 (0.176)	-0.16 (0.197)
Poor Quality of Water	-0.42*** (0.157)	-0.0085 (0.180)
Very Poor Quality of Water	-0.71** (0.291)	0.0085 (0.259)
Price Elasticity	-0.25	-1.28
Observations	400	309

Standard Error in Parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7: Consumer Surplus (Recreational Benefits) Estimates (INR per household per trip and per year)

Consumer Surplus	Scenario 1 (no change)	Scenario 2 (environmental quality improvements)	Scenario 3 (environmental quality improvements and price increases)
On-site visitors per trip	2082.46	1562.5	780.45
Off-Site visitors per trip	965.43	2280.50	523.36
On-site visitors per year	7246.98	7890.63	1748.22
Off-site visitors per year	1100.60	5336.37	340.19

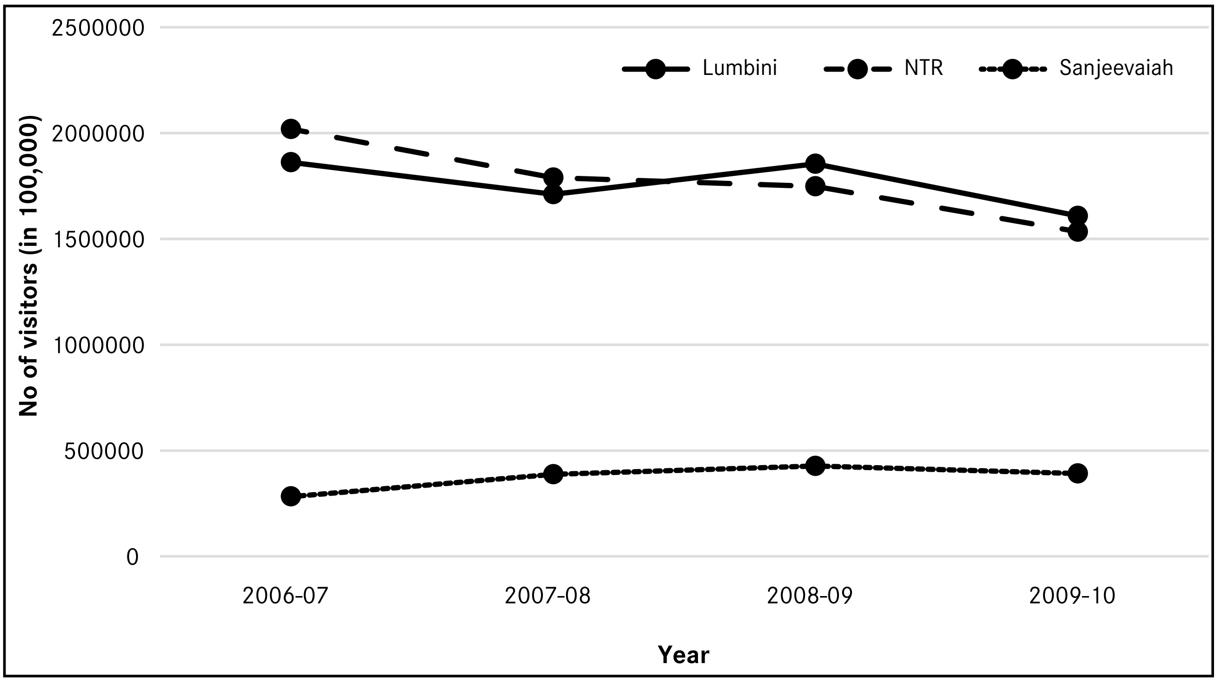
Table 8: Simulated Total Revenue from Different Entry Fees (Using Model 1 and 3 with data from on-site visitors)

Entry Fee (INR)	Model 1 (Revealed Behavior with Current Quality)		Model 3 (Stated Behavior with Improved Quality)	
	Predicted Trips (No.)[1]	Maximum Total Revenue (Million INR)[2]	Predicted Trips (No.)[1]	Maximum Total Revenue (Million INR)[2]
10	3.48	49.55	5.00	71.19
15	3.46	69.18	4.97	99.37
20	3.45	88.84	4.95	127.46
30	3.42	127.44	4.89	182.21
40	3.40	165.84	4.83	235.58
50	3.37	203.17	4.78	288.17

Note:
[1] In estimating predicted trips, we added 1 to the predictions obtained from STATA, because it automatically deducts 1 from predicted trips in cases of endogenous stratification.
[2] Revenue Estimation in Table A2 of Annex 3.

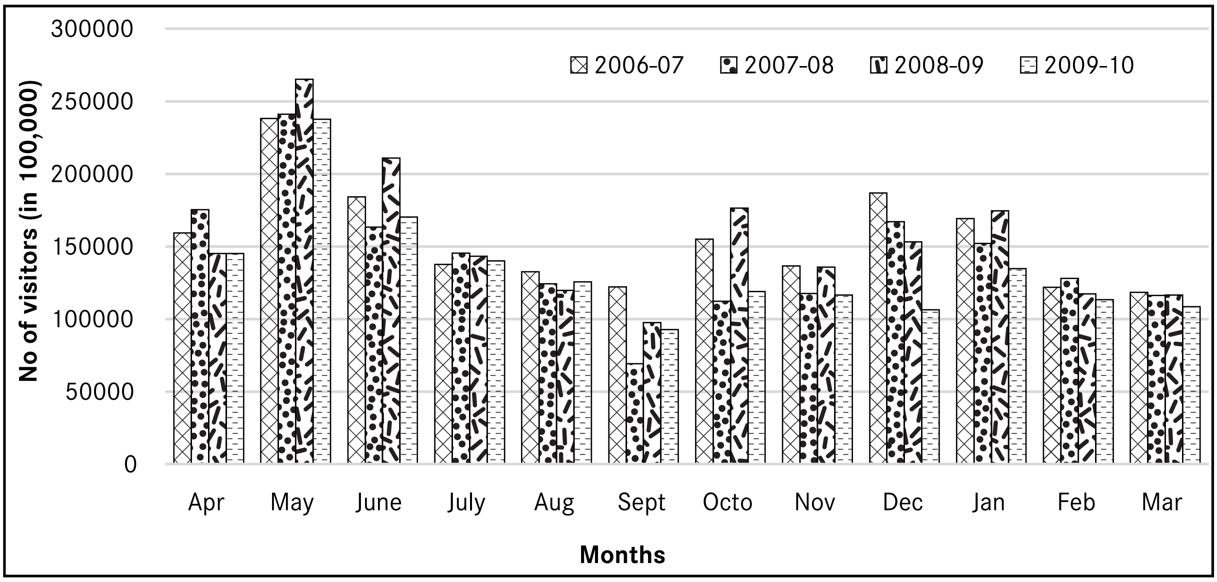
Figures

Figure 1: Visitors to different parks near Hussain Sagar Lake



Source: BPP Office (2011)

Figure 2: Visitors to Lumbini Park



Source: BPP Office (2011)

Figure 3: Hypothetical Demand Curve On-site with Environmental Quality Improvements (Model 3)

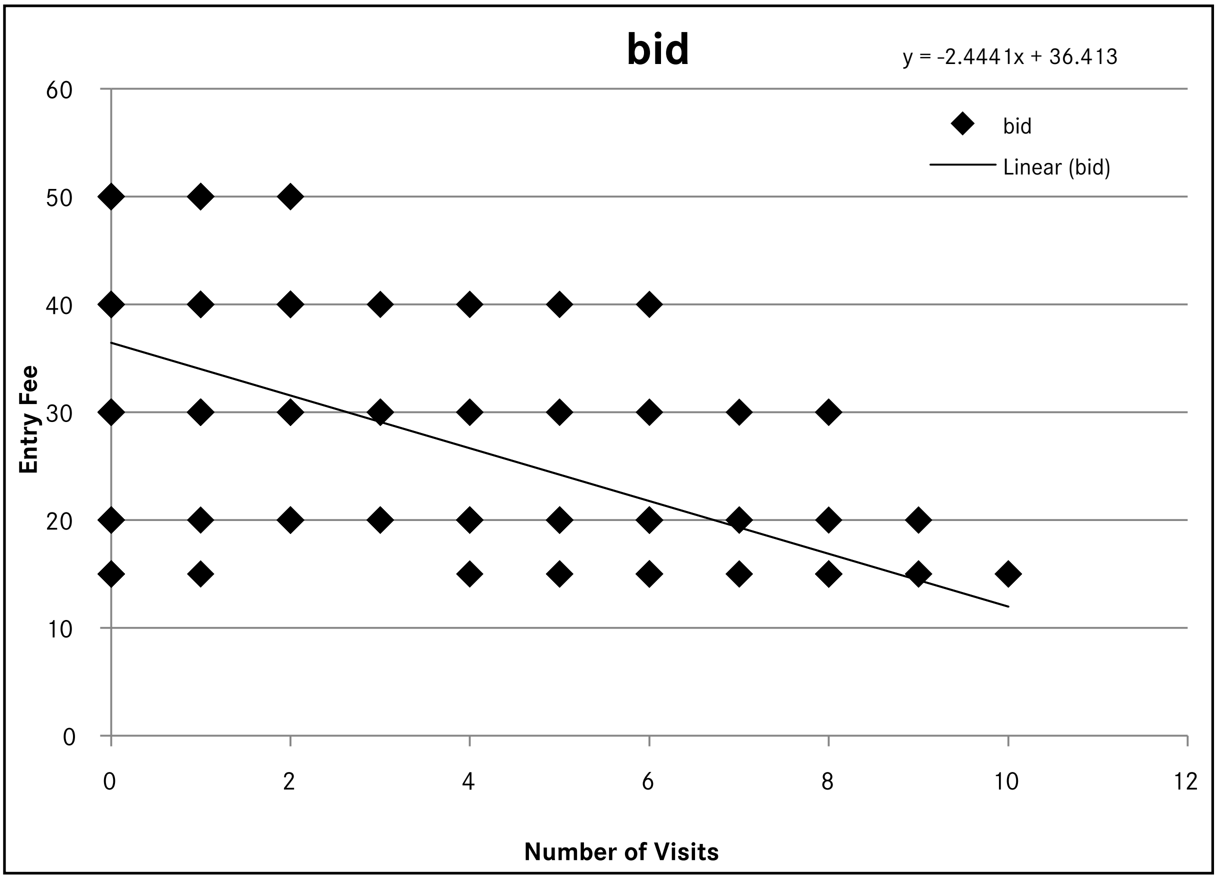


Figure 4: Hypothetical Demand Curve Off-site Visitors with Environmental Quality Improvements (Model 3)

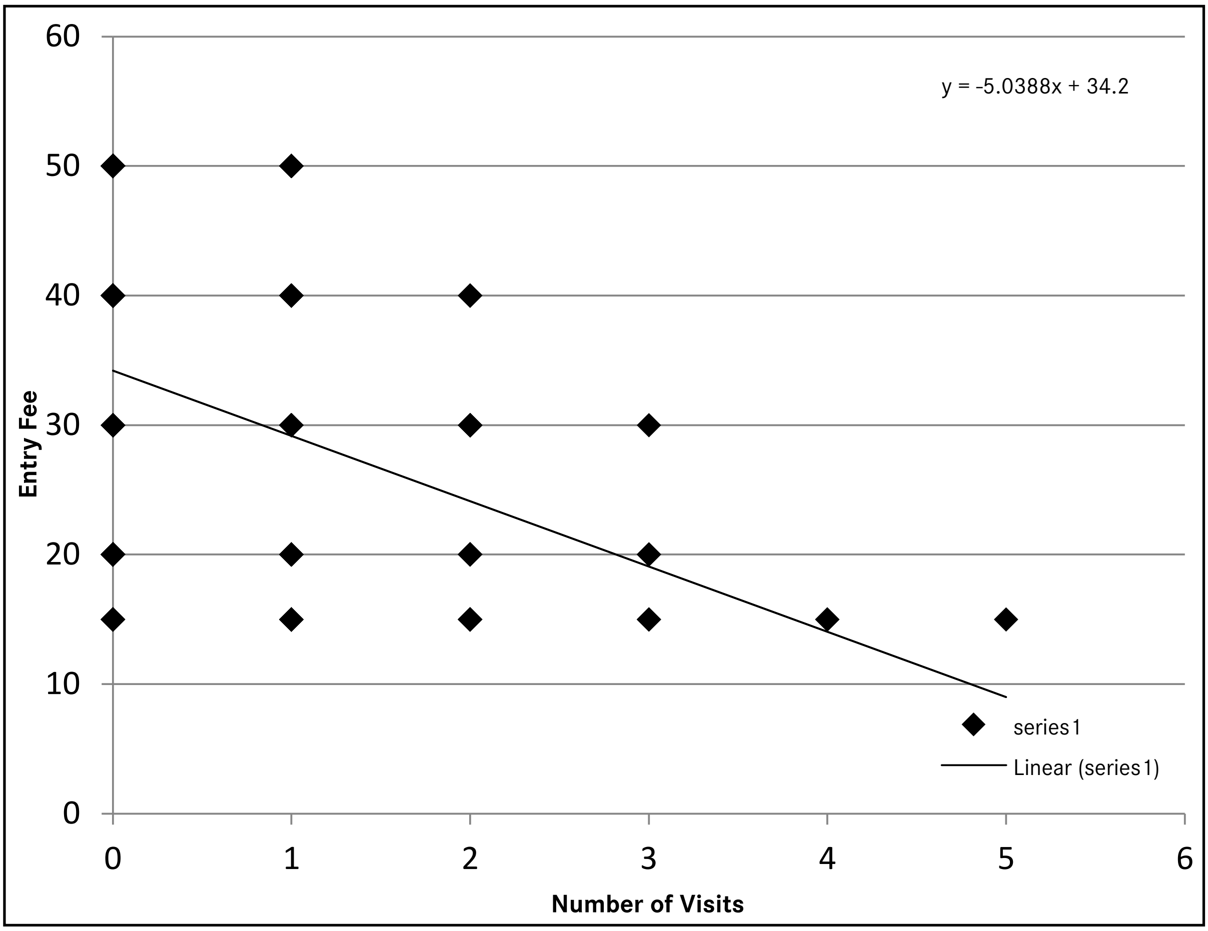
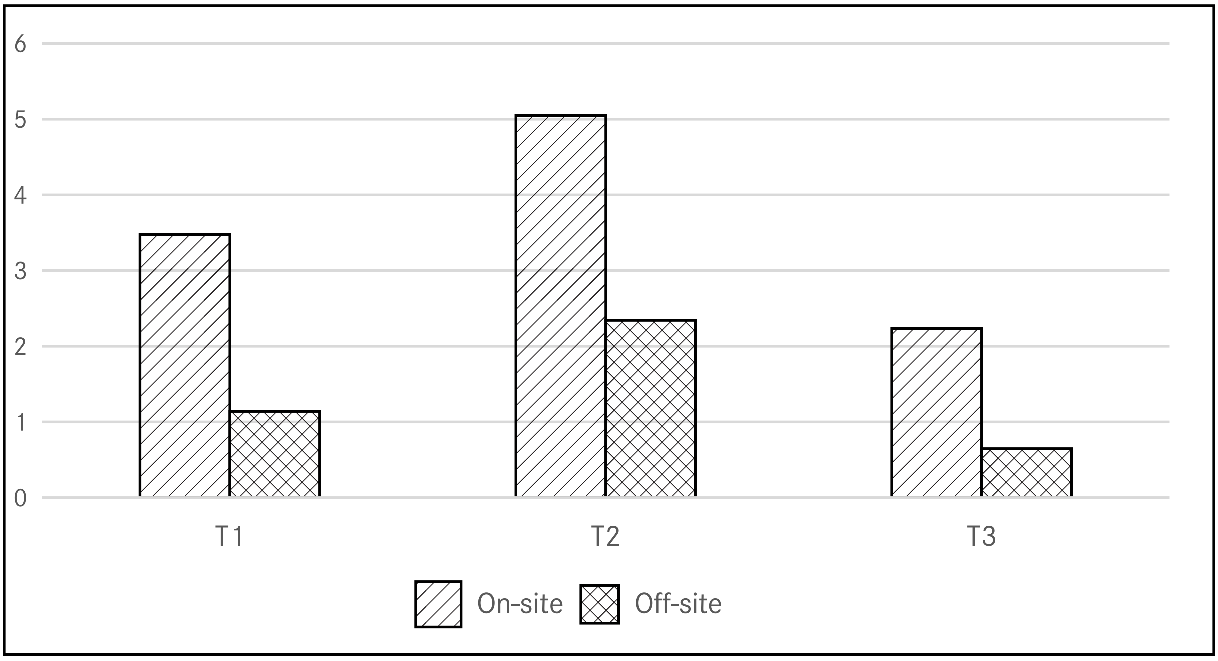
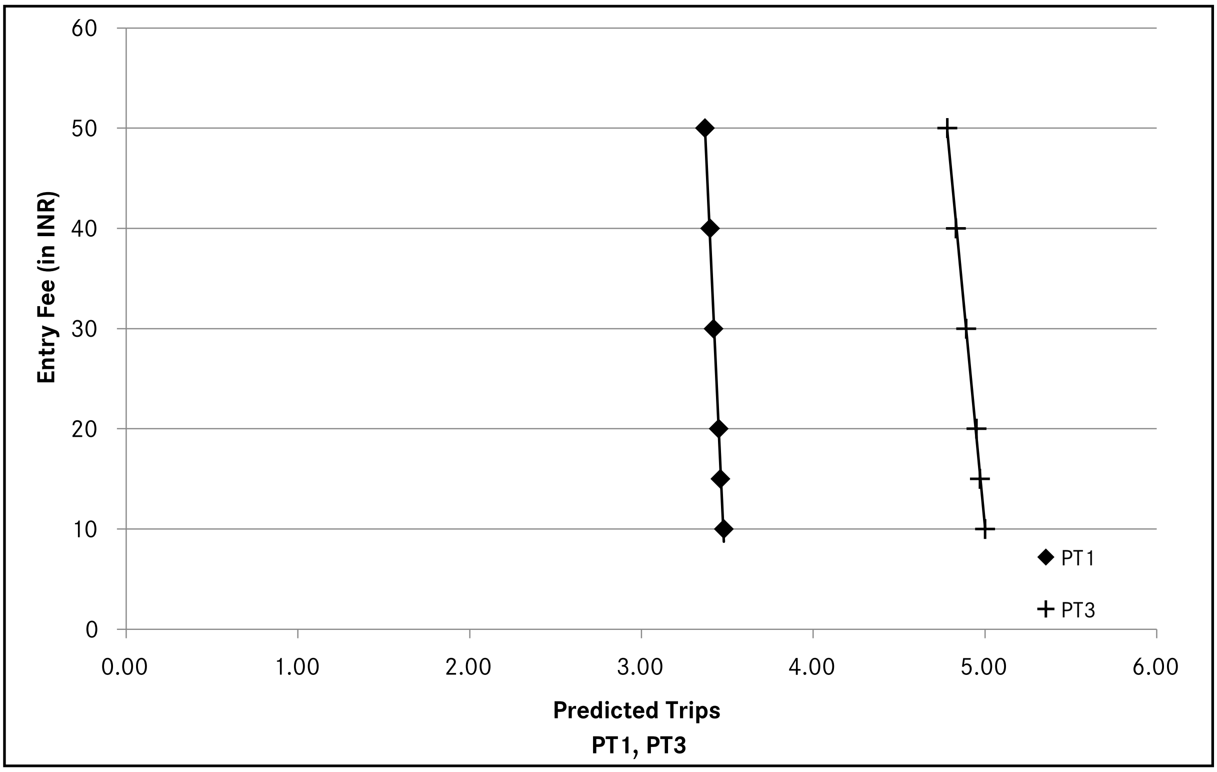


Figure 5: Average number of trips per person by scenario



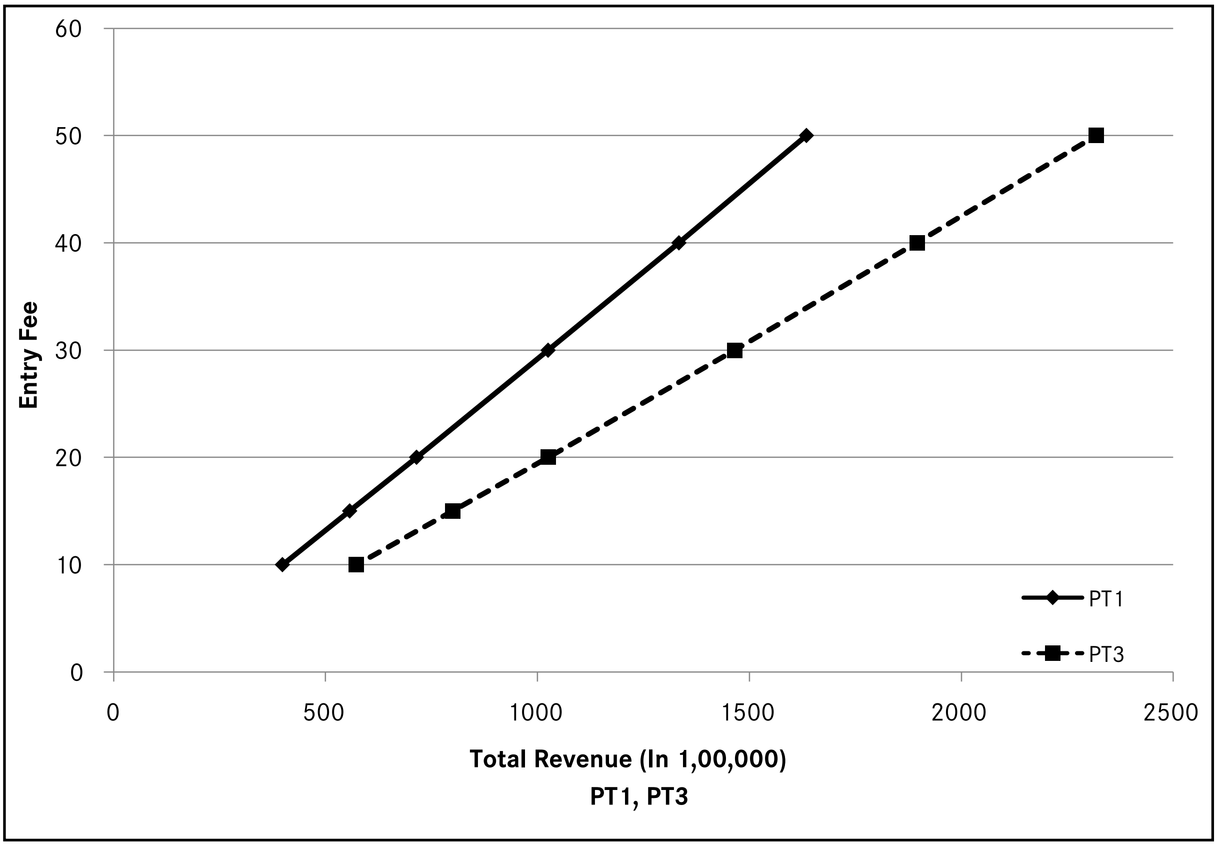
Note: T1= no change in entry fee or quality, T2= changes in environmental quality, T3= changes in entry fee and quality

Figure 6: Predicted Trips with Different Different Levels of Entry Fee (in INR)



PT1 refers to current environmental quality and PT3 to a scenario with improvements in environmental quality

Figure 7: Total Revenue (INR) with Different Entry Fee



PT1 refers to current environmental quality and PT3 to a scenario with improvements in environmental quality

Annex 1: Pre-Pilot Survey Questionnaire

RECREATION VS. POLLUTION:

A Study of Hussain Sagar lake in Hyderabad and its Surroundings

Pre-Pilot Survey Questionnaire

S.No ____________ Date: ____/____/2010 Name of Interviewer:______________

Name of Zone: ________________ Name of eSeva:_______________________________

A: General Information about the Respondent

A1: Name _________________________________

A2: Gender: ____Male __Female

A3: Age _____________(years)

A4: Household Size _____________________

A5: Level of Education: 1. None____, 2. Primary____, 3.Secondary, 4. University ____, 5. Others___

A6: Profession ___________________

A7: Where do you live? Name of Place _______________________

B: Respondent's Recreational Behavior

B1: How many times did you visit the Hussain Sagar lake and its surrounding within the past 12 months for recreational purposes?

No. of times __________________________

B2: How would you describe the quality of recreational benefits in that area?

____ Very Poor, ____ Poor, ____Fair, ____Good, ____Excellent, ____ Do not know

B3: Are you satisfied with the existing recreational benefits of the area? ____ Yes _____No

B4: Do you know any other recreational area that you would like to visit instead of this area?

_______Yes _________No

B5: If yes to Q.B4, which other sites do you visit? _____________________________________

B6: If no to Q.B4, would you like to have improved recreational services? ______Yes _____No

B7: We are going to do a detailed survey. Would you like to participate? _______Yes _____No

B8: If yes to Q.B7, Please give your address.

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Annex 2: Survey Instrument

Name of the Project: Recreation vs. Pollution: A Study of Hussain Sagar lake and its Surroundings in Hyderabad.
Abstract: Hussain Sagar is a beautiful lake situated in the heart of Hyderabad, India. The Government of Andhra Pradesh has constituted the Buddha Purnima Project (BPP) for the development of Hussain Sagar lake and its surrounding environment. The Authority has undertaken a number of programs to clean the lake. They are interested to know people's perception about pollution of the lake. What are the main things of attractions and what are the drawbacks? Based on this information, corrective measures can be taken for the overall improvement of the area. This will draw policy maker's attention to the welfare benefits resulting from such improvements, especially given the high cost of improvements.
Date of Survey:
Place of Survey: Hyderabad
Type of Survey: Urban
Number of Respondents: 800
Sponsored by: South Asian Network for Development and Environmental Economics (SANDEE)
Coordinated by: CENTRE FOR ECONOMIC AND SOCIAL STUDIES **Nizamiah Observatory Campus, Begumpet, Hyderabad – 500 016**

RECREATION VS. POLLUTION:

A Study of Hussain Sagar Lake in Hyderabad and its Surroundings

CENTRE FOR ECONOMIC AND SOCIAL STUDIES

Nizamiah Observatory Campus, Begumpet, Hyderabad – 500 016

S.No ________ Date: ____/____/2011 Name of Interviewer: __________

1. Recreational Behavior

1.1: Including today's trip, how many visits have you made to this lake in the past 12 months? ________________

1.1: How many times did you visit the Hussain Sagar lake and its surrounding within the past 12 months for recreational purposes? ________________. (For eSeva- If the answer is zero, go to only question 1.5 of this section).

1.2: What are the months during which you visit? __________________________________.

1.3: With water quality unchanged, how many trips would you take during the next 12 months? ________________.

1.4: Is/was your visit to this lake the main purpose of your journey today/last time you visited? _____Yes_____No.

1.5: Where do you live? ________________________________(Name of the Place)

1.6: Did you travel from home today/that day? ___________Yes__________No

1.7: If No, where did you travel from today/that day? ________________(Name of the Place)

1.8: How long did it take you to get to this lake today/that day, i.e., what was the travel time here from your home or other place of origin in hours and minutes (one way)?_____________

1.9: How did you come to the lake? By ____ Public bus, ____Private car,____Motorcycle, ____Taxi, ____Tour bus, ____Auto, ____Bicycle, ____Others.

1.10: Total number of members in today's/ that day's trip_________. Children ______ Adult ______.

1.11: As part of your trip to this area today/that day, how much money in total do you think your group has spent/ will spend/had spent in the area during your visit today/that day? How much have you spent mainly in the following categories?

Transportation (Round Trip): _________________INR (in case of public transport)

Fuel (Round Trip): _________________INR (in case of private/own vehicle)

Entrance Fee: _______________________INR

Food & Drink: _________________INR

Boating/Laser Show/Children's car ride etc. :_________________INR

Other: _________________INR.

Total: __________________INR

1.12: How long do/did you plan on staying/stay at the lake today/that day (in hours)? ________.

1.13: Which of the following activities do you generally participate in when you visit this lake?

Walking ___________

Boating ___________

Parasailing ___________

Water Sports ___________

Playing with one's Children ___________

Other, please specify ___________

2. Environmental Issues and Water Quality

2.1: What do you think about the standard of water quality of the lake?

___Very good, ______Good, ______ Neither good nor poor, ______Poor, ______Very poor

______Do not know.

2.2: Are you satisfied with the existing recreational benefits of the lake? ___Yes___No

2.3: If no, would you like to have improved recreational services provided by the lake? ________Yes_______No.

2.4: If yes, what types of improvements would you like to see?

2.5: Are there any other site that you have visited for outdoor recreation during the last 12 months apart from Hussain Sagar Lake? __Y__N (Only day trips).

2.6: If yes, which other single site do you visit frequently? __________________________
(Name)__________________________(Location)

3. Improving/Maintaining Water Quality

3.1: Despite improvements that have been made in the past, the water of this lake where we are at today is still regularly not of good quality. This is related to surrounding land uses and Ganesh idol immersion, but most importantly because of the way in which sewage is discharged into the lake. To improve the situation Buddha Purnima Project (BPP) is investing money in the development of the lake and its surrounding environs. The major developments are:

i) Improvement in lake water quality by preventing pollutants entering into the lake by construction of additional Sewage Treatment Plant (STP) and upgrading of existing STP.

ii) Once water is cleaned, BPP will provide water sports facilities, swimming, swimming pool, fishing, etc.

iii) There will be an increase in drinking water facilities (extra fountains), improved food quality, good seating arrangements (extra benches with shelter to prevent exposure of visitors to rain and sunlight), increase in number of restrooms and trashcans.

iv) Extra security will be provided with CC cameras inside and there will be an increase in the number of security at the main gate. Illegal activities will be banned around the lake.

v) The lake and its surrounding area will be a plastic free zone.

3.2: If all these improvements went ahead and entrance fee remained the same, do you think you might visit the lake more often? ________Yes________No

3.3: You said earlier that you made ___ visits to this lake during the past 12 months. If water quality were improved and all other improvements described earlier were to take place, entrance fee remaining the same, how many visits do you think you would make during the next 12 months to the lake? ________________.

3.4: *Buddha Purnima Project* would need more money for water treatment and the improvements described earlier. They will try to cover it with the entrance fee. Would you be willing to pay a higher entry fee if it were used to restore water quality and make the improvements described earlier?___Y__N

3.5 If the entry fee were INR 15 for adults (vary across schedules to INR 15,.20,30,40 and 50), how many times do you think you would visit the lake during the next 12 months? _____________. (0, go to 3.7, non-zero go to 3.6)

3.6: What is the most important reason for your willingness to pay? (Do not read responses, circle all that are given).

a) For better recreation

b) For future generations

c) For friends and family

d) For fish and wildlife

e) It is the right thing to do

f) I do not believe I will have to pay

g) It sounds like a good cause

h) I want a clean environment

i) Do not know. (Go to Section 4)

3.7: What is the most important reason for your unwillingness to pay? (Do not read responses, circle all that are given).

a) The cost is too high

b) Polluters should pay

c) I do not trust government

d) The environment is clean enough

f) I do not have enough income

g) Other areas are clean enough

i) Do not know

4: General Data

Finally, I am going to ask you a few general questions about yourself. I hope these will give us a profile of the people who come to this lake and help us to understand people's perceptions of water quality. All of the information will be kept confidential.

4.1 Gender of the respondent: ___________Male ___________Female

4.2: Age _________________(years)

4.3: Marital Status: ________Single________Married_________Widowed_________Divorced

4.4: Household Size :__________________(No. of Family Members).

4.5: Number of Children under 18 years living in Household ___________.

4.6: Level of Education: High School________Inter_______Degree________P.G_____

4.7: Monthly Income of the Household (INR/month): ____________________

4.8: Profession: ______________________

4.9: Total Earning Members in the Family: _________________

4.10: Total Working Hours: ___________________

Annex 3: Park Revenue Estimation

Table A1 shows the entry fees earned by the Lumbini Park Authority during 2009-10. The entry fees were INR 5 for all visitors during 2009. The fees were hiked to INR 10 for adults, starting January 2010.

Three months data (Jan-March) in 2010 shows the Adult-Child ratio was 90:10. Assuming the same ratio from April to Dec 2009 and assuming the current entry fee (INR 10 for Adults and INR 5 for Children), the park authority could have earned 15 million. These calculations are shown in the last column of Table A1.

Table A1: Visitors to Lumbini Park (2009-10), Actual Revenues and Calculated Revenues with a change in entry fees.

Months	No. of Adults	No of Children	Total Visitors	Actual Revenues* (Entry fee is INR 5 for all in 2009)	Calculated Revenues if entry fee was INR 10 for adults and 5 for children for all 12 months
Apr 09	-	-	145,030	725,150	1,377,785
May 09	-	-	237,490	1,187,450	2,256,155
June 09	-	-	170,240	851,200	1,617,280
July 09	-	-	140,110	700,550	1,331,045
Aug 09	-	-	125,640	628,200	1,193,580
Sept 09	-	-	92,640	463,200	880,080
Oct 09	-	-	118,790	593,950	1,128,505
Nov 09	-	-	116,370	581,850	1,105,515
Dec 09	-	-	106,250	531,250	1,009,375
Jan 10	119,997	14,688	134,685	1,273,410	1,273,410
Feb 10	101,803	11,386	113,189	1,074,960	1,074,960
Mar 10	98,389	10,142	108,531	1,034,600	1,034,600
Total	**3,20,189**	**36,216**	**16,08,965**	**9,645,770**	**15,282,290**

Source: BPP Authority and author calculations

*The entry fee for Adult and Child was the same (INR 5) up to December 2009. Therefore, the Authority does not have separate visitation numbers for Adults and Children in 2009. However, after January 2010 the Entry Fee for Adults was increased to INR 10. The entry fee for children remained same at INR 5.

Table A2 presents information on revenues if entry fees are increased based on predicted changes in the number of trips. We first estimate the revenues obtained with trip increases for our survey sample of 400 households in column 3. We then estimate revenues from changes in predicted trips for the entire population of visitors to Lumbini.

The total number of visitors to Lumbini in 2009-10 is 1,608,965 (see Table A1). Our sample represents 0.08% of the total number of visitors in a year. In order to obtain revenue estimates for the entire population of visitors, we multiply our sample revenues by time 1250 (1/0.0008).

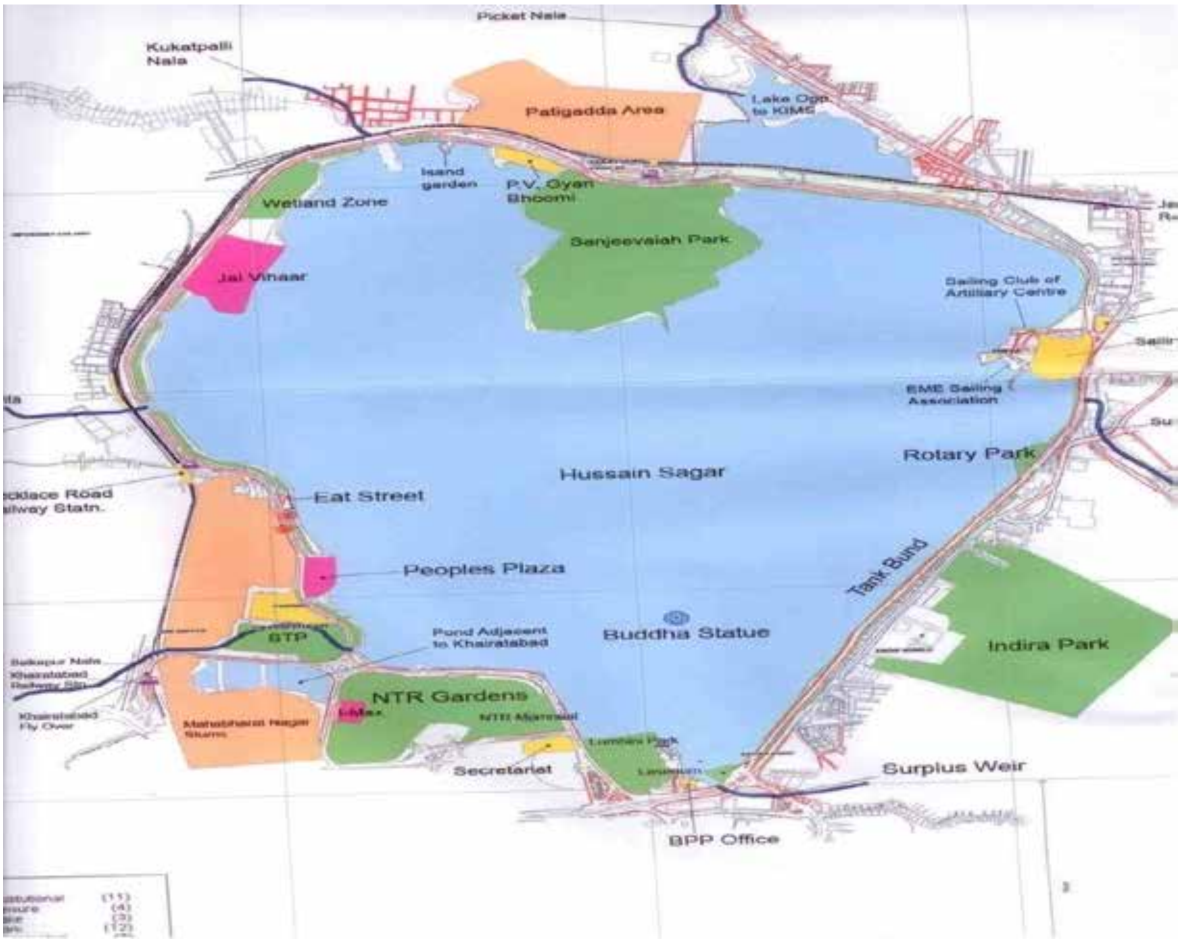
Table A2: Predicted Revenues to Park Authorities if Entry Fees are increased

Entry Fee (INR)	Average Predicted Trips for different Entry fees*	Revenue for Sample visitors**	Predicted Revenue from Visitors to Lumbini Park (Million INR)			
			100% Visitors take predicted trips	50% Visitors take predicted trips	25% Visitors take predicted trips	% Change in revenue
Model 1: Revealed Behaviour with Current Quality						
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
10	3.48	39,637	49.55	24.77	12.39	-
15	3.46	55,343	69.18	34.59	17.29	39.62
20	3.45	71,070	88.84	44.42	22.21	28.42
30	3.42	101,950	127.44	63.72	31.86	43.45
40	3.4	132,668	165.84	82.92	41.46	30.13
50	3.37	162,535	203.17	101.58	50.79	22.51
Model 3: Stated Behaviour with Improved Quality						
10	5.00	56,950	71.19	35.59	17.80	-
15	4.97	79,495	99.37	49.68	24.84	39.59
20	4.95	101,970	127.46	63.73	31.87	28.27
30	4.89	145,771	182.21	91.11	45.55	42.95
40	4.83	188,467	235.58	117.79	58.90	29.29
50	4.78	230,539	288.17	144.09	72.04	22.32

*Trips are predicted based on Model 1 and Model 3in Table 4 and 5.

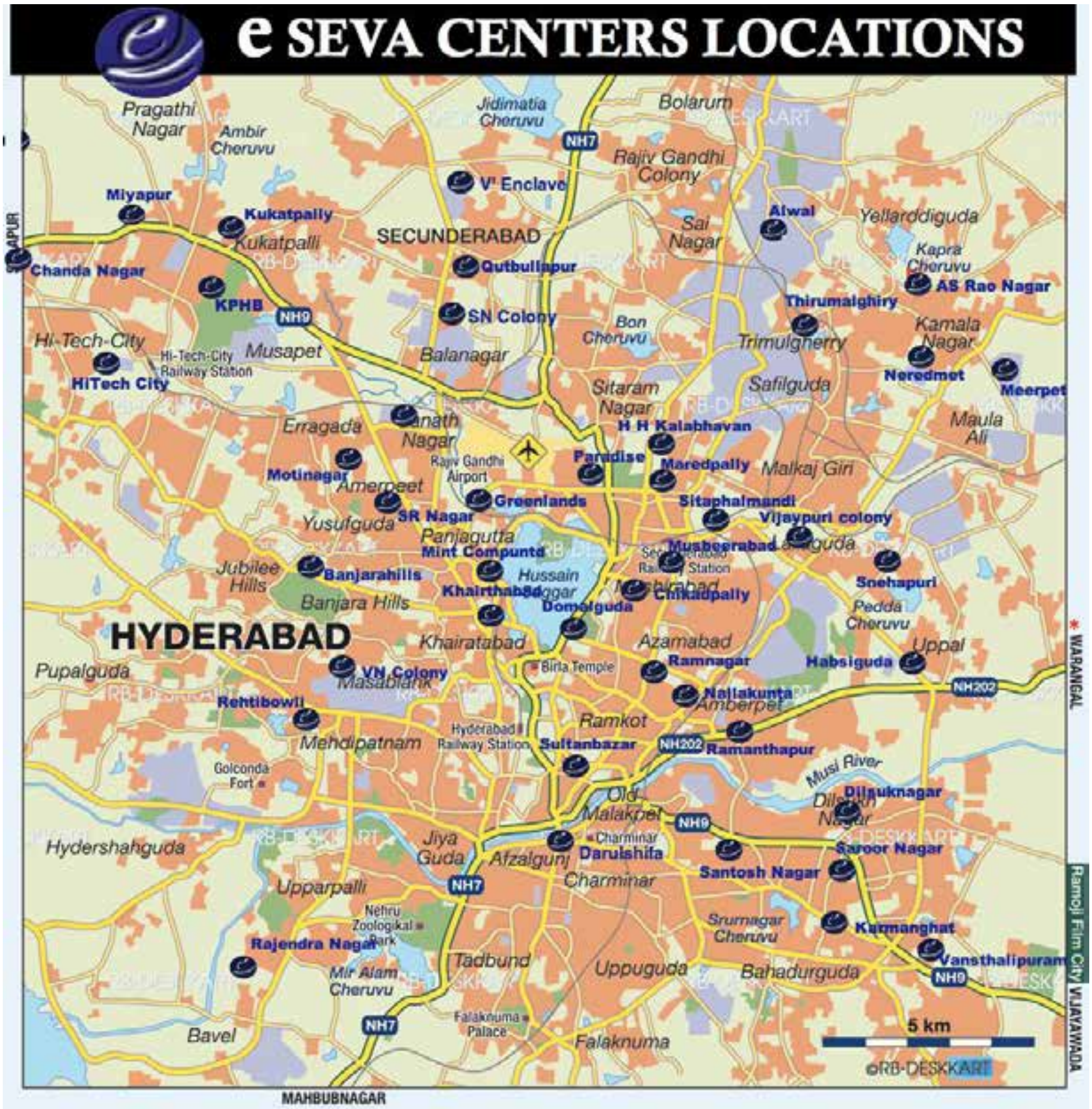
**Revenue for Sample = Predicted Trips *(No of Children paying fee *child entry fee +No. of Adults paying fee *adult entry fee) and summed across households. This is predicted revenue for 400 households or 1,357 individuals.

Annex 4: Hussain Sagar Lake



Source: BPP, 2008

Annex 5: eSeva Centers in Hyderabad



Source: Available at http://www.esevaonline.com/, Accessed on 30th August, 2013.

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