An Empirical Study of Valuation of Economic of Benefits of Lake Conserving Projects in India - A Case study of Anasagar Lake in Ajmer, Rajasthan

Miss Vishakha Bhiryani[1] and Dr V.V.Barthwal[2]

1. Analyst at Frontier Growth Advisors Pvt. Ltd., Research Wing, Gurgaon, Haryana, India
2. Vice Principal, SBD Govt. College, Sardarshahar, Rajasthan, India

Abstract: *The paper tries to evaluate the economic valuation of conserving Anasagar Lake in Ajmer. In the study, it was analyzed that the lake has very less use value and the estimated cost to improve the lake quality is very high which initiates the researcher to work on the development of Lake Front and to increase its rejuvenation value by estimating the willingness to pay i.e. whether the citizen/visitors are ready to pay the minimal amount for the betterment of the lake. The lake is situated in the middle of Ajmer, hence the visitation rate of the people are very high which was examined with the help of Travel cost approach. And further it adds that water quality of lake can also be restored and improved under the water quality scheme of NLCP (National Lake conservation Plan.*

Keywords- Economic Valuation, Estimated Cost and Revenue, Willingness to pay, Zonal Travel cost Approach, Visitation Rate.

Introduction:

Anasagar Lake is situated in the north- west of Ajmer city. The catchment area of lake is 70.55sq.km and its circumference is 12.88sq.km. The maximum and minimum depth is 16 feet and 3 feet. Anasagar was source of water supply to Ajmer city in the past. Presently capacity of lake is reduced due to various reasons like encroachment; siltation and water quality is deteriorating gradually due to flowing of sewer and waste water and solid waste from the adjacent area.

In case of heavy rainfall, the overflow from Anasagar is conveyed by Anasagar Escape channel to Khanpura Talab. All the drains in Anasagar zone have nearly similar kind of problems. Due to the absence of proper sewerage system the drains carry the municipal wastewater and finally discharging into Anasagar Lake thus deteriorating the water quality of the lake.

Presently the lake is used for recreational purpose. A public garden named Daulat Bag/Subhash Garden is maintained by Municipal Corporation on the bank of Anasagar Lake. During rainy season, reduced carrying capacity of lake creates flood in the adjacent area of lake. It gives a stinking smell and poor ambience to the public visiting the garden.

The lake suffers also from the disposal of solid wastes, and various pollution-causing activities such as washing of clothes and wading of animals.

Economic Valuation assigns monetary value to environmental factors (such as quality of air, water and damage caused by pollution) that are normally not taken into account in financial valuation. It is concerned with identifying all the benefits that are associated with goods and services. Economic Valuation of the benefits of any lake would use all the use and non use value that can be derived from utilization. It depends on individual preferences and choices. People express their preferences through the trade offs and choices that they make, given certain constraints such as those on income and available time.

Contingent Valuation is the pricing method that depends on customers' response to survey questions, such as what they are willing to pay for a benefit or feature or what they would accept as compensation if a certain benefit or feature was missing. It is used to estimate economic values for all kind of ecosystem and environmental services. It is also referred to as Stated Preference Method.

Willingness to Pay is the maximum sum an individual is ready to pay to acquire some goods

and services, or the maximum sum an individual is willing to pay to avoid a perspective loss. It is usually elicited from stated or revealed preference experiments. The willingness to pay is highly conditioned by ability to pay. It does not mean that government would be talking funds from the public, but it is a measure to ascertain how much price it holds for the current sum and for future generation. It is a tool to know that whether it is feasible to carry out the conservation project.

The difficulties faced by Anasagar Lake:

- Presently capacity of lake is reduced due to various reasons like encroachment; siltation and water quality is deteriorating gradually due to flowing of sewer and waste water and solid waste from the adjacent area.
- There are encroachments in the lake bed due to soil dump and solid waste dump.
- Anasagar Lake also leads to water pollution and siltation.

Objectives:

Researcher intends to study the overall objective of determinants with the following specific objectives.

- To determine the cost involved in conservation of Anasagar Lake.
- To identify all possible use and non use values of lake conservation.
- To ascertain the economic benefits of lake conservation in terms of willingness to pay.

Review Of literature:

- **Development of Lake Conservation Projects, Karnataka.**

  The report studied the development of lake conservation in Karnataka. To restore conserves, manage and maintain the lakes as a valuable part of the whole ecosystem could no longer be ignored. Government of Karnataka realizes that if the lakes are not conserved without loss of time, the restoration costs later will not only reach phenomenal heights, but will more importantly because a permanent ecological damage and this may lead to scarcity in potable water, cause heat

islands in the cities and affect biodiversity in cities as well as villages. It also focused on economic and social impact of lake restoration, in which it studies the impact of visual quality and its recreational property value as well as impact of climate, recreational facility, encroachments, rainwater harvesting and biodiversity. It also analyses the cost and revenue associated with the maintenance of lake and the benefit derived through it. As per the revenue projections, major part of revenues comes from facilities created under Lake Front Development. If Lake Front is not developed along with Lake Conservation, the project revenues will be very low.

- **Integrated Management of Water Resources of Lake Nainital and its Watershed: An Environmental Economics Approach**

  *S.P.Singh(2002)*studied and focused on the specific objectives i.e. (i) estimation of costs and benefits of resource use of Lake Nainital itself and the lake watershed as well; and (ii) estimation of cost of water quality degradation in Lake Nainital and to work out its relationship with anthropogenic activities in the watershed; and (iii) developing a resource management policy for the Lake Nainital and its watershed was the long-term objective. As the lake has become highly eutrophic and the phosphorous (P) inflow is more than the outflow leads to removal of phosphorus from detergents and treatment of the watershed (better network of sewer lines and afforestation) are some of the measure required. Hence measure should be undertaken like people's participations should be promoted at all levels: constituting bodies, decisions Nearly Rs.57 million (much of which is generated through tourism) is distributed across the poorer stakeholders groups numbering over 1600 individuals comprising rickshaw-pullers, horsemen, boatmen, coolies and vendors. It examined the dependence of different stakeholders on the lake and its watershed and determine its benefits, besides looking into

the current status of the lake for e.g. if the lake is degrading, then the study was to propose possible management action plan so that the lake continues to yield benefits sustainably. More than Rs.10 million has already been spent in the past six years (i.e., Rs. 1.66 million/year) on maintenance of lake and catchment. The expenditure has been incurred on following main activities: desilting of silt deltas near shoreline; the repair, expansion and construction of sewer lines and toilets; repair of drainages and research on different aspects of Lake Limnology. It observed that the consumer surplus arrived at by the use of zonal travel cost method from tourism ranges between Rs.4.3 – 6.5 million depending upon functional form used for calculations. The values obtained are an underestimate of the total value that the people are willing to pay to preserve the lake, as the method captures only the use-value and that too is under represented. When considered in relation to the lake area the density of money flow is about Rs.1.17 million per hectare annually, which is quite enormous given the fact that this is only a fraction of the total economy of more than Rs.400 million (a crude estimate) based on tourism. High quality school education is another major component of the economy of Nainital. It was initiated and established largely due to the nature, the lake and the climate present making, sharing responsibilities, and awareness programs, education, understanding the carrying capacity of the project management.

- **Spatial Hedonic Pricing Models for the Valuation of Irrigation Water.**

  Z. Mallios, et al. (2008) analyzed and discussed the economic value of irrigation water with the help of hedonic pricing method using the spatial econometric. Spatial dependence is incorporated in the modelling in two ways: a) by including a spatially lagged dependent variable (spatial lag model) and b) by including the spatial dependence of the error term (spatial error model). The two spatial econometric models together with a

conventional model of multiple regression are applied in a typical rural area of Greece. Result shows that the spatial methods increase the efficiency and consistency and reduce the bias of the parameter estimates. Hedonic pricing treats a marketed good, usually land property or house, as a sum of individual goods (characteristics or attributes) that cannot be sold separately in the market. The value of any land parcel depends on several characteristics as its size, its land use (e.g. cultivated crops), the irrigation water availability, the location in relation to various places of interest or infrastructures e.g. settlements, urban centers, roads, highways, the sea etc. As all these characteristics contribute - either positively or negatively - to the price (value) of each parcel, an implicit price (i.e. a reliable surrogate of the value) for anyone of these characteristics can be estimated. The prices of agricultural land parcels are assumed to be affected by both spatial and non-spatial characteristics. The non-spatial agricultural land attributes include its size or use, whereas the spatial attributes comprise the so-called neighbourhood characteristics, like the local irrigation water availability, the altitude of the land parcel, the distance from the nearest settlement, the nearest road, the nearest highway, the sea etc. The methodology presents the statistical summary of all the variables that are used for the estimation of the subsequent models, the diagnostic tests, Moran's I and Lagrange Multiplier (LM), are presented as they are used to test the existence of spatial dependence. Therefore it shows that multicollinearity condition number is 34.98>30, that there is a multicollinearity problem. And the Jarque – Bera test is significant, which means that the assumption that the residuals follow the normal distribution is rejected. Also, the tests to detect heteroskedasticity, i.e. Breusch-Pagan and Koenker-Bassett, are also significant and this fact indicates that there are heteroskedasticity problems. As an immediate consequence of all these, the OLS model is not considered to be the

most appropriate one to describe the relation between the price of the land parcels and their characteristics. The assessments of the spatial lag model and the spatial error model are presented. By comparing the values of the Log-Likelihood, the Akaike info criterion and the Schawarz criterion as well as the performance of the other statistics, it can be seen that there is a better fit in the spatial error model, meaning that in the region of the Municipality of Moudania, Greece this model describes better the relation between the land parcels prices and their characteristics. The overall conclusion is that the use of spatial econometric models in the formulation of the hedonic pricing function leads to a better fitted model, as compared to the conventional one of the OLS regression.

Methodology

The Technique used in the research is based on Primary Survey with the help of Schedule and the data is collected on the basis of secondary Research.

Sample Frame: It consists of data from Ajmer Development Authority and Price Waterhouse Coopers and Surveyors visiting the lake.

Sample Size: Sample size is 120 respondents and it depends on population visiting the park and nearby areas and it was collected from 20 March till 30 April 2015

Project Result and Summary

Anticipated Cost:

The various projects for lake conservation will increase the ground water level, water quality improvement and also contribute revenue enhancement. The total capital cost of the project is Rs. 23.3 crore.

Project Name	Anticipated Cost (Rs) Cr
Afforestation and Soil conservation measures	3.6
Desiltation of Anasagar lake	8.91

Equipment for Deweeding	0.9
Construction of community toilets complexes	1
Public Awareness and Training	1.35
Lab for Water quality monitoring & biological research	1.35
Creation of Lake conservation Authority	6.3
Total	**23.41**

Source: City Development Plan, ADA

Estimation of Footfalls

The footfall in weekdays and weekends varies a lot. Average number of people visiting the lake front is arrived as shown below and the round off is 90 people visiting the Lake in a day.

Assumptions in calculating key footfalls of Anasagar lake	
No of persons visiting per day in weekdays	69
Total weekdays in a year	261
No of persons visiting per day in weekends	84
Total weekends in a year	104
Average persons visiting per day	73.285
Footfalls rounded off	90

Estimation of Revenue

Various case studies and surveys indicate that people are willing to pay, if facilities such as green relaxation areas, garden, jogging track, walkways, boating are provided. As shown in the Project, the revenue streams are assumed for two scenarios:

Revenues from lake rejuvenation: These revenues will be coming irrespective of the lakefront development.

Revenues from lake front development: These revenues will be specific to the lake front

development. If lakefront is not developed, we will not get these revenues.

| Revenue from Lake Rejuvenation					
Sr.no	Revenue Source	Amount	Unit	Assumption	Total(yearly)
1	Boating	15	Per person	Average 90 person visit lake per day,10% of them go for boating	49,275
2	Space Rent for food stalls	20	Per sq ft per month	5 stalls for 400 sq ft	4,80,000
3	Parking	Car- Rs 20 and two wheeler -Rs 10	Per vehicle	22 Cars per day and 60 two wheelers	3,84,600
4	Theme Park	Onetime			50,00,000
Revenue from Lake Front Development					
1	Entry Fees	22	Per Person	Assuming 90 person visit park in a day	7,22,700
2	Yoga Classes	30	Per person	Assuming 90 person visit park in a day , 10% of them go for yoga classes	98,550
Total					68,66,525

Estimation of Willingness to pay

This measures the willingness to pay of human beings. As per the data collected, it shows that the people with income level more than Rs50000 are ready to pay more amounts as compared to their income level groups. If we see the yearly basis, the amount generated from individuals would be Rs 965425. According to the respondents, the estimated cost of lake front development would be up to 1.48 Cr. And if add the revenue of theme park, the willingness to pay would be 59, 65,425

Willingness to pay	Day Basis	Yearly Basis
Above Rs 50000	1545	563925
25000-50000	465	169725
10000-25000	330	120450
less than 10000	305	111325
Total		965425

Visitation Rate: The Travel Cost method is used to estimate economic use values associated with the ecosystems or sites that are used for recreation. It is used to measure the time taken and the travel cost expenses that people incur to visit a site represent the "price" of access to the site. And shows the willingness to pay to visit the site can be estimated

based on the number of trips that they make at different travel costs.
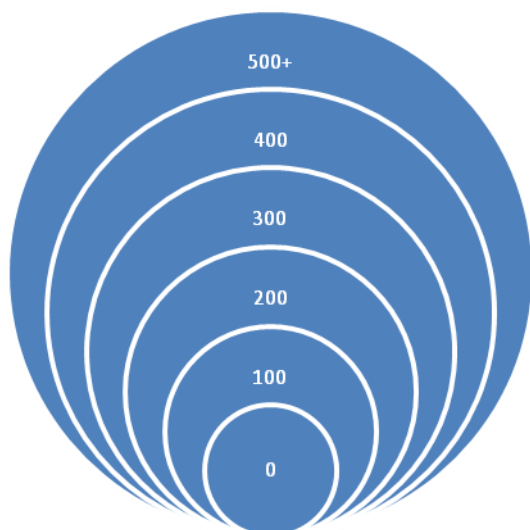
The **Zonal Travel Cost Approach** is the simplest and least expensive approach. It will estimate a value for recreational services of the site. It is applied by collecting information on the number of visits to the site from different distances. It helps us to calculate the Demand function for the site and estimate the consumer surplus as well as economic benefits for the recreational services of the site. The total number of visits is 37,472 in lakhs. And the travel cost of the entire zones is different and the distance time cost in miles is calculated on the basis of railway per km rate i.e. Rs 10 per km and 6.2 in miles and the travel time was measured on the basis of Rajasthan labour income i.e. Rs 259 per day which was Rs 25.9 in an hour.

To make it simple, the visitation rate/lakhs is a function of Total cost/trip which is denoted as

Visit/lakhs=f (Total travel Cost)

Zones	Visitors	Total Visits/year	Zone Population	Visits/Lakhs
Zone 1(0-100)	73	572	10,00,000	5720
Zone 2(100-200)	10	12	35,00,000	420
Zone 3(200-300)	3	3	59,00,000	177
Zone 4(300-400)	12	9	1,83,00,000	183
Zone 5(400-500)	5	1	2,66,00,000	12,236
Zone 6(500+)	17	46	4,70,00,000	21,620
Total	**120**			37,472

Zones	Round Trip Travel in Kms	Round Trip Travel in time (hours)	Distance Time Cost/miles (6.2miles)	Travel Time Cost/Mins (25.9)	Total Cost/ trip
Zone 1 (0-100)	200	4	124000	10360	134360
Zone 2 (100-200)	400	8	496000	41440	537440
Zone 3 (200-300)	600	12	1116000	93240	1209240
Zone 4 (300-400)	800	16	1984000	165760	2149760
Zone 5 (400-500)	1000	20	3100000	259000	3359000
Zone 6 (500+)	1200	24	4464000	372960	4836960

Total					

Zones	Visits/Lakhs	Total Cost/trip
Zone 1(0-100)	5720	134360
Zone 2(100-200)	420	537440
Zone 3(200-300)	177	1209240
Zone 4(300-400)	183	2149760
Zone 5(400-500)	12,236	3359000
Zone 6(500+)	21,620	4836960

Valuation of Anasagar Lake:

It depends on the use and non use value of the lake. Recreational and Aesthetic value of lake shows the use value and the non use value depends upon bequest, existence and altruistic value. On an average suppose 90 people visits the lake, and among them 47 people are local and rest of the sample are from outside the city. It would lead to more of revenue generation from the outside the city. But if see the revenue generation from the local people, suppose they are willing to pay Rs 500 , then it would be 47*500=25850 per day, 25850*365=94,35,250.It means that the revenue in next two years would be equal to the anticipated cost i.e. 23.41 cr. Hence the project on lake conservation is beneficial for the Ajmer City.

The Water Quality of Anasagar Lake

It was studied that the water quality of Anasagar Lake is highly degraded because of pollution from various point and non point sources. The wastewater from the catchment area enters the lake through an open surface drainage system as the natural valley lines have been converted into open drains. There are about 8 major/ minor open drains which carry an estimated 13 mild wastewater from the areas surrounding the lake. The lake suffers also from the disposal of solid wastes, and various pollution-causing activities such as washing of clothes and wading of animals.

The supply of water from the Bisalpur Dam to the rapidly growing city for domestic use is likely to steeply increase the wastewater load. The state government has planned a sewerage system and two sewage treatment plants under the JNNURM scheme of Government of India.

The measures for the restoration and improvement of Anasagar Lake under the NLCP include:

a) De-siltation by dredging out about 0.5 m of sediment deposits from all parts of the lake;
b) cleaning of storm water drains , constructed wetlands along the periphery of the lake for tertiary treatment of effluents from the proposed STPs and the storm water;
c) Catchment area treatment for trapping the sediments and checking soil erosion with the help of about 30 check dams and plantation in over 200 ha;
d) Solid waste management system for the Ajmer City.
Development Plans for Conservation of Anasagar Lake

Proposed Plans for Conserving Anasagar Lake

City development plan for Ajmer & Pushkar.

In Rajasthan, the city of Raipur and the cities of Ajmer-Pushkar (jointly) have been selected as eligible cities which can seek assistance under the jnnurm. The nodal agency for the jnnurm in Rajasthan is the Rajasthan urban infrastructure

finance and development corporation limited (ruifdco). The project development corporation of Rajasthan (pdcor) has been mandated with the task of preparing cdps for the mission towns. The city development plan (cdp) is an assimilation of a number of "sector plans". The sectors covered in the cdp are: land use and spatial growth, roads and transport, water supply, sewerage and sanitation, drainage, lake rejuvenation, solid waste management, tourism and heritage conservation, basic urban services for the poor and institutional strengthening.

Proposed Lake Authority

It is suggested that an agency preferably called Lake Authority is created by the state government as autonomous body to undertake all the construction and other works related to the conservation of lakes like fisheries development, improvement in landscape around lake, periodic desilting and deweeding. Since such an agency will have status of public sector body it can receive fund and operate them in the best interest of public. The Chairman of such an agency will opt for members from concerned government department, public, retired engineers, scientists and social workers on its managing body. This agency will review the work of lake conservation and suggest measures as and when needed.

Conclusion and Recommendations:

An attempt has been made in this paper to evaluate the economic valuation of conserving Anasagar Lake in Ajmer. In the study, it was analyzed that the lake has very less use value and the estimated cost to improve the lake quality is very high which initiates the researcher to work on the development of Lake Front and to increase its rejuvenation value by estimating the willingness to pay i.e. whether the citizen/visitors are ready to pay the minimal amount for the betterment of the lake. The lake is situated in the middle of Ajmer, hence the visitation rate of the people are very high which was examined with the help of Travel cost approach. And further it adds that water quality of lake can also be restored and improved under the water quality scheme of NLCP (National Lake conservation Plan.Ajmer is a place where thousands of pilgrims visit in a day and they face a lot of problems. Anasagar is a recreational place where people spend time and feed the aquatic life

but the lake has very less value, as the water quality of the lake is not appropriate, so there should be some measures like Water quality improvement, increasing water level in the lake as well surrounding area, controlling encroachment, use of lake for recreation via revenue generation, infrastructure development for cleaning of lake, construction of community toilet complexes, provision of water monitoring laboratory for regular monitoring of water quality, identification of pollution sources and research, arranging public awareness campaigns to improve public awareness rejuvenation, prevention of sewage and waste water discharge into the lake, cleaning of the lake by biological and mechanical method, construction and maintenance of bathing ghat and public toilet, plantation of suitable species in catchment area, public awareness campaign, establishment of laboratory for water quality monitoring, creation of Lake conservation Authority.

References / Bibliography (APA format)

- *Anuj Tiwari, Dr. Kamal Jain August 2014, GIS Steering Smart Future for Smart Indian Cities ,ISSN 2250-3153*

- *Mallios et al.,2008, spatial hedonic pricing models for the valuation of Irrigation water, vol 11, no 4, pp 575-582,*

- *Infrastructure Development Corporation (Karnataka) limited development of lake conservation projects, Karnataka*

- *S P Singh et al.,2002, Integrated Management of Water Resources of Lake Nainital and its Watershed: An Environmental Economics Approach, EERC Working Paper Series: WB-8*

- *Adinarayanane Ramamurthy, and Monsingh D. Devadas,2013, Smart Sustainable Cities: An Integrated Planning Approach towards Sustainable Urban Energy Systems, India, Vol:7 No:1*

- *Prof. K N joshi et al., city level back ground paper on Ajmer*

- *Government of Rajasthan "city development plan for Ajmer& Pushkar" http://www.moef.nic.in/sites/default/files/nlcp/ Lakes/Anasagar%20Lake*

An Empirical Study of Valuation of Economic of Benefits of Lake Conserving Projects in India - A Case study of Anasagar Lake in Ajmer, Rajasthan

16