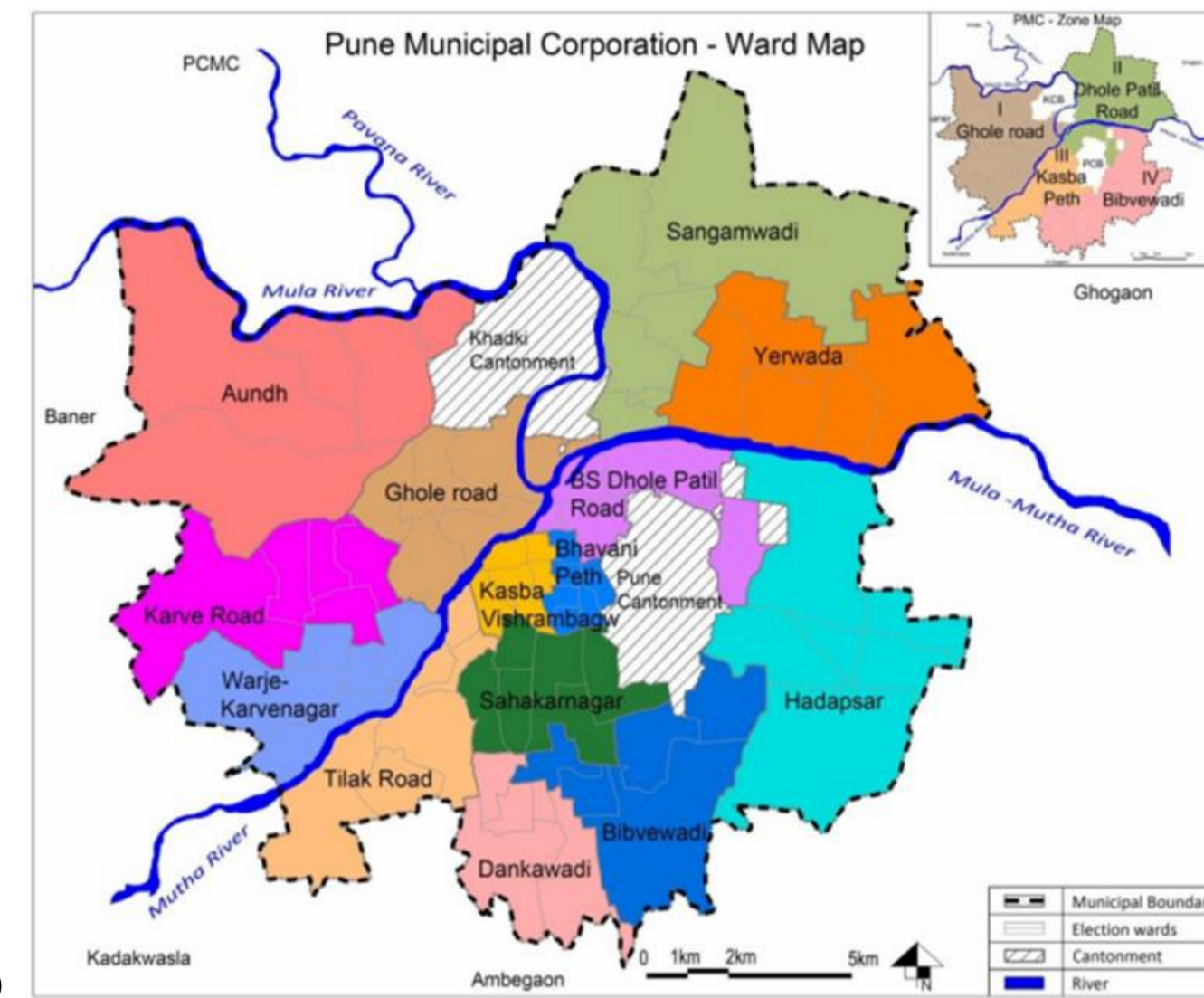


INTRODUCTION

Current state of the river

- Mula- Mutha river is part of the 302 polluted river stretches of India
- Only 64% of total sewage is treated, rest is disposed-off in the river as untreated sewage (CPCB, 2013)
- Unregulated dumping of garbage and solid wastes
- Effluents and industrial wastes directly released onto the river
- Construction debris dumped in the rivers
- Encroachment of river basin due to unplanned development
- Negatively breaches all the 'Designated Best Use' criteria of CPCB



Pollution Level

Indicator	Criteria (mg/l)	Present status (mean range) mg/l
Dissolved Oxygen	> 4	1.2 – 3.2
Biological Oxygen Demand	< 3	10.2 – 15.9

Intervention and Policy Option

- Government and civil society organizations are involved in its restoration
- Research suggests full impact of interventions and policies, on general welfare, needs a Total Economic Value (TEV) framework
- Willingness-to-pay (WTP) is a tool to measure Total Economic Value

Why Mula- Mutha River of Maharashtra?

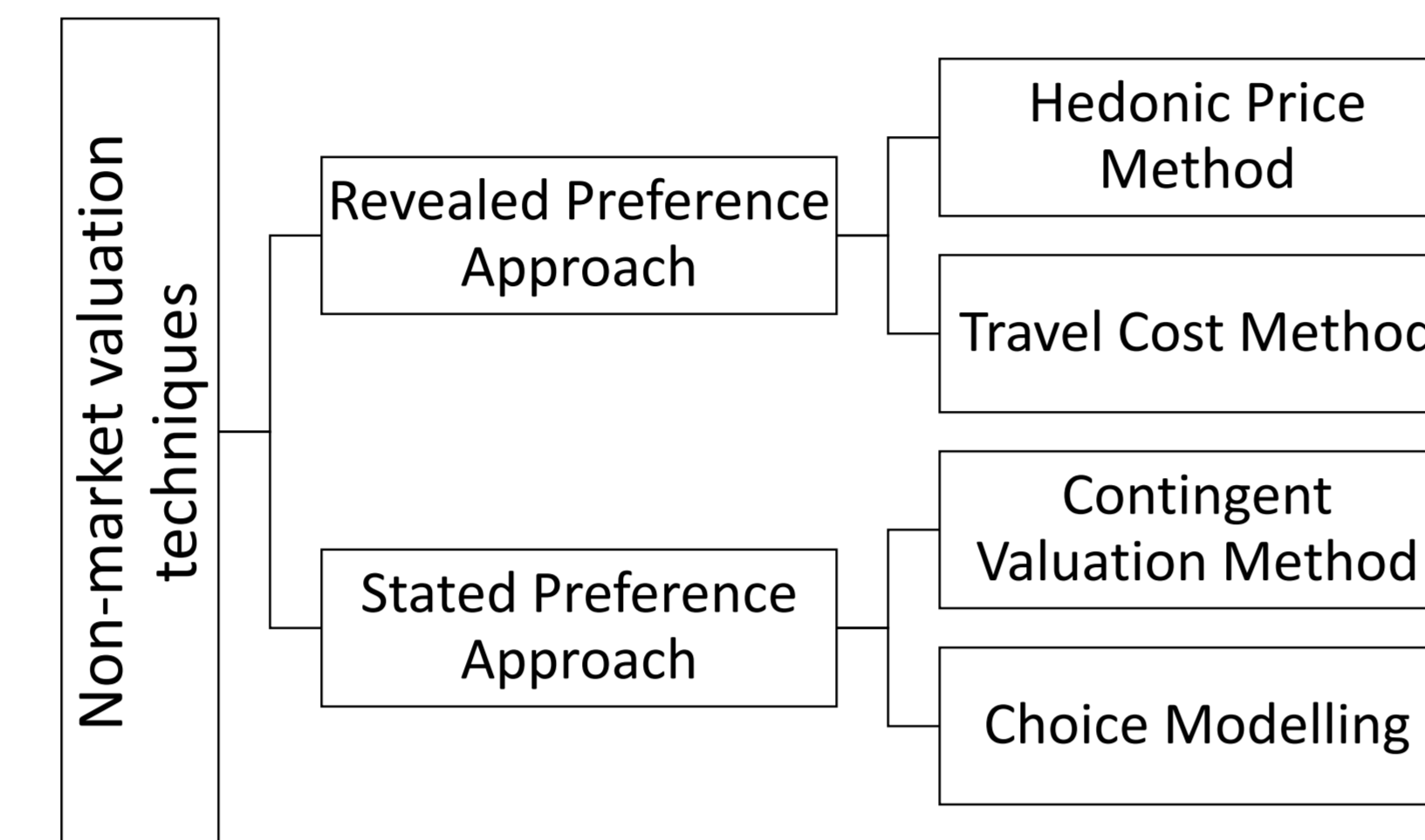
- Maharashtra has second highest (30.4%) decadal growth rate of population and highest net migrants (2.3 million)
- Within Maharashtra, rivers in Pune are most polluted (Madaan, 2014)
- Pune is one of the awardees of the 'smart City Projects' which has provision of clean and sustainable environment as one of the basic objectives



LITERATURE REVIEW

Willingness-to-pay is an expression of consumer's demand which shows consumer's trade-off of using his monetary resources between buying conventional goods and services and environmental protection (Kolstad, 2011)

Methods to estimate WTP



Some recent studies using stated preference approach

Goods valued	Location	Method	Study
Air Quality	China	CVM	Wang & Zhang, 2009
Water quality	UK	DCE	Day, et al., 2012
	India	CVM	Raje, Dhobe & Deshpande, 2002
	Pakistan	CVM	Khan, Iqbal, Saeed, & Khan, 2010
National Parks/forests/conservation area	India	CVM	Maharana, Rai, & Sharma, 2000
	Nepal	CVM	Baral, Stern, & Bhattarai, 2008
	Portugal	CVM	Madureira, Nunes, Borges, & Falcao, 2011
	USA	CVM	Loomis, Kent, Strange, Fausch, & Covich, 2000
Rivers/ wetlands	Greece	CE	Biol, Karousakis, & Koundouri, 2006
	Vietnam	CM	Do & Bennett, 2007
	India	CVM	Imandoust & Gadam, 2007
	Bangladesh	CVM	Alam, 2008
	India	CE	Biol & Das, 2010
	India	CVM	Nallathiga & Paravasthu, 2010
Climate change	Spain	CVM	Longo, Hoyos, & Markandya, 2012

CVM= Contingent Valuation Method; DCE= Discrete Choice Experiment; CE= Choice Experiment

Willingness-to-pay amounts for river water improvements in India

Study	WTP
Imandoust and Gadam, 2007	Rs. 17.33 per month
Biol and Das, 2010	Rs. 16.46 per month
Nallathiga and Paravasthu, 2010	Rs. 84.89 per capita per annum

(Studies conducted after year 2000)

RESEARCH GAP

- Scarcity of studies estimating TEV of natural resources in India
- Environmental policy decisions not linked to total economic value
- Lack of studies on understanding attributes of the resource which influence WTP

RESEARCH OBJECTIVES

Primary Objective

To estimate household's willingness-to- pay (WTP) for restoring the polluted state of Mula-Mutha river

Secondary Objective

- To explore factors (socio-economic, attitudinal & attributes) that influence WTP
- To develop a feasible payment instrument
- To understand causes of deterioration of Mula-Mutha river
- To understand kinds and levels of interventions carried out for its improvement

RESEARCH QUESTIONS

- What is household's willingness to pay to restore and maintain Mula -Mutha rivers?
- What are the socio-economic factors, attitudinal factors and other attributes that influence household's WTP?
- What is the most feasible payment instrument (i.e. agency responsible to collect the payment and periodicity)
- What are the primary causes for river deterioration and interventions made for its improvement?

PROPOSED MODEL

Choice Modelling

- Attribute based approach
- It captures a wider range of environmental quality changes
- Preferable if one needs to value changes in specific attributes of the good
- Can be applied through choice experiments, contingent ranking, contingent rating and pair comparison

METHODOLOGY

Characterize the problem

- Identify the causes of pollution
- Identify the stakeholders
- Identify different levels of interventions done by Government, Civil Society organizations, citizenry etc.

Selection of relevant attributes and levels

- Semi structured interviews and existing literature: Q- Methodology
- Expert interview to gather information, knowledge and their opinion

Questionnaire development

- Statistical design theory to construct environmental scenarios to be put in choice sets
- Information on socio- economic and attitudinal factors
- Pilot survey

Sampling design and collection of data

- Sampling frame: Households under Pune Municipal Corporation limit
- Proportionate Stratified Random Sampling
- Tools: Questionnaire, Verbal narratives, photographs, maps, drawings etc.

Model estimation and statistical analysis

- Based on Characteristic theory of value (Lancaster, 1966)
- Analysed using logistic regression modelling techniques
- Factor Analysis: Key factors influencing WTP

SIGNIFICANCE

- Assess demand for restoring Mula-Mutha river
- WTP estimates can provide benchmarks to policy makers for:

- Developing payment instruments

- Developing guidelines to design and implement policies for river basin management

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