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"Planning Green Infrastructures for Industrial Cities"

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Nature in the City vs Factories in the City

Exploring Residents' Preferences in Post-Industrial Metropolitan Areas

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Context

Industrial cities face a dual transition (UN. Habitat., 2020): :

- **Environmental:** Reduce pollution and mitigate urban heat through green infrastructures
- **Economic:** Maintain industrial activity, jobs, and local competitiveness .

A key challenge: How can cities reconcile *industrial continuity* with *environmental improvement*?

Urban well-being depends on citizens' perceptions of these trade-offs.

The concept of **"acceptability"** links these two dimensions:

1. Environmental performance: livability: human well-being and environmental impact (Baobeid et al., 2021; Zanella et al 2015)
2. Economic vitality and social justice (Heckert, 2012; Jung., 2023)

Underlying question: *Can green urban areas and industrial activities coexist sustainably within post-industrial metropolitan areas?*

Theoretical Framework

Not In My Backyard (NIMBY) vs Yes In My Backyard (YIMBY) and Context Effects

NIMBY (Not-In-My-Back-Yard) and YIMBY (Yes-In-My-Back-Yard): describe negative and positive attitudes toward proposed development projects, respectively.

NIMBY: Certain services are, ***in principle,*** **considered beneficial** by the majority of the population, but the proposed facilities to provide these services are, in practice, often **strongly opposed by residents:** "a social response to unwanted facilities, sometimes called **locally unwanted land uses** (LULUs)

YIMBY: an antithesis that describes people who support local development near where they live – housing development that improves local housing conditions (Yimby, 2009) .

→ The NIMBY/ YIMBY effects are **context-dependent**: In **stigmatized or industrialized areas**, residents may welcome "green" projects.

→ **Hypothesis:** The acceptability of industrial plants or green infrastructures depends on the **industrial identity** of the territory.

Key Concepts and Definitions

- **WTP (Willingness To Pay)** = the maximum amount residents are ready to contribute financially for more green spaces.
- **WTA (Willingness To Accept)** = the compensation residents would accept for hosting a new industrial plant.

- **Contingent Valuation Method (CVM):** A stated preference method

  That elicits respondents' WTP/WTA for goods or services

  Calculates the value of goods and services that are typically not exchanged in the marketplace,

  Estimates both use values and **nonuse values - altruistic value -** of environmental goods

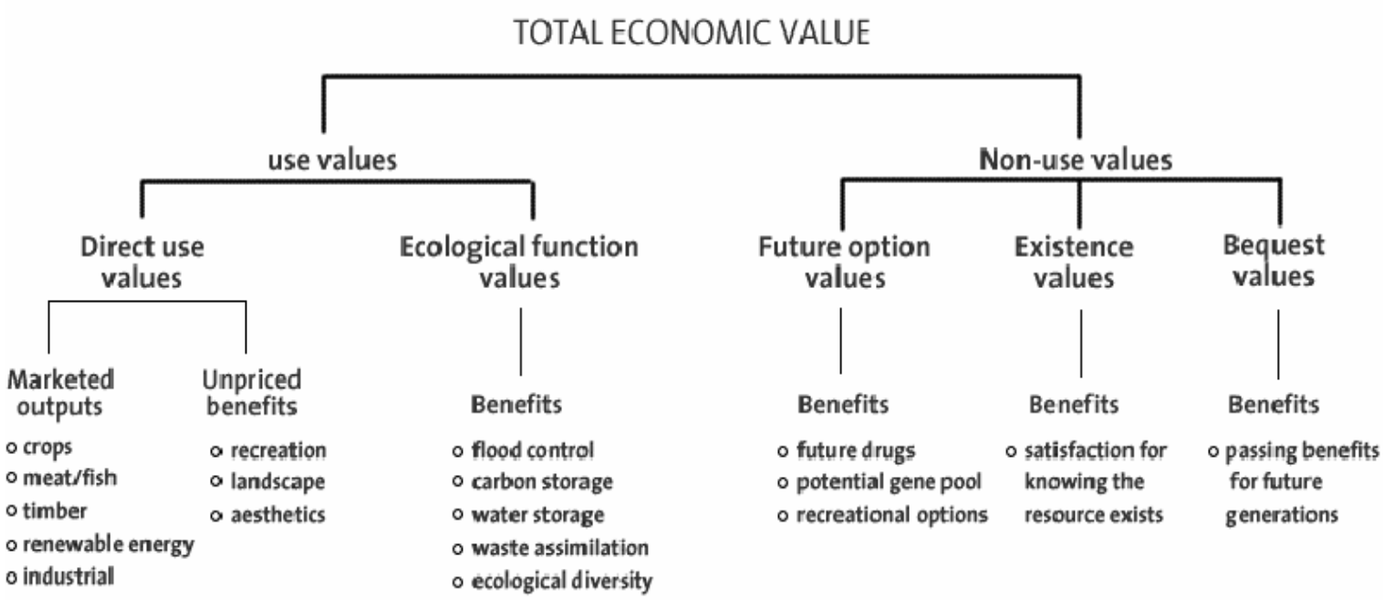


Figure – The total economic value of environmental goods as measured by the contingent valuation method

Literature Review: Willingness to Pay for Urban Green Spaces

Positive impacts: Urban Green Infrastructure = Urban Ecosystem Services

- Securing storage and release of urban water flows
- Temperature regulation (shade and humid environment) – reducing heat island effect
- Biodiversity hotspot (for birds and species) – supporting pollination
- Physical and mental health: amenities, recreational opportunities

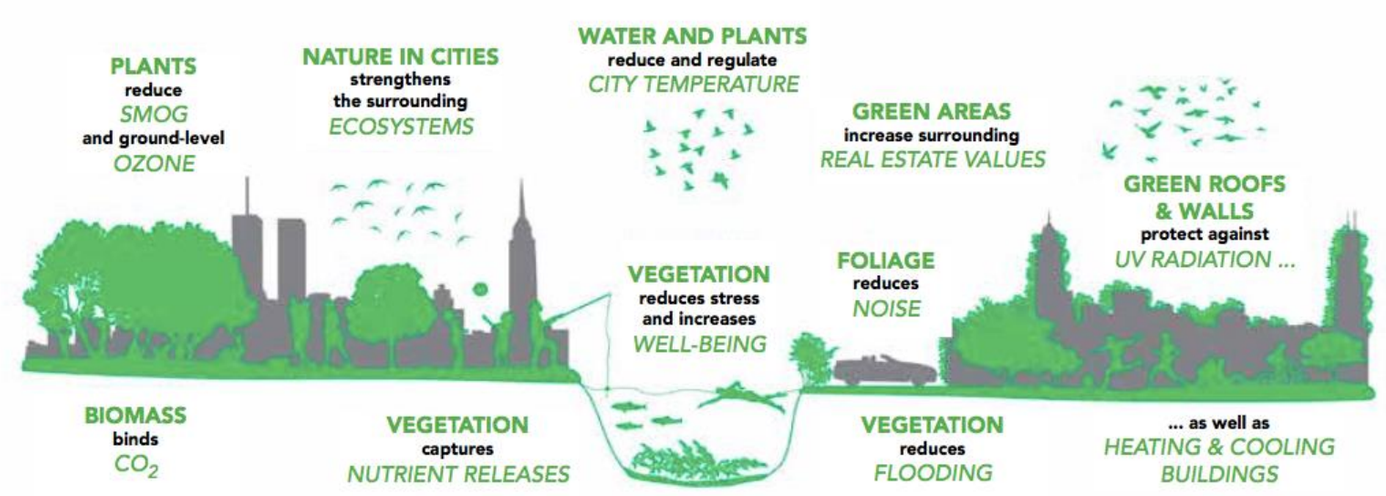


Figure – A typology of urban ecosystem service (source: C/O cities

Influencing Willingness to Pay factors

- **Socio-demographics:** income, age, education, gender, household composition
- **Psychological constructs:** motivation (Lo & Jim, 2010), perceived benefits (Latinopoulos et al., 2016), satisfaction, and emotional attachment (Lopez-Mosquera & Sanchez, 2011).

Literature Review : Willingness to Accept - WTA - Compensation for Industrial Development in Cities

Chemical industry parks - chemical industrial zones: areas planned for chemical or petrochemical industry development, generally as a satellite site or separate, independently operated industrial parks on the edges or outside the main residential areas and city center (Ding and Hua, 2012)

Positive impacts of industrial sites in cities vs. environmental or health risks.

- Job creation
- Income opportunities –
- Local business stimulation
- Fiscal contribution – Tax revenue for municipalities (used to fund public infrastructure and social services).

- Perceived risk
- Expected benefits;
- Distributive justice (fair sharing of costs/benefits);
- Environmental values;
- Greater distance;
- Trust (esp. at the local/project level
- Income

→ *He et al. (2018)* , **economic gains significantly increase acceptance**, even when risks are perceived as moderate

Research questions and hypnosis

Research question

To what extent do socio-economic characteristics influence citizens' willingness to contribute to environmental protection (WTP) and accept industrial development (WTA)?

Hypothesis

- H1: Socio-demographic factors (age, gender, education, income) significantly affect WTP and WTA.
- H2: WTP/WTA profiles differ between metropolitan areas.
- H3: Citizens can be categorized into distinct contribution/compensation typologies.

Methodology

The online survey structure (4 parts):

1. Scenarios for *increasing green spaces* (WTP).
2. Scenarios for *hosting industrial sites* (WTA).
3. Psychological dimensions (trust, feeling of fairness, satisfaction, motivations) and current use of urban green spaces
4. Socio-demographic information.

Statistical analysis

- Rao–Scott Chi-square tests → relationships between variables.
- Logistic regression (binary/multinomial) → determinants of WTP/WTA.

Case studies – Three French Metropolitan Areas: Rouen, Le Havre & Lyon

UniLaSalle
Institut Polytechnique

Table – industrial heritage vs. Urban greening project in the studied cities

City	Population	Industrial Heritage	Urban greening projects
Rouen	500,000	Textile, steel, oil, petrochemicals	"Rouen naturellement" plan, riverside redevelopment
Le Havre	266,000	Port industries, petrochemicals	"Nature & Biodiversity" plan, demineralization
Lyon	1.4 M	Silk, metallurgy, mechanics	"Nature Plan 2030": 300,000 trees, greening roofs

Results – Descritive statistics

Descriptive statistics

- ~1,000 respondents across the three metropolitan areas.
- 938 exploitable observations after corrected weighting to ensure representativeness across demographic categories.
- Balanced **gender ratio** and **weighted socio-professional categories**.
- The majority of respondents report **satisfaction with current living conditions (73% above average rating)**

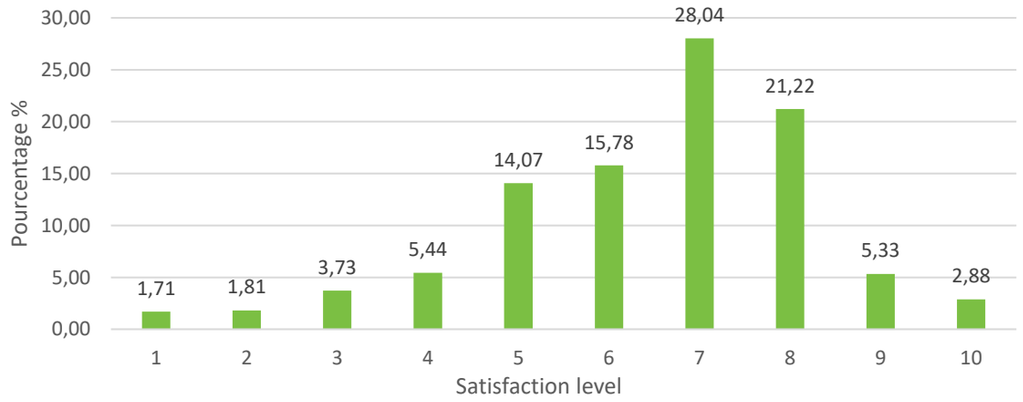
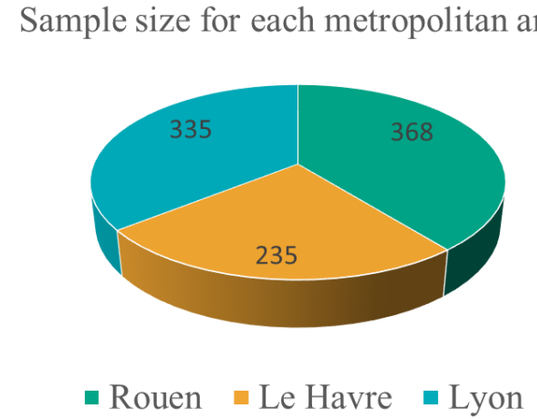
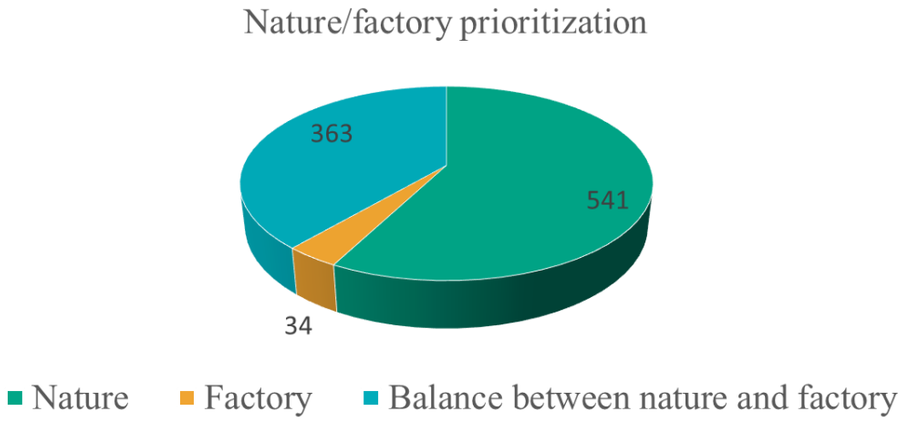


Figure – Rate from 1 to 10 how are you satisfied with the quality of life in your city





Results -**Willigness-to-Pay for Urban Green Areas**

Rao–Scott Chi-square tests

Determinants and Profiles

- Significant links (Rao–Scott test):
  - **Gender** ($p < 0.001$): women are more willing to contribute.
  - **Education** ($p < 0.05$): higher WTP for degree holders.
  - **Age** ($p < 0.01$): decline in WTP with age.

- **Perception and non-use variables:**
  - Higher WTP among those who perceive a good quality of life or well-maintained parks and perform activities in UGA
  - Non-use values do not influence WTP

Table – Variables' signifiance and interprétation

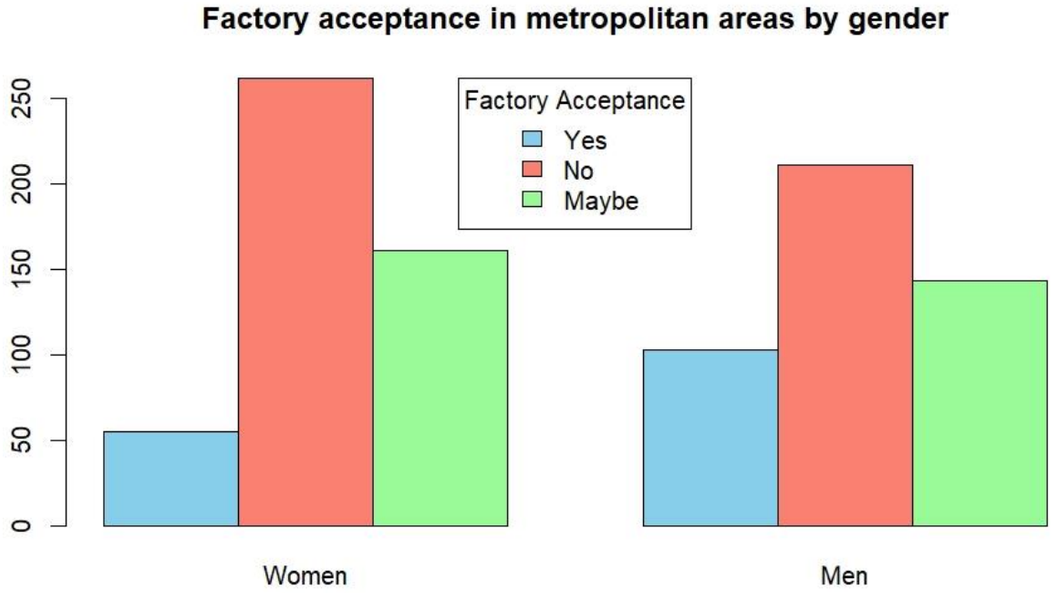
Rank	Variable	p-value	Significance level	Interpretation
	Gender: Women are more willing to pay	< 2e-16	**** (extremely significant)	Women are more willing to pay than men
1	Number of activities in green spaces	< 2e-16	**** (extremely significant)	Strongest relationship: more activities → more acceptance of a contribution
2	Comfort in the city	3.22e-9	**** (very highly significant)	Feeling comfortable in one's city strongly correlates with willingness to contribute
3	Perception of well-maintained green spaces	3.98e-8	**** (very highly significant)	Positive perception strongly predicts willingness to pay
4	Level of education	0.0122	* (moderately significant)	Education influences acceptance, especially high education vs. none
5	Frequency of visits to green spaces	0.0351	* (significant at 5%)	Visitors more likely to accept a WTP

Results - Willingness to accept determinants and profiles

- **Rao–Scott Chi-square tests results**

- Only **gender** shows a significant link:
  - Men are more likely to accept compensation for new industrial sites.
- No significant effect of income, education, or proximity to factories.

- Suggests **contextual rather than personal** determinants (trust, perception of nuisance).



Results – WTP levels toward UGA: Inter-city comparison

"Would you be willing to pay to preserve or improve UGC?"

Metropolitan Area	Yes	No	Maybe	Interpretation
Le Havre	43	140 (+)	59	Residents of Le Havre are more reluctant to contribute to green spaces compared to those in Rouen.
Lyon	57	171	103	—
Rouen	95 (+)	165 (–)	105	—
p-value (Rao–Scott chi-square test)				0.0332

"How much would you be willing to pay to preserve or improve UGC?"

Metropolitan Area	5–10 €	20–50 €	≥100 €	Interpretation
Le Havre	29 (–)	62 (+)	12	When it comes to contributing, the residents of Le Havre are more generous. Those from Lyon, less so.
Lyon	70 (+)	68	23	—
Rouen	73	92	35	—
p-value (Rao–Scott chi-square test)				0.0991

- **Legend:** (+) Overrepresented; (–) Underrepresented

Results - WTA levels toward factories across the three cities

"Would you accept an industrial site in your city?"

Metropolitan Area	Yes (%)	No (%)	Maybe (%)	Interpretation
Le Havre	0.11	0.55	0.34	No significant difference across metropolitan areas regarding factory acceptance.
Rouen	0.23	0.46	0.31	—
Lyon	0.23	0.46	0.31	—

"***How much compensation would you demand*** *to accept an industrial site in your city?"*

Metropolitan Area	100 €	250 €	500 €	750 €	Other	Interpretation
Le Havre	18	22	21	34	25	The amount of compensation requested does not differ significantly between cities.
Lyon	25	36	54	41	20	—
Rouen	20	36	36	48	27	—

Results - Multinomial logistic regression for Rouen city

The regression tests how different **socio-demographic and perceptual factors** influence the probability of belonging to one of three WTP categories:

- **WTP 1:** 5–10 € (lowest_1)
- **WTP 2:** 20–50 € (medium_2)
- **WTP 3:** More than 50 € (Highest_3)
- **High income** and **younger generations** are the strongest positive predictors of higher WTP.
- **Negative perceptions** of maintenance and **living in rural zones** sharply reduce the likelihood of high contribution.
- The **model discriminates well** between low and high WTP categories, confirming that both **socioeconomic** and **perceptual variables** play key roles.

Table – regression analysis for determinants of WTP for UGA in Rouen

Variable	Interpretation	Meaning
Good living (neutral opinion)	3× less chance WTP 3 / WTP 1	People who feel only moderately positive about their quality of life are less likely to pay more.
Negative maintenance perception	7× less chance WTP 3 / WTP 1 (p = 0.005)	Dissatisfaction with maintenance of green spaces strongly reduces WTP.
Generation Z	5–9× more chance (WTP 2 & WTP 3)	Younger respondents are more inclined to contribute higher amounts.
Rural area	5–7× less chance (WTP 2 & WTP 3)	Rural residents are less willing to pay for more urban nature.
Employees	7× less chance WTP 3 / WTP 1	Employed individuals contribute less, possibly due to income or time constraints.
Income > 54,620 €	4–14× more chance (WTP 2 & WTP 3)	Wealthier respondents are far more likely to pay higher amounts (p = 0.0288).

Discussion

Residents of post-industrial metropolitan areas share **consistent attitudes toward urban environmental change**.

→ Across Lyon, Le Havre, and Rouen, WTP for UGA and WTA compensation for industrial sites show **no statistically significant inter-city differences**.

→ The relationship between urban greening and industrial acceptance **transcends local identity and reflects a broader cultural valuation of environmental quality**.

Socio-demographic effects remain decisive.

- Higher **income** and **education** levels significantly increase WTP
- **Younger respondents** express higher WTP,
- **Gender** differences are symmetrical across domains

Perceptual and contextual factors shape contributions

In Rouen, both **economic resources** and **subjective perceptions** are strong predictors of WTP.

Income and perceived environmental benefits are key drivers of high contributions (> 50 €)

The lack of influence of income or education on WTA indicates that **acceptance of industrial sites depends more on contextual trust and perceived fairness** than on personal characteristics

Conclusion

Our findings highlight **social norm of environmental concern** across post-industrial metropolitan areas in France.

→ Citizens collectively value the ecological and social functions of urban green spaces and exhibit **limited tolerance for new industrial facilities**,

Main insights:

1. **Homogeneity across territories:** Urban residents in industrial regions express comparable environmental preferences and compensation expectations, suggesting the emergence of a common "urban environmental culture."

2. **Socio-economic and perceptual duality:** Economic capacity explains part of the WTP variation, but environmental perception and trust play an equally crucial role in shaping pro-environmental behavior.

3. **Policy implications:** Promoting green infrastructures in industrial cities requires not only funding mechanisms but also **strategies to build trust, demonstrate fairness, and communicate co-benefits** (e.g., employment, climate adaptation, well-being).

Thank you for your attention

To keep in touch !

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