# To Participate or Not to Participate in Air Pollution Decision-Making? A study on the factors underlying the willingness to be engaged among the residents of Porto, Portugal[1]

## 1. Introduction

Air pollution is widely recognised as one of the most pressing environmental and public health challenges of our time. It contributes significantly to premature mortality, chronic disease, and reduced quality of life, particularly in urban areas. Globally, air pollution is responsible for approximately seven million deaths each year and is considered the most significant environmental health risk in Europe (e.g., Landeros-Mugica et al., 2024). The intensification of air pollution is associated with a broad set of structural and socioeconomic factors, including patterns of production and consumption, urbanisation processes, mobility systems, and industrial activity, all of which contribute to increased pollutant concentrations, especially in densely populated areas (Milibari et al., 2025). Although the relationship between air pollution and contemporary lifestyles is well documented, alongside substantial advances in air pollution monitoring technologies, modelling techniques, and regulatory frameworks, limited attention has been devoted to social perceptions, everyday practices, and citizens' willingness to participate in air-quality-related decision-making, particularly at the local level (Zajchowski et al., 2023). As some authors argue (e.g., Bickerstaff & Walker, 2001; Völker & Sujaritpong, 2024), if air pollution constitutes a major social problem, its mitigation must also involve social solutions, requiring public awareness, knowledge dissemination, and active civic engagement.

Public participation is crucial for mitigating the adverse impacts of air pollution, fostering more sustainable practices, and improving public health outcomes. Individuals' willingness to engage in participatory processes is closely linked to how they perceive and experience air pollution in their daily lives, including its impacts on health, well-being, and everyday routines. Furthermore, behavioural change, risk management, and public support for mitigation policies depend heavily on the adoption of inclusive and participatory governance strategies. Understanding citizens' willingness to engage, their preferred modes of participation, and the contributions they are prepared to make is therefore essential for designing and implementing effective and socially legitimate environmental policies.

Against this backdrop, this study aims to analyse residents' willingness to participate in local decision-making processes on air pollution in the Metropolitan Area of Porto (MAP), Portugal. Drawing on survey data collected from 1,205 residents, the study examines how social perceptions of air pollution, socioeconomic vulnerabilities, sociodemographic

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characteristics, and health exposure inequalities shape the respondents' willingness to engage in participatory governance.

## 2. Methodology

This study is based on survey data collected in two parishes within the Metropolitan Area of Porto (MAP), located in northern Portugal: Rio Mau, a predominantly rural parish in the municipality of Penafiel, and Campanhã, an urban parish in the municipality of Porto. These parishes significantly differ in terms of socioeconomic characteristics and environmental contexts. The municipality of Porto has experienced occasional exceedances of regulatory limit values for air pollutants, particularly PM10 and $NO_2$, mainly due to domestic heating systems (especially during winter) and road traffic. Episodic disturbances caused by Saharan dust events have also been documented. Although specific air quality monitoring data is not available for Rio Mau, the parish hosts a large construction and demolition landfill site that has generated substantial local contestation. While its most significant impacts concern soil and water degradation, increased heavy-vehicle traffic associated with waste transportation also affects local air quality.

Between November 2024 and April 2025, a survey was administered to residents aged 15 years or older (N=1,205), including 119 respondents from Rio Mau and 1,086 from Campanhã, representing approximately 5% and 10% of the respective resident populations aged 15 or above. The majority of questionnaires (N=1,000) were conducted by a professional agency using computer-assisted telephone interviewing (CATI). The remaining 205 questionnaires were administered online and face-to-face, particularly targeting immigrant and older populations to ensure broader inclusivity. Ethical standards were strictly observed, and informed consent was obtained from all participants. Respondents were selected based on non-probability quota sampling procedures considering the following criteria: (i) number of inhabitants in each parish, (ii) gender, (iii) age, (iv) literacy level, and (v) number of immigrants. Although this sampling strategy limits statistical generalization, it ensures representation of key sociodemographic groups within each parish

The questionnaire was designed based on an extensive literature review regarding social perceptions of air pollution and other environmental issues, and their interrelation with socioeconomic variables, residency, health conditions and public participation in air pollution-related decision-making (e.g., Bosone et al., 2023; Landeros-Mugica et al., 2024; Tourlioti et al., 2024; Zárate Valencia et al., 2020). The questionnaire included 42 mainly closed-ended questions and was structured in five distinct sections: (i) socioeconomic characteristics of the respondents; (ii) perceptions of air quality and air pollution; (iii) health problems experienced; (iv) behaviours and practices; and (v) accountability and willingness to be involved in air-pollution-related decisions at the local level.

The sample was divided according to the responses to the dichotomic question: *"Would you like to be involved in decisions about air quality in your residency area?"* This resulted in two groups: those willing to participate (n = 491; 41.4%) and those unwilling to participate (n = 696; 58.6%). Despite simplifying degrees of willingness, this dichotomisation allows for clearer comparison between engaged and disengaged profiles. Data was analysed

using SPSS (Statistical Package for the Social Sciences, version 29, IBM, USA). Chi-square tests were used to analyse differences between the two groups for qualitative variables (e.g., sociodemographic characteristics; perceptions of air pollution and air quality; assessment of air quality over time and seasonal and daily changes; health problems experienced; governmental action). Independent-samples t-tests were conducted to assess differences in Likert-scale variables (ranging from 1 “less important”/ “totally disagree” to 5 “more important”/ “totally agree”), including evaluations of air quality at different territorial scales, perceived impacts, environmental and socioeconomic inequalities, everyday-life consequences, information sources, and perceived responsibility of relevant actors.

**3. Results**

The findings reveal statistically significant differences between the two groups across most of the dimensions analysed. Willingness to participate in air pollution decision-making varies significantly according to place of residence, age, education level, and income. Residents of more socioeconomically vulnerable neighbourhoods, individuals with lower income and educational levels, and both younger respondents (under 39) and older individuals (over 65) demonstrate lower willingness to engage in decision-making processes.

Perceptions of pollution sources also differ markedly. Respondents unwilling to participate tend to associate air pollution primarily with landfills and waste disposal sites, whereas those willing to engage more frequently identify industrial activities and chemical emissions as major sources. The latter group is also more likely to anticipate an increase in air pollution over the next five years, while the former expects pollution levels to remain stable. Additionally, unwilling respondents are more likely to perceive no significant seasonal or weekly variation in pollution levels, despite rating local and regional air quality more negatively than willing respondents.

Respondents willing to engage report greater awareness of health risks and are more likely to indicate having experienced pollution-related health problems. They identify multiple pollution sources, including traffic, industrial emissions, dust, and wildfires. Beyond health impacts, they recognise broader consequences for quality of life, biodiversity, agricultural production, mental well-being, daily activities, climate change, infrastructure degradation, and life expectancy. Conversely, respondents unwilling to participate appear more detached from the perceived impacts of air pollution, often viewing associated risks as affecting distant regions rather than their immediate environment and their closest family and friends. In contrast, willing participants demonstrate greater awareness of the links between air pollution, socioeconomic inequalities, environmental hazards, and the urgency of mitigation policies. This awareness is reflected in their stronger support for behavioural change, including increased use of public transportation, remote working, reduced air travel, adoption of electric vehicles, and soft mobility practices. They also acknowledge citizens’ shared responsibility in protecting vulnerable populations such as children and older adults. In turn, those unwilling to participate tend to prioritise economic growth and job creation over pollution mitigation and view environmental protection primarily as a governmental responsibility rather than a civic duty.

Information sources use patterns also differ significantly. Willing participants consult a broader range of sources, including newspapers, radio, specialised websites, and conferences or seminars. They are also more likely to attribute responsibility for improving air quality to a diverse set of actors, including industries, governmental bodies, citizens, and scientific institutions. Political behaviour further distinguishes the groups. Respondents willing to participate are more likely to consider air pollution and other environmental issues when voting in local, national, European, and presidential elections. Interestingly, although they are more critical of governmental efforts to address air pollution, they also demonstrate a stronger interest in the topic. In contrast, unwilling respondents frequently report a lack of time or knowledge and maintain that air pollution mitigation should be managed exclusively by public authorities. Among those willing to participate, the primary motivations for engagement include a sense of civic duty, concerns about health and quality of life, environmental protection, and the belief that local residents possess contextual knowledge relevant to decision-making. Nevertheless, participatory preferences tend to be relatively passive: most favour responding to surveys or receiving information at home. Fewer express willingness to attend meetings with responsible entities, participate in awareness and education campaigns, or join non-governmental organisations focused on air quality issues

## 4. Conclusion

This study demonstrates that willingness to participate in air pollution-related decision-making is not evenly distributed across the population but is strongly shaped by socioeconomic position, age, place of residence, and perceptions of risk. Individuals who express greater awareness of health impacts, environmental inequalities, and the broader societal consequences of air pollution are significantly more inclined to engage in governance processes. In contrast, those who perceive pollution as distant, stable, or primarily the responsibility of governmental authorities tend to remain disengaged. These findings highlight the central role of social perceptions and lived experiences in shaping civic engagement, reinforcing the argument that environmental governance cannot be detached from questions of social vulnerability, knowledge access, and everyday practices.

At the same time, the results reveal an important paradox: even among those willing to participate, preferred forms of engagement remain largely passive. This suggests that while awareness and concern are necessary conditions for participation, they are not sufficient to ensure active civic involvement. Effective air quality governance, therefore, requires not only technological and regulatory advances but also inclusive participatory mechanisms tailored to different social groups, particularly those in more vulnerable contexts. Strengthening environmental literacy, fostering trust in institutions, and creating accessible, meaningful opportunities for engagement are essential steps toward more socially responsive and democratically grounded air pollution mitigation strategies.

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