

Reviewers' comments – responses

Compared to the version presented at the preliminary defense, the candidate has taken into account the comments and recommendations I previously provided. The dissertation has been substantially improved and restructured into a coherent and consistent whole. The sections that were previously subject to criticism have been revised in an appropriate and satisfactory manner.

Thank you very much for this positive assessment. I sincerely appreciate the time and care the reviewer devoted to evaluating the revised work, and I am glad that the changes made since the preliminary defence are seen as having brought the dissertation together into a more coherent and consistent whole, with the previously raised concerns addressed in a satisfactory way.

Significance of the Topic, Problem Statement, and Research Objectives

The topic of the dissertation is highly relevant and timely. With global urbanisation expected to reach approximately 68% by 2050, cities will play a central role in addressing climate change challenges. In this context, the dissertation identifies a clear research gap: although many cities have developed climate mitigation and adaptation plans, these remain highly diverse, fragmented, and difficult to compare across contexts.

The dissertation positions itself appropriately within this gap. Its main contribution is the development of a structured framework for categorising, analysing, and comparing climate actions at the urban scale. This is particularly important because existing research tends to focus on isolated sectors such as energy efficiency, transport, or flood management, while relatively few studies attempt to integrate these action types into a comprehensive analytical system. The overall objective of the research—to develop an analytical and practical framework supporting cities in designing and evaluating climate strategies aligned with sustainable and resilient development—is clearly formulated and justified.

The dissertation is structured into four main parts that follow a clear analytical logic. The first part focuses on the categorisation of urban climate actions. Based on the analysis of 99 SECAP reports, the candidate applies text mining and exploratory methods to identify recurring patterns and develops a structured classification of climate actions. This provides a systematic foundation for the subsequent analyses. The second part investigates the role of public awareness in urban climate action. Here, the research examines how awareness-raising measures and education levels relate to environmental outcomes. Using statistical analysis, the candidate explores the connections between public awareness, air quality, and emission indicators, highlighting the importance of social factors in climate strategies. The third part presents the development of a data-driven decision-support model. Using a large dataset of European climate action plans, the candidate constructs a decision tree model that links city characteristics to recommended climate actions. This approach allows for the identification of suitable strategies tailored to different

urban contexts and supports evidence-based decision-making. The fourth part addresses the environmental impacts of construction materials used in climate action projects. It applies a life-cycle assessment approach to quantify material use and evaluate key

environmental indicators, such as global warming potential. The analysis compares different types of interventions and highlights the trade-offs associated with material choices, thereby contributing to a more comprehensive evaluation of climate actions.

The four research questions (RQ1–RQ4) are relevant and cover important dimensions, including public awareness, decision-support systems, and material impacts. The research questions closely connected to the 4 main research topic discussed in the dissertation.

Thank you very much for this thorough and generous appraisal of the topic, the research gap, and the overall structure of the dissertation. I am grateful for the time the reviewer invested in engaging so closely with each part of the work.

I am pleased that the relevance and timeliness of the subject come through clearly, and that the dissertation is seen as positioned appropriately within the identified gap, particularly in its attempt to bring together action types that the existing literature usually treats in isolation, rather than within a single integrated analytical system. I am also glad that the overall objective is regarded as clearly formulated and justified.

It is especially encouraging that the four-part structure is seen to follow a coherent analytical logic, with each component, the categorisation of urban climate actions, the role of public awareness, the data-driven decision-support model, and the material-centred environmental assessment, building on the previous one, and that the four research questions are considered relevant and well connected to the main topics of the work. I sincerely thank the reviewer for this careful and constructive reading.

Literature Review and Theoretical Background

Overall, the literature review demonstrates extensive reading, and it provides a comprehensive and well-structured overview of the existing research on urban climate change and climate action planning. It covers key thematic areas, including climate impacts in cities, urban governance challenges, the role of international initiatives such as the Covenant of Mayors, and the increasing importance of data-driven and computational approaches.

Thank you for this positive assessment of the literature review. I appreciate the reviewer's careful reading, and I am glad that the breadth of the material is recognised and that the overview is seen as comprehensive and well organised across the main thematic areas, from climate impacts and governance challenges in cities to international initiatives such as the Covenant of Mayors and the growing role of data-driven and computational approaches.

Research Structure and Organisation

A clear research plan and workflow diagram at the beginning of the dissertation helps the reader to identify the key challenges in the researches of the dissertation. The structure and organisation of the dissertation are clear, logical, and well aligned with the research objectives. The dissertation follows a coherent progression from problem identification through methodological development to the presentation and discussion of results.

Thank you for this positive feedback. I am glad that the early research plan and workflow diagram serves its intended purpose of orienting the reader to the key challenges addressed in the work, and that the overall structure is seen as clear, logical, and well aligned with the research objectives, following a coherent progression from problem identification through methodological development to the presentation and discussion of the results.

Data and Methodology

The methodology section presents several strong elements. The data and methods applied in the dissertation are comprehensive, well-structured, and appropriate for addressing the research questions. The study is based on a combination of diverse data sources, including published SECAP reports, international databases, and project-level documentation, which ensures a solid empirical foundation. The methodological framework integrates several approaches, including text mining for the systematic analysis and categorisation of climate action plans, statistical analysis for examining the role of public awareness, and machine learning techniques—particularly decision tree modelling—for the development of a data-driven decision-support tool. In addition, the research incorporates a material-based environmental assessment using life cycle assessment (LCA) principles, allowing the comparison of environmental impacts across different climate action projects.

Thank you for this positive assessment of the data and methodology. I am pleased that the empirical foundation is regarded as solid, drawing on a combination of published SECAP reports, international databases, and project-level documentation, and that the methodological framework is seen as comprehensive and well suited to the research questions. It is encouraging that the integration of different approaches, text mining for the categorisation of climate action plans, statistical analysis of the role of public awareness, decision-tree modelling for the data-driven decision-support tool, and a material-based assessment grounded in life-cycle-assessment principles, is recognised as a coherent way of addressing the four components of the work.

Results and Discussion

The results section presents several interesting findings, which are well supported with connected scientific publications.

Although connecting to the preliminary defense, I found the comparison between countries due to the differences in climate and development levels still weak. Although the comparison of the three countries (Germany, Brazil, and Kenya) provides an illustrative perspective on the relationship between climate conditions, education, and public awareness. Though, from a

methodological point of view, this part of the analysis remains relatively weak. The small sample size, limited to only three countries, significantly constrains the robustness and generalizability of the findings. In addition, the analysis is conducted at the national level, while the overall focus of the dissertation is on urban climate action, which introduces a certain inconsistency in scale.

Furthermore, the selected countries differ substantially in multiple socio-economic, climatic, and structural aspects, making it difficult to isolate the specific effect of public awareness or education on environmental outcomes. As a result, the observed relationships cannot be interpreted as causal, but rather as descriptive associations. Although the candidate appropriately acknowledges these limitations, the conclusions drawn from this comparison should be treated with caution.

Despite these weaknesses, this section still plays a useful role within the dissertation by highlighting the potential importance of social factors in climate action and by providing a conceptual motivation for the inclusion of public awareness in the broader analytical framework. The part of the dissertation focusing on European cities and the application of decision tree modelling represents one of the core analytical contribution of the work. Based on a large dataset of urban climate action plans, the candidate develops a data-driven model that links city characteristics to the selection of climate actions. The use of European cities provides a sufficiently diverse and well-documented empirical basis, allowing for meaningful pattern identification.

Material-Based Climate Action Analysis

The most developed and convincing part of the dissertation is the analysis of environmental impacts based on construction materials. This section is well-structured, methodologically sound, and clearly presented. The use of life cycle assessment (LCA) provides a strong analytical foundation, and the comparison between modelled and experimental results is particularly valuable.

Thank you for this detailed and balanced assessment of the results. I appreciate the reviewer's close engagement with each part of the analysis.

Regarding the cross-country comparison, I fully accept the concerns raised. The reliance on only three countries, the national scale of the indicators against the urban focus of the dissertation, and the substantial socio-economic, climatic, and structural differences between the cases all limit what can be inferred, and for these reasons the relationships are presented as descriptive associations rather than causal effects, to be read with caution. I am glad that, despite these limitations, the section is still seen as serving a useful purpose, drawing attention to the potential role of social factors and providing the conceptual motivation for incorporating public awareness into the broader framework. I am also encouraged that the European-cities analysis and the decision-tree modelling are recognised as a core analytical contribution, supported by a sufficiently diverse and well-documented empirical basis, and that the material-based

environmental assessment is regarded as the most developed part of the work, with the comparison between modelled and experimental results seen as particularly valuable. I sincerely thank the reviewer for this thorough and constructive evaluation.

Overall Evaluation of Research Contributions

Among the three research results, the second and third (decision-support tools and material-based evaluation) are well developed and scientifically convincing. The first (public awareness and environmental impact) is less robust and would require further refinement.

Overall, the dissertation contains valuable contributions but lacks coherence in its current form. It appears to combine several promising research strands that are not fully integrated into a single framework.

Thank you for this candid overall assessment. I am glad that the decision-support modelling and the material-based evaluation are seen as well developed and scientifically convincing, and I accept the view that the public-awareness component is the more exploratory of the strands and the one most open to further refinement, consistent with the limitations stated for that part of the work. On the question of coherence, I appreciate the reviewer's perspective. The intention behind the four components is to follow a single logical progression, from categorising urban climate actions, to understanding the factors that support them, to guiding their selection, and finally to evaluating their material impacts, and the workflow diagram, the four aligned research questions, and the summary linking the questions, assumptions, and theses were introduced to make that connecting thread more visible across the strands. I am grateful for this feedback, which I take as a valuable reflection on how the integration of these components can continue to be strengthened.

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