An interactive visualisation tool for circular economy and building materials recovery

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**Summary:** *Construction materials represent the largest material stock accumulated in modern society. The unprecedented growth of material stock is directly linked to high resource and energy consumption, demolition of waste discharges, and is correlated with the increased embodied energy and the associated CO2 emissions. Governments in Europe are looking for possibilities in the construction sector to replace raw materials with secondary resources through reuse and recycling by transitioning to a circular economy. But for cities, the practical aspects of the initiative remain challenging in multiple aspects. This work aims to introduce a visualization tool for built environment material stocks and flows to support circularity enabling recycling and reuse of these materials in existing buildings and infrastructures. The recovery of building materials in the circular economy requires map-based visualization tools through which statistical analyses can be made on buildings or groups of buildings. For this, it is necessary that the visualization tool contains API links to real building inventory data from local public authorities and advanced functions of real-time analysis of the attribute table and geospatial data.*

**Keywords:** circular economy, building material, stocks and flows, visualization tool, reuse and recycle.

# Motivation and Description of Work

Over the past century, global material stocks have increased dramatically, driven by extensive resource consumption, energy use, and the generation of demolition waste [1]. This accelerating trend underlines the necessity to adopt circular economy (CE) strategies aimed at optimizing resource utilization, reducing greenhouse gas emissions, and mitigating environmental degradation. Therefore, the visualization tool presented in this paper aims to enhance decision-making processes and support the transition to a circular built environment by improving and expanding existing, validated tools and frameworks. The focus will be on strengthening the recycling and reuse of materials within existing buildings and infrastructure, through a co-creation process [2] and a living lab participation approach [3] to engage stakeholders and tailor outputs to their specific needs.

# Results

The main scope is to develop and deploy a visualization tool for built environment material stocks and flows and provide tailored software solutions to cities to support circularity with the focus on reuse and recycling. Figure 1 presents the detailed architecture of the visualization tool developed in CREATE project.

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| Fig. 1.Architecture of the CREATE visualization tool |

During the last months, several activities were perfumed for the development of the tool: setting up the technologies used, development environment and version control system, plan and define the database structure, setting up the database server, etc. Figures 2-3 present the functionalities of the visualization platform. As future work we envision integration of datasets and APIs from the municipalities and urban living labs involved in the project to enhance the results and functionalities of the tool.

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| Fig. 2. Selection the area of city | Fig. 3. Building information in the selected area |

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### References

1. F. Krausmann, D. Wiedenhofer, C. Lauk, W. Haas, H. Tanikawa, T. Fishman, A. Miatto, H. Schandl, H. Haberl, “Global socioeconomic material stocks rise 23-fold over the 20th century and require half of annual resource use”, Proceedings of the National Academy of Sciences. 114. 201613773, 2017. 10.1073/pnas.1613773114
2. C. J. A. M. Termeer, T. A. P Metze, “More than peanuts: Transformation towards a circular economy through a small-wins governance framework”, Journal of Cleaner Production, Vol. 240, 2019, <https://doi.org/10.1016/j.jclepro.2019.118272>.
3. R. Dekker, J. Contreras, A. Meijer, “The Living Lab as a Methodology for Public Administration Research a Systematic Literature Review of its Applications in the Social Sciences”, International Journal of Public Administration. 43. 1-11, 2019. 10.1080/01900692.2019.1668410.