

## Key performed indicators to assess sustainability level in cities

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This research study uses indices of municipal solid waste management to assess urban sustainability. In particular, three indicators were developed for three municipalities in the Attica Prefecture, namely Piraeus, Vyronas, and Nea Smirni, based on the drivers, pressures, state, impact and response model of intervention.

The sustainability indicators developed were; a) the Municipal Solid Waste Production Indicator which reports the ratio of the amount of municipal solid waste to the municipal population at a specific point of time, providing a measure of the average waste quantity, b) the Municipal Solid Waste Composition Indicator which reports the most known materials included in the total amount of municipal solid waste weight, providing information on the economic and ecological utility of the waste, in addition to the disposal methods, and c) the Municipal Solid Waste Recycling Indicator which compared the weight of recycled municipal solid waste to that of the total municipal solid waste produced.

The findings revealed that MSW in Greek cities has decreased in recent years, indicating a persistent lower trend that might be compared to that of per capita incomes in Greece as a result of the country's prolonged economic austerity. Recycling has also become efficient in the cities of Attica Prefecture over the previous decade, with rates considerably below the EU's targets, which could help to explain the drop. The findings of this study also reveal that the economic crisis has had a substantial negative influence on sustainability indices, with the exception of a significant reduction in waste, which is, of course, a vital parameter for urban sustainable development. It should, however, not be directly linked to the increase in recycling or improved waste management but to the loss of income and the increase of unemployment which affect consumer habits. After all, sustainable development is directly linked to municipal waste management policies, focused towards a circular economy.

The usual practice of municipal solid waste management is disposal in the Sanitary Landfill of Fili in Attica, and recyclable materials are subject of the recycling service enterprises tasked by each municipal authority. The composition of municipal solid waste does not differ greatly, but it certainly changes over time. Data on the composition of municipal solid waste is subject to estimates based on national composition calculations. When the three local municipal waste plans are compared, it is noted that they are -strangely enough- quite similar, that they are mostly developed with estimation methods -subject to a large margin of error-, and that they tend to present similar projections. Without further inquiry or assessment of the handling capacity, the regional objectives set, reflect the objectives set by the Hellenic National Waste Management Plan.

Because the regional waste management plans are not mandatory, they do not aim for any form of efficient, effective, or sustainable waste management, and should be considered as a guide, or plan adjusting European regulations. In addition, the lack of a centralized national waste data system, makes the collecting of credible statistics and information a difficult task, putting solid waste management targets, assessments, and results -conveniently- all into question.

The findings of the current research are particularly valuable for policymakers and local governments in implementing activities linked to sustainable urban development and circular economy strategy.

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