## Accepted Manuscript

A Systematic Life Cycle Thinking Approach to Develop Sustainable Municipal Solid Waste Management Systems for Developing Countries



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## ACCEPTED MANUSCRIPT

| 1           | A Systematic Life Cycle Thinking Approach to Develop Sustainable                                   |
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| 2           | Municipal Solid Waste Management Systems for Developing Countries                                  |
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| 7<br>8      | Abstract   |
| 9           | Waste management (WM) is a complex sustainability issue because of its intrinsic association with  |
| 10          | many environmental and economic drivers. Addressing this issue requires clear vision,              |
| 11          | consideration of the waste life cycle, integrative approaches, and implementation of best-practice |
| 12          | WM systems. Therefore, this research aims to present an approach to sustainable management of      |
| 13          | municipal solid waste in developing countries through systematic life cycle thinking. The study    |
| 14          | examined the practices in Lebanon as a case study of uncontrolled disposal. The environmental      |
| 15          | impacts of Lebanon's waste disposal were evaluated to better understand their serious threats. In  |
| 16          | the next step, 30 alternative WM systems of waste handling were designed. They were assessed       |
| 17          | for their environmental and economic benefits to demonstrate the proposed approach of              |
| 18          | developing WM systems and selecting alternatives. The results showed that recycling coupled with   |
| 19          | composting notably reduces the environmental impacts. It also showed that different waste          |
| 20          | compositions play a major role in the environmental performance of a WM system, and therefore,     |
| 21          | they should be considered when developing WM plans. In this regard, high fractions of organic      |
| 22          | waste are associated with multiple environmental impacts. Such organic waste levels create a       |
| 23          | challenge for making better use of recycling due to the high amounts in developing countries.      |
| 24          | Overall, the study concluded that sustainability of WM is a broad concept and should be defined    |
| 25          | at the local level, with the most pressing environmental issues addressed by each country.         |

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