The current system of waste collection and transport in Albania is mostly municipal, if implemented. This means that, in the best case, each municipality’s (LGU) manages its collection in an individual way and is transporting its waste to, most of the time, landfills not conform to the norms. This procedure will not be accepted by the new norms and therefore the waste will have to be sent to regional landfills. The main goals of this project are therefore to minimise the costs of the waste management system by:

- located an optimised number of transfer stations
- organising the waste collection at a sub-regional scale
- developing a methodology to apply the optimisation to the whole country
- determining an efficient sustainable solution for the waste management system

The methodology developed follows 6 main steps:

- Definition of the objectives, identification of the scenarios, data and software requirements, data collection
- Data processing in a GIS software
- Computation of the optimisation model in Xpress
- Global and detailed costs calculation in Matlab/Octave
- Interpretation and conclusion
- Sensitivity analysis in Matlab/Octave

The most important part in terms of cost reduction corresponds to the location of an optimal number of transfer stations.

## Scenarios

### Scenario 0 : Reference
- Each municipality collects its waste and goes directly to the landfill
- In practice, the waste is not always transported to the landfill
- Clearly economically unsustainable solution
- Used as reference scenario to compare with the optimised solutions

### Optimised scenarios
- Transfer stations responsible for the waste collection of its assigned municipalities
- Landfill responsible for the collection of the waste at the transfer stations and for the collection of the close enough LGUs

### Scenario 1 : Implementation of transfer stations

#### Variant A:
- No compaction at the transfer station
- Big transportation trucks, small waste density

- Advantages
  - Simple implementation
  - Little maintenance
- Drawbacks
  - Big trucks needed
  - Road damage

#### Variant B:
- Compaction with self compactor containers
- Smaller transportation trucks, high waste density

- Advantages
  - Smaller trucks
  - Longer life time of landfill
- Drawbacks
  - Higher maintenance costs

### Location of the transfer stations
- Optimal number of transfer stations : 5

- Transfer stations in the municipalities of :
  - Lezhë, Rrëshen, Koplik, Pukë, Shkodër

- Continuous maintenance of the trucks and containers to increase their lifetime
- Recycling at the source of half of the organic waste could decrease the new system’s cost by 25 
- Based on field observations, implement an efficient routing system for the waste collection between the grouped municipalities

### Cost per inhabitant before optimisation

<table>
<thead>
<tr>
<th>Sc.</th>
<th>No compaction</th>
<th>Self compactor cont.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost with investment</td>
<td>- 39 %</td>
<td>- 40 %</td>
</tr>
<tr>
<td>Operating cost</td>
<td>+ 25 %</td>
<td>+ 24 %</td>
</tr>
<tr>
<td>Transportation cost</td>
<td>- 57 %</td>
<td>- 58 %</td>
</tr>
<tr>
<td>Collection cost</td>
<td>- 63 %</td>
<td>- 65 %</td>
</tr>
<tr>
<td>Percent reduction in cost per inhabitant - Variant B</td>
<td>- 73 %</td>
<td>- 73 %</td>
</tr>
</tbody>
</table>

### Average costs reduction on a yearly basis

- The total cost per year is lowered in average by 40 % with the optimisation solutions developed
- Implementation of the 5 transfer stations required
- Inter-municipality organisation necessary
- Best solution for the long term : transfer stations with self compactor containers
- Recycling of half of the organic waste at the households could reduce by another 25 % the costs of the waste management system

### Conclusions

- Scenarios 1 and 2 are economically sustainable solutions
- Scenario 2 requires a higher investment cost, but it is compensated by cost savings in the operating costs
- Scenarios 1 and 2 are recommendations for the future development of the waste management system in Albania

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