CALCULATING THE COST FOR SOLID WASTE MANAGEMENT AT LOCAL GOVERNMENT UNIT LEVEL IN ALBANIA

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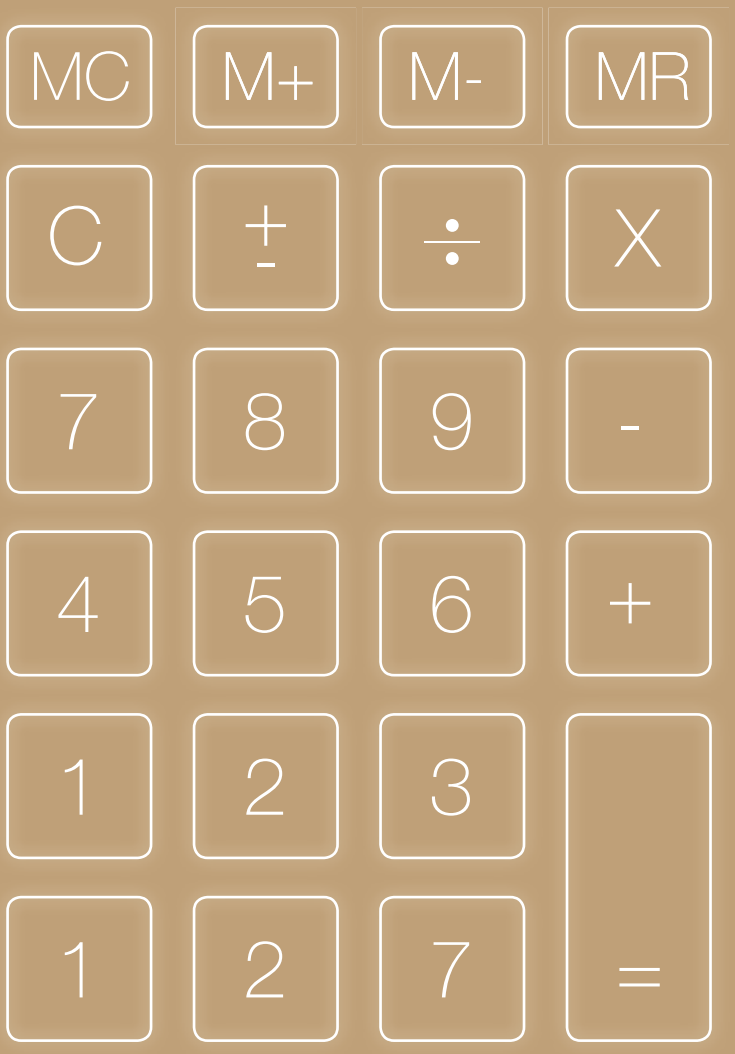

guideline

on calculating the costs for Solid Waste Management at Local Government Unit level in Albania

April 2013

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Content

1. Introduction

Waste management is a service based on tariff, which in principle is offered to the every "client" able to pay for it. On the other side it is an environmental and health protection service, to maintain clean environments and prevent disease. These two elements need to be well managed and positively approached by communities and service providers (i.e. LGUs).

The Albanian legislation, based on European standards, requires from the administrators to provide a quality service for the citizens and protect the environment at the highest quality scale. This implies an efficient infrastructure and financial mechanisms which are able to address the need and be affordable for the community.

The general provisions of the legislation[1] require from the LGUs to collect, transport, treat and dump in safe way the solid waste produced by the "clients". These provisions do not allow the establishment and operation of non-sanitary dump-sites, by putting fines for such activities, considering them illegal.

The use of modern infrastructure and facilities is a must. Each service provider (i.e. LGU), shall seek for Best Available Technologies and smart systems, considering its financial possibilities.

All above mentioned issues are related to the financial requirements for management. LGUs have to act smart and based on efficient schemes, to address the cost. A complete cost calculation will help the LGU to determine its budget, to evaluate the possible savings and develop cost recovery strategies.

All related costs can be divided in two major groups:

a) **internal costs, which are to be managed by the LGUs, for the collection, transport, investments and maintenance; and**

1 National Waste Strategy and Action Plan 2011;
Law No. 8652, date 31.7.2000 "On the Organization and Operation of Local Government;
Law No. 10 463, date 22.9.2011 "On Integrated Waste Management"

b) shared costs, reflecting facilities used by different LGU. For example, landfilling.

The aim of this guideline is to demonstrate how these costs are developed and can vary according different variables in the organization of the service. Understanding these variations will serve to the LGU on calculating internal and external costs, use of technology and the benefit of cost efficiency strategies.

The guideline provides theoretical knowledge on the development of a cost calculation model developed in Excel based system. Such a model, fully functional is developed and treated throughout this paper, in the form of knwoledge gain, reference and full appearance in the Annex chapter.

Annexes in this publication show sample of the fully developed system in Excel format, which can be used in electronic form from the local administrations. It comes the first and unique tool for LGUs. The model in Excel program provides both knowledge of the operation, as well as immediate figures for every aspect of solid waste management.

Inside this edition, you will find references made to the model. These references can be found in the annexes of this publication, but may be used in an interactive electronic model developed.

2. General provisions of the calculation model

A standard waste management cost calculation system for a single LGU has to be based on the following overall clusters[2]:

- **General data on the administrative area**
- **Capital Investments (trucks and bins required)**
- **Operating costs (maintenance, transport and personnel)**
- **Cost for landfill (gate fee)**
- **Amortization (re-invest) costs**
- **Administrative costs**

All above clusters and related elements which populate them, are framed in a Excel based system (refer to the annexes for a detailed explanation of the system) as a smart system, which is able to provide all related infrastructure, human and financial assets required for running the management system.

Each of this clusters are explained in details below, on their use and interactivity. The Waste Management Manager will be able to use the system and understand how is developed so to be able to interpret the results and to develop it further based on the changes in variables and standard costs.

2 Further modeling can include: **Prevention**, amount of waste in percentage, which is reduced at source; **Reuse** and **recycle**, amount of waste which is channeled outside the overall cost system; **Remediation**, related to the closure of current dumpsites or other contaminated sites. The LGU might seek external funds or develop public-private partnership schemes to address these aspects.

Box 1: Before you start

Before you start using a cost management system, a set of data has to be collected, which relate to population, geography, road types and conditions (potentially a GIS map, or may use Google maps), truck types, bin types, actual fuel costs, salary system. A modern data collection would be based on benchmarking system, which can be developed in small-scale at local level. Waste management plan is crucial before starting to calculate costs, as it would provide most of the technical and infrastructure information required for the system variables.

Most data can be collected by referring to the existing national and regional strategies, databases, references and reports, while some of them, such as amount of waste per capita, road distances and conditions, number of waste producer units, have to be calculated and may require overviews and assessments.

2.1 General data on the administrative area [CLUSTER 1]

The purpose of this cluster is to evaluate the situation and assess needs for capital investments, operations, personnel and other administrative issues.

The main variables used for this cluster are: a) type of the LGU; b) no. of population, c) Visitors and tourists d) road distances, e) amount of waste produced.

Hereinafter, we provide an explanation of the variance of each variable:

a) Type of LGU. It considers the explicit division of LGUs into Urban, Rural. This variable is important for determining (based on National Waste Strategy and experience) the amount of waste produced, type of trucks, distances, personnel and all related costs to these.

b) Population (No. of inhabitants). A typical population of a LGU will consist of resident inhabitants and seasonal inhabitants (tourists/visitors) , which have to be considered separately. The number of residents can be estimated through the civil register. But there are examples of registered inhabitants, who are not actually living within the administrative area of the Unit (such as emigrants, students, etc.) and should not be considered in the calculation.

In the model (refer to the annexes), you will see how we deduct from the registered inhabitants those not living in the area by applying an average percentage, based on the knowledge of the LGU.

c) Visitors and tourists (No. of daily visitors). These waste producers have to be considered separately, since they are only present in a specific period of the year. The consideration of this population should be limited to LGUs for whom the touristic season has a significant impact on the waste management. These ones should provide the daily number of visitors and the months of the touristic season.

Box 2: Visitors and tourists

The calculation of the number of tourist/visitors, which can vary from thousands (historic, nature sites) to hundreds of thousands (sea side resorts, mass tourism), must be calculated separately, so not become a burden for households.

A separate system for managing the solid waste produced during the heavy touristic season has been developed to identify the related costs which should be billed to tourists. These costs are considered as additional costs.

d) Road distance and conditions (in km). Normally a collection truck has to visit all the administrative area (points of collections), by traveling around until the truck is full, then driving to the landfill and come back, which can relate to a shift or completion of the collection service. The road conditions are very important as this will primarily relate to the consumption and amortization costs and furthermore to the time spent for collection. Paved roads would improve the collection service very much. Distances to consider are:

1) **Distance in collection to fill one truck**

2) **Distance in transport to go to the landfill when the truck is full, and come back**

d) Amount of waste produced (kg/capita). This constitutes a real variable, which keeps updating based on the site verifications. Based on the studies, the amount of waste per capita varies from 0.6kg/capita in rural areas to 0.8-1kg/capita for urban areas. There are exceptions for the LGUs with very low number of population and located in very remote areas, where this number must be verified and can result lower than 0.3kg/capita, and for very urban areas, where this figure could be more than 1kg/capita.

All above figures relate to solid waste, not including hazardous, farming, debris and bulky waste, which have to be treated separately based on standards for operations.

As a first estimation, it is suggested to consider an average number of waste productions per inhabitant, embracing the whole production of the LGU, including the production of households, institutions and businesses.

The amount of waste per capita is the most important figure which affects the whole system. Therefore the LGU should verify the real production by weighing the waste based on a plan.

Tab. 1 - Use the table below to build this cluster of the cost calculation system [TC 1]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**LGU Name**	*NA*	Indicative	NA
B	**Collection frequency (nb of collection per week)**	*number*	Exact number	This is calculated based on the amount of waste produced and is usually operated 2 or 7 days a week
C	**Type (Rural, Urban)**	*PA*	Text	Use Urban or Rural as by law. The difference between these types defines the variables and standards of operations.
D	**Population (registered/ cencus)**	*number*	Exact number	Provide the number as by census, despite the factual number of whole year residents.
E	*% of population to be excluded (registered, but living outside)*	*%*	Exact number	The number of population excluded is usual emigrants staying for more than a half of the year outside the administrative area
F	**Population served (receiving/considered for the service)**	*number*	Variable	This is calculated by the formula D-E. Deducting the number of population excluded from the population by census.
G	**Road (distance from Landfill one way)**	*km*	Exact number	Usually the landfill remains the same for years.
H	**Road (distance during collection for one shift for one truck)**	*km*	Exact number	This is calculated based on the field measurements, by measuring the total distance covered by the truck until is full

Ref.	Figure name	Measuring unit	Use of the figure	Comments
I	**Waste produced per person standard**	kg/inh	Exact number	Use standards provided by the plans, but be vigilant to verify the consistency of the data
J	**Total waste produced**	*t/day*	Variable	Calculated by formula D * I/1000 so to produce results in total per kg
K	**Total waste produced between 2 collections according to frequency**	*t*	Variable	Calculated by formula. If the collection is every day than the figure is equal with J, otherwise if the collection is 2 days a week, the amount of waste generated in the other days without service is accumulated.
L	**Total waste produced in a year**	*t/year*	Variable	**Calculated by formula J * 365 days**

2.2 Capital Investments [CLUSTER 2]

The purpose of this cluster is to establish the basic physical infrastructure of waste management (trucks and bins). This is based on the data gathered in the first cluster, which will address the need for collection and transport of the generated solid waste.

As a first step, we need to calculate how many trucks and bins are required to manage the waste properly. The purchase of these equipments represents the capital investment.

The variables used in this part of the system are: a) shifts b) waste collection truck; c) bins.

Starting from this cluster, it will be possible to calculate the operating costs (next chapter).

Here we provide an explanation of the variance of each figure:

f) Shifts (No.). This represents the number of "tours" a truck can do in one day, including collection and transport to the landfill (go and return), according to the quantity of waste to collect. It is usually more efficient to perform minimum 2 shifts with one truck.

a) Waste collection truck type (tons) and **price** (lek). The typical waste collection and transport trucks are self-compactor of 5t and 10t capacity. These trucks are suggested to be used based on the population of the unit. By default a rural area would use a 5t type while an urban one a 10t type. The number of trucks will vary based on the amount of waste to be collected, and the number of shifts

considered for each truck. The actual loading capacity for a typical waste composition is about 85% of the total carrying capacity.

b) Bins capacity (ton) and **price** (lek). A typical bin would be a 1.1m3 volume bin, which has a capacity of about 0.10 tons of solid waste, if we consider a general density for waste of 0.11 ton/m3 . This density was measured in Shkodra during a weighing campaign in 2009 and is subject to variation according to the waste composition. A bin capacity is depending on its size (volume, m3) and on the specific density of waste in the bin. The given figures can be used as a first estimation. The number of bins needed is calculated considering a limited use to household waste. Other kind of waste like farming waste, demolition waste or any other "big" waste should be excluded and eliminated by the producers themselves.

Tab. 2 - Use the table below to build this cluster of the cost calculation system [TC 2]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Truck type**	*ton*	Exact number	Typically here will appear a truck type 5t or 10t. The use of this figure is indicative.
B	**Truck capacity**	*ton*	Exact number	Calculated 85% of the carrying capacity (85% * A)
C	**Shifts**	*number*	Variable	Calculated by formula. It considers the amount of waste produced (T1C1-K) and the truck capacity, for producing 1 or 2 shifts a day
D	**Trucks (quantity)**	*number*	Variable	Calculated by formula, considering the amount of waste produced and number of shifts. For large LGUs (more than 50.000 inhabitants) one replacement truck is necessary to keep operations ongoing.
E	**Bin capacity**	*ton*	Variable	Typical bin of 1.1 m3 can carry up to 0.10 t of solid waste. But the figure is subject of supervision as the type and density of waste determines the mass.
F	**Bins (total)**	*number*	Variable	Calculated by formula, considering the amount of waste to be collected and the carrying capacity of the bin.
G	**Truck costs (all trucks)**	*Lek*	Variable	Calculated by the formula, considering the price of one truck (the price comes from the market. It might be a new or a used one.) multiplied by the number of trucks

Ref.	Figure name	Measuring unit	Use of the figure	Comments
H	**Bins costs (all bins)**	*Lek*	Variable	Calculated by the formula, considering the price of one bin (the price comes from the market. It might be a new or a used one.) multiplied by the number of bins
I	**Total investment costs**	*Lek*	Variable	**Calculated by the formula (G + H)**
I	**Total investment costs**	*Lek*	Variable	**Calculated by the formula (G + H)**

2.3 Operating costs [CLUSTER 3]

The purpose of this cluster is to calculate the costs related to the infrastructure maintenance (related to trucks and bins) and to the transport, including personnel cost. These are yearly costs and are important to keep separate because are strongly related to market changes and inflation.

The main variables used for this cluster are a) yearly days in operation; b) fuel cost

Here we provide an explanation of the variance of each figure:

a) Yearly days in operation. Considers the number of days in one year when the waste collection is performed. It depends on the frequency of collection (2 times a week or 7 times a week). This is highly related to the amount of waste to be collected. Basically if there is a production of about 3.5t of waste per day, there is a need for daily operations,. For those producing less than 3t/day the collection might be arranged one per 2 or 3 days, in which case an appropriate number of bins must be allocated to receive the waste produced. Based on expereince we consider two options: 7 or 2 collections a week.

b) Fuel cost. Fuel costs highly influence the overall costs of the waste management. The fuel consumption must be highly supervised and a good plan of routing, efficient collection and transport is a must. In addition fuel is subject of international changes and country inflation. The administrators have to calculate the multiyear changes in the price of fuel and address it properly.

2.3.1 Maintenance costs [Cluster 3a]

The main variables used for this cluster are: a) truck maintenance; b) mechanical maintenance; c) parking.

Here we provide an explanation of the variance of each figure:

a) Truck maintenance (Lek). All vehicles are subject of regular maintenance required by the legislation, and related to oil change, tire change and other necessary maintenance works. The costs related to trucks are very high and a good maintenance plan must be part of the administrative manual. Furthermore, insurance and tax expenses have to be calculated yearly and integrated in this variable.

b) Mechanical maintenance (Lek). This is based on the truck working hours. The mechanical maintenance is closely related to road conditions and use of the truck during daily operations. A proper training and support must be provided to the operating staff so to ensure that these costs keep at the lowest level.

c) Parking (Lek). The LGU is suggested to use its own land to establish a parking station. There will be always costs related to parking maintenance, internal operations, guards, etc.

Tab. 3 - Use the table below to build this cluster of the cost calculation system [TC 3]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Truck insurance + tax**	*Lek/truck/year*	Exact number	The figure comes from the national tax standards for the type of truck
B	**Oil + filters**	*Lek/truck/year*	Exact number	The figure is determined by the type of truck and the use of the truck in km
C	**Tires**	*Lek/truck/year*	Exact number	The tire change depends on the consumption of the tires and might not be yearly.
D	**Mechanical maintenance**	*Lek/truck/year*	Exact number	The amount of money for the maintenance comes from experience.
E	**Parking**	*Lek/truck/year*	Exact number	The amount of money for parking is based on the parking management costs. If the LGU has its own land, can reduce the cost by having one park for all assets of all departments.
F	**Total maintenance costs**	*Lek/year*	Variable	**Calculated by formula (SUM=A:E) * number of trucks**

2.3.2 Collection and transport costs [Cluster 3b]

The main variables used for this cluster are: a) time spent; b) overall distances; c)fuel consumption

h) Time spent (hrs). There are two different variables used here: a) the time for spent for collection; and, b) time spent for transport to landfill. The use of these figures is different for urban and rural units, and by the type of truck. Typically for the collection time a 5t truck would need 3hrs to complete while a 10t type needs 4hrs. The time spent for transport varies on the distance to the landfill and speed of the truck. At the landfill the trucks would need an extra time to unload of an average 0.3 hrs/shift.

i) Overall distances (km). This calculates the distance in collection and distance to landfill. A good internal system would result very efficient to reduce the overall distances, so therefore, less time and less fuel. The internal routing of the truck is suggested to be studied well in advance, not to cross (if possible) same roads twice.

j) Fuel consumption (lt). The fuel consumption depends on the truck type and the operation times. By experience the consumption for collection for the trucks is respectively: for 5t type = 3l/hr; for 10t type 5l/hr. The consumption during transport for the trucks is respectively: for 5t type = 0.4l/km, for 10t type = 0.5l/km.

In order to be precise and to determine where are the main costs (and savings potential), it is advised to separate the collection costs (when the truck is being filled) from the transport costs (when the truck is full and going to the landfill).

Tab. 4 - Use the table below to build this cluster of the cost calculation system [TC 3]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Days in operation**	*days/year*	Variable	Calculated by formula, based on days in operation, which can be 365 or 108
B	**Time to load one truck at one time - Collection time**	*hrs*	Exact number (for one truck)	Figure based on type of unit (Urban 4hrs, rural 3hrs)
C	**Time collection (total)**	*hrs/day*	Variable	Calculated by formula (no. trucks * time/truck * no. of shifts)

Ref.	Figure name	Measuring unit	Use of the figure	Comments
D	**Time to unload in landfill**	*hrs*	Exact number	Comes from experience (0.3hrs), but improved by measurements
E	**Fuel consumption during collection**	*lt/day*	Variable	Calculated by formula, considering many factors, such as number of trucks, shifts, time for collection, time for landfill and the rate of consumption based on the truck type
F	**Total fuel consumed over the year for collection**	*lt/year*	Variable	Calculated by formula considering the rate of consumption and total time spent for all trucks for collection
G	**Truck speed**	*km/hrs*	Exact number	Depending on the type of truck and it's condition as well as road conditions
H	**Transportation time to landfill**	*hrs*	Variable	Calculated by formula based on the number of trucks, shifts and time spent going to landfill and unloading
I	**Total time spent for transport (one day/all trucks)**	*hrs/day*	Variable	Calculated by formula considering the number of trucks, shifts and distance to landfill * 2 directions
J	**Fuel consumption during transport**	*lt*	Variable	Calculated by formula considering the rate of consumption and total time spent for all trucks for transport
K	**Total fuel consumed over the year for transport**	*lt/day*	Variable	Calculated by formula, considering the total fuel consumed during transport * price of fuel per lt

2.3.3 Personnel Costs [CLUSTER3c]

The purpose of this cluster is to calculate all operation personnel costs, but being limited to only drivers and truck operators. This represents a very critical cluster of the system, a due diligent component, which must address the social aspects and responsible management.

The variables used in this part of the system are: a) personnel; b) working hrs; c) salaries.

Despite the service is in-house or outsourced, the personnel hired must be always supervised by the LGU service administrators to make sure that the company ensures operation efficiency (time, safety, task performance, etc.).

Here we provide an explanation of the variance of each figure:

a) Personnel (Number). This is composed by at least drivers and truck operators. A usual composition is one driver per car and two operators during collection, but in urban areas with more than 50,000 inhabitants there could be one extra worker, (which is not a good practice). the operators should not follow the truck to landfill. In large teams this scheduling will reduce the number of operators needed for the collection, thus reducing the costs.

In the attached model, the number of drivers and workers is calculated considering the number of shifts for one truck, and the legal limitation of working hours per day, and per week. In this scheme, two drivers would share one same truck (one driver could use it in the morning and the other one at night).

There is a need for support infrastructure for the personnel, which included uniforms, collection tools, cleaning chemicals, etc. These costs are part of the administrative costs and are calculated at the end of the calculation scheme.

b) Working hours (hrs). According to the country labor code, an employee must not work more than 48hrs per week, 8hrs of which are considered as higher paid ones as extra hours, and not more than 12 hours per day, 4 of which are considered as extra hrs. So to calculate the working hrs for the personnel the manager must be guided by the need of truck operation to remove the waste generated. The overtime must be avoided when possible, but a good balance between number of shifts, hrs per shift and total working hours for each staff, must be established. If not avoidable, extra costs must be calculated for extra hrs, or if very necessary hire personnel.

In the developed model (refer to annexes), we consider maximum 8 hours per day and 40 hours per week, in order to avoid extra hours.

The working day of the personnel is composed by time for collection, transport, maintenance (cleaning the truck), reporting (daily diary) and meetings/trainings. For the calculation of the cost a distribution between truck operation and maintenance must be conducted.

In the attached model, we consider maximum 7.3% of time spent in maintenance works and an additional 7.7% for holidays time.

c) Salaries (Lek). The salaries are calculated based on the working code, to respect the minimum salary, the rest is subject of type

of work and capacity. Combined to the working hours a salary must incorporate other tasks (other communal services) if the operations are once in three days or less than 4 hours per day for waste management.

Tab. 5 - Use the table below to build this cluster of the cost calculation system [TC 3]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Max working time**	h/day	Exact number	This figure is important for determining the number of personnel so to avoid overtime. Labor code is considered here.
B	**Max number of working days per week**	days/week	Exact number	This figure is important for determining the number of personnel so to avoid overtime. Labor code is considered here.
C	**Maximum weekly working time**	hrs/week	Exact number	This figure is important for determining the number of personnel so to avoid overtime. Labor code is considered here.
D	**Maintenance [% of working time]**	%	Variable	This figure is important for determining the number of personnel so to avoid overtime.
E	**Vacation [% of working time]**	%	Variable	This figure is important for determining the number of personnel so to avoid overtime
F	**Drivers quantity**	Number	Variable	Calculated by formula, considering the maximum time spent for one driver, limited by the shifts and labor code for maximum working hrs (A) and vacations.
G	**Driver salary** (all drivers)	lek/year	Variable	Calculated by formula, considering the gross salary for each driver * number of drivers in operation. The driver's salary is subject of change by the administrator
H	**Workers quantity**	Number	Variable	Calculated by formula base on the number of drivers and a standard of 2 operators for truck with the exception of large LGUs of over 50.000 inh, where a number of 3 operators are necessary.
I	**Workers going to landfill**	Text	Variable	This is important to be determined as Yes or No, as it recalculates the time spent by the workers and increase the time availability for workers. As a good practice, workers should not go to the landfill.

Ref.	Figure name	Measuring unit	Use of the figure	Comments
J	**Workers salary** (all workers)	Lek	Variable	Calculated by formula, considering the gross salary for each operator * number of operators in operation. The worker's salary is subject of change by the administrator
K	**Total personnel**	Lek	Variable	Calculated by formula, considering total for drivers + workers

2.4 Cost for landfill (gate fee) [CLUSTER 4]

The purpose of this cluster is to calculate and maintain a separate calculation of this third party related cost. According to "waste" legislation each and every LGU must dump the waste in a proper and safe way. The cost for waste landfill is set as gate fee and is usually paid per ton.

The landfill costs are subject of change, based on the amount of waste going daily to the landfill and on change in operations. Therefore a good agreement, which will address the fee based on an appropriate business plan and extended in time, must be established.

The variables related to landfill costs are simple, based on gate fee per ton, which is calculated daily and yearly, for the sake of operations and setting the tariff.

Tab. 6 - Use the table below to build this cluster of the cost calculation system [TC 4]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Gate fee**	*Lek/ton*	Exact number	The gate fee is provided by the landfill operator/authority and is fixed by contract between parties
B	**Total cost for landfill**	*Lek/ton/day*	Variable	Calculated by the formula, considering the amount of waste sent to landfill daily * gate fee per ton
C	**Total cost for landfill**	*Lek/year*	Variable	**Calculated by the formula, considering total waste produced per year (is all sent to landfill) * B**

2.5 Amortization (re-invest) costs [CLUSTER 5]

The purpose of this cluster is calculating the costs needed for re-investment, so to keep the system working for a long time. It is a matter of system sustainability and will ensure a functional system.

The calculation is based on the Albanian legislation for amortization of equipments, which indicates a 5 year life span.

The variables in this cluster are simple and directly relate to the yearly cost for amortization for the trucks and bins. This is added to the system as a percentage for year, which practically represents 20% of total amount of cost for the trucks and bins per year. It does not relate to the real amortization. The inappropriate use might shorten the life of the equipment and therefore significantly influence the cost for maintenance, investment and efficiency of the operation (time, fuel).

Tab. 7 - Use the table below to build this cluster of the cost calculation system [TC 5]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Truck amortization, years**	*Number*	Exact figure	This figure here will be 5 years, considering a standard average 20% amortisation per year.
B	**Truck amortization cost**	*Lek/year*	Variable	Calculated by formula, considering number of trucks, price of one truck and the amortization rate per year
C	**Bin amortization, years**	*Number*	Exact figure	This figure here will be 5 years, considering a standard average 20% amortisation per year. But, must be verified, based on the use (proper) of the bins.
D	**Bin amortization cost**	*Lek/year*	Variable	Calculated by formula, considering number of bins, price of one bin and the amortization rate per year

2.6 Administrative costs [CLUSTER 6]

The purpose of this cluster is to calculate the administrative costs necessary to run the whole system, develop strategies and policies, ensure efficiency and effectiveness, provide training and coaching, etc.

The administrative costs may include the necessary cost for tax recollection and for public awareness campaigns, which can be added separately to the system or be part of the overall administrative costs. This decision is taken based on the capacities and needs of the LGU. The system allows the use of both approaches.

In addition, a net income is calculated, which will be needed for new technologies, extension of the service and other not planned and immediate issues.

The variables here are simple and the figure is set by the local administrator based on the financial capacity. The figure is set in percentage of the total costs of the 6 clusters developed above. The experience suggests that these percentages are respectively: 9% for administrative costs; and 4% net income.

Tab. 8 - Use the table below to build this cluster of the cost calculation system [TC 6]

Ref.	Zërat	Njësia matëse	Përdorimi i zërit	Komente
A	**Tarifa e administrimit** (total)	*%*	Numër fiks	Përllogaritur nga formula si **9%** e kostove totale operacionale
B	**Kostot administrative për kapjen e kostove**	*%*	Numër fiks	Përllogaritur nga formula si **xx%** e kostove totale operacionale
C	**Kostot administrative për fushtat e ndërgjegjësimit**	*%*	Numër fiks	Përllogaritur nga formula si **xx%** e kostove totale operacionale
D	**Kostot administartive** *(totale)*	*Lek/vit*	Variabël	Përllogaritur nga formula (**%A+B+C * total operacione)**.
E	**Të ardhura neto**	*Lek/vit*	Variabël	Përllogaritur nga formula (**4% * total operacione)**

By the end of this cluster, we can add two other rows for the scheme totals

2.7 Overall totals [CLUSTER 7]

This block provides a final presentation of total costs. Here we distinguish the cost required for investments for the first year of operations and the total bill per year for the waste management.

Tab. 9 - Use the table below to calculate the total amounts of the management system [TC 7]

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Total investment (1 time)**	*Lek*	Variable	This value is equal with sum of purchase costs for trucks and bins.
B	**Total yearly costs**	*Lek*	Variable	This is calculated as sum of operating costs +landfill costs + administrative and net income costs + amortization costs. This sum represents the annual budget for waste management.
C	**Total operations + investments first year**	*Lek*	Variable	This is calculated formula (A + B) and represents the required financial capacity to start an operational waste management system

By listing all above tables as explained and link them with each other, we have developed a system of cost calculation. This system will inform the manager on the needs for investments, personnel, operations, amortization and other costs, so to be able to present cost estimation to the mayor and council of unit.

To keep the system up-to-date the fixed variables are kept in a different sheet, such as the road distances in one table, prices for the equipments, fuels cost, personnel salaries, etc. by doing so, the manager would change the figures in these tables and the system, being connected to these tables would update all figures and provide immediate results.

Here we provide an example how all these tables would form a complete, closed and functional system.

2.8 Tab. 9 – Screenshot - Waste management cost calculation system

COST CALCULATION		
MODEL		
Base data		
LGU Name	Sample	
Collection frequency (nb of collection per week)	7	2 options: 2 or 7
Type (Rural, Urban)	Urban	
Population (registered/cencus)	113,350	
% of population to be excluded (registered, but living outside)	0%	
Population served (receiving/considered for the service)	113,350	
Road (distance from Landfill one way) [km]	16.0	
Road (distance during collection for one shift for one truck) [km]	15.0	
Waste produced per person standard [kg/inh]	1.0	
Total waste produced [t/day]	113.4	
Total waste produced between 2 collections [t] according to frequency	113.4	
Total waste produced [t/y]	41373	
Trucks		
Hypothesis : collection on all the LGU area, each day of collection		
Type of truck (types : 10t urban - 5t rural) [t]	10	
Fullness factor collection trucks [%]	0.85	
Truck capacity in tons (85% carrying cap) [t]	8.5	
Threshold for the number of shifts and trucks needed (taking into account the possibility of having completely full trucks to avoid buying a new one) [t]	1.50	
Number of shifts per truck per day [shifts/d]	2	1 or 2 shifts
Number ot trucks required	7.0	
Bins		
Hypothesis : collection on all the LGU area, each day of collection		
Weight of waste in a bin [t]	0.10	
Number of bins (1.1 m3 type-85% carrying per bin)	1102	
Operating costs (collection, transport, maintenance, personnel)		
Days in operation/YEAR (If less than 2t/day, coll. 2times/week)	365	

Fuel cost [LEK/L]	190.0	
Maintenance costs		
Truck insurance + vehicle tax [LEK/truck/year]	150,000 Lek	1,079.14 €
Oil + filters [LEK/truck/year]	90,000 Lek	647.48 €
Tires [LEK/truck/year]	160,000 Lek	1,151.08 €
Mechanical maintenance [LEK/truck/year]	200,000 Lek	1,438.85 €
Parking lot [LEK/truck/year]	200,000 Lek	1,438.85 €
Total maintenance costs [LEK/y]	5,600,000 Lek	40,287.77 €
Collection and transport costs		
Collection costs		
Time to load one truck at one time - Collection time [h]	4	
Total time collection (no. trucks * time/truck * no. of shifts) [h/d]	56	
Time to unload the truck at the landfill [h]	0.3	
Proportion of total time for collection [%]	83%	
Fuel consumed during collection [L/d]	301.0	
Total fuel consumed for collection [L/y]	109,865.0	
Total cost for collection [/y]	20,874,350 Lek	150,175.18 €
Transport costs		
Truck speed [km/h]	60.0	
Transportation time to landfill [h]	0.5	
Total time spent for transport (one day/all trucks) [h/d]	11.7	
Proportion of total time for transport [%]	17%	
Total km of transport per day all trucks [km/d]	448	
Fuel consumed during transport [L/d]	202	
Total fuel consumed for transport [L/y]	73584	
Total cost for transport [/y]	13,980,960 Lek	100,582.45 €
Collection and transport subtotal costs		
Time landfilling (dist.*2/speed+unload 0.30 h) [h]	0.8	
Total time spent for one truck to complete in one shift [h/shift]	4.8	
Total time spend for collection and landfill (one day/all trucks) [h/d]	67.7	
Total fuel consumed [L/d]	502.6	
Total fuel consumed [L/y]	183,449.0	
Total fuel cost for collection and transport [LEK/y]	34,855,310 Lek	250,757.63 €
Personnel costs		

Max working time [h/d]	8.0	
Max number of working days per week [d/w]	7.0	
Maximum weekly working time [h/w]	40	
Maintenance [% of working time]	7.30	
Vacation [% of working time]	7.70	
Drivers		
Calculation based on daily needs:		
Drivers quantity based on daily needs (taking into account the limitation with shifts = can't change driver in the middle of a shift)	14	
Calculation based on weekly needs:		
Working hours per week / driver (without maintenance and holidays) [h/w]	39.9	
Weekly time considered on maintenance [h/w]	2.91	
Weekly time considered on holidays [h/w]	3.07	
Working hours per week / driver (with maintenance) [h/w]	42.8	
Total drivers needed (taking into account the maximum working time per week)	15	
Working hours per week / driver (without maintenance and holidays) [h/w]	37.3	
Weekly time considered on maintenance [h/w]	2.72	
Weekly time considered on holidays [h/w]	2.87	
Working hours per week / driver (with maintenance) [h/w]	42.8	
Monthly salary of the drivers [LEK/month]	27000	
Tax rate [%]	0.48	
Drivers salary (incl taxes) [LEK/y]	7,192,800 Lek	51,746.76 €
Workers		
Number of workers per team (1 driver, x workers)	3	
Total number of workers	45	
Workers going to the landfill (Yes/no)	yes	
Working hours per week / worker (without maintenance and vacation) [hrs/w]	37.25	
Maintenance and vacation [h/w]	2.23	
Working hours per week / worker (with maintenance and vacation) [hrs/w]	42.84	
Monthly salary of the workers [LEK(/month]	25000	
Tax rate [%]	0.48	
Workers salary (incl taxes) [LEK/y]	19,980,000 Lek	143,741.01 €
Subtotal personnel costs		
Personel costs [LEK/t]	657 Lek	4.73 €
Personel costs [LEK/inh/y]	240 Lek	1.72 €

Total Personnel costs [LEK/y]	27,172,800 Lek	195,487.77 €
Total cost (Maintenance, collection, transport, personnel)		
Operating costs per ton [LEK/t]	1,635 Lek	11.76 €
Operating costs per inhabitant/year [LEK/inh/y]	597 Lek	4.29 €
Subtotal Operating costs (Maintenance, collection, transport + personnel) [LEK/y]	67,628,110 Lek	486,533.17 €

Capital investment

Trucks		
Waste collection truck unit price [LEK]	5,977,000 Lek	43,000.00 €
Waste coll. truck total for investment (large urban + 1) [LEK]	47,816,000 Lek	344,000.00 €
Bins		
Waste collection bins (1.1 m3) unit price [LEK]	35,000 Lek	251.80 €
Waste collection bins price total [LEK]	38,573,165 Lek	277,504.78 €
Subtotal capital investment [LEK]	86,389,165 Lek	621,504.78 €

Landfilling costs

Landfill fee [LEK/t]	1,200 Lek	8.63 €
Total cost for landfilling (total ton * cost per ton) per day [LEK/d]	136,020 Lek	978.56 €
Total cost for landfilling [LEK/inh/y]	438 Lek	3.15 €
Total cost for landfilling (total ton * cost per ton) [LEK/y]	49,647,300 Lek	357,174.82 €

Amortization costs

Trucks		
Truck amortization years [y]	5	
Truck amortization [LEK/y]	8,367,800 Lek	60,200.00 €
Bins		
Bins amortisation years [y]	5	
Bins amortisation [LEK/y]	7,714,633 Lek	55,500.96 €
Subtotal amortization costs [LEK]		

Total Amortization [LEK/y]	16,082,433 Lek	115,700.96 €
Total Amortization [LEK/t]	389 Lek	2.80 €
Total Amortization [LEK/inh/y]	142 Lek	1.02 €

Total costs		
Total operation costs (Maintenance, collection, transport, personnel, landfilling, amortization)		
Total operation costs [LEK/y]	133,357,843 Lek	959,408.94 €
Total operation costs (Maintenance, collection, transport, personnel, landfilling, amortization, administration fee and net income)		
Administration fee [% of total cost]	9%	
Administrative cost for tax recollection [% of total cost]	0%	
Administrative cost for public awareness campaign [% of total cost]	0%	
Administration (of total) [LEK/y]	12,002,205.87Lek	86,346.80 €
Net income [% of total cost]	4%	
Net income (of total) [LEK/y]	5,334,314 Lek	38,376.36 €
Total operation costs [LEK/y]	150,694,363 Lek	1,084, 132.10 €
Total operation cost per ton (complete cycle) [LEK/t]	3,642 Lek	26.20 €
Total operation cost per inhabitant per year (complete cycle) [LEK/inh/y]	1,329 Lek	9.56 €
Investment		
Investment total cost	86,389,165 Lek	621,504.78 €

3. Prezantimi i rezultateve

We mentioned before that waste management is a service and therefore subject to tariffs. As such, it must be addressed as cost to the producer. In order to understand the bill for the producer, we have to calculate the cost per treating one ton of waste and cost/inhabitant or cost/producer, so to develop a cost recovery analysis and strategy.

For a better understanding these costs it is suggested to make a calculation for each cluster separately. This would provide more information for the manager on clusters influence on the global budget, and on savings opportunities.

a) Calculating cost per ton

Basically the cost to treat a ton of waste is calculated as a division of the total cluster cost by total waste produced per year.

To do so, simply add a line below each cluster and use the formula to divide Cluster total amount with the total waste produced per year, which in our guideline corresponds to the Table 1 Cluster 1 Letter L.

b) Calculating cost per inhabitant

Here we make use of the total population to get the costs for producer. Basically the manager will obtain the cost or burden of each cluster to each producer (in our case inhabitant).

To do so, simply add a line below each cluster and use the formula to divide Cluster total amount with the total number of population served which in our guideline corresponds to the Table 1 Cluster 1 Letter F.

The results can be grouped in the main elements of the service, to understand the level of impact of each of them:

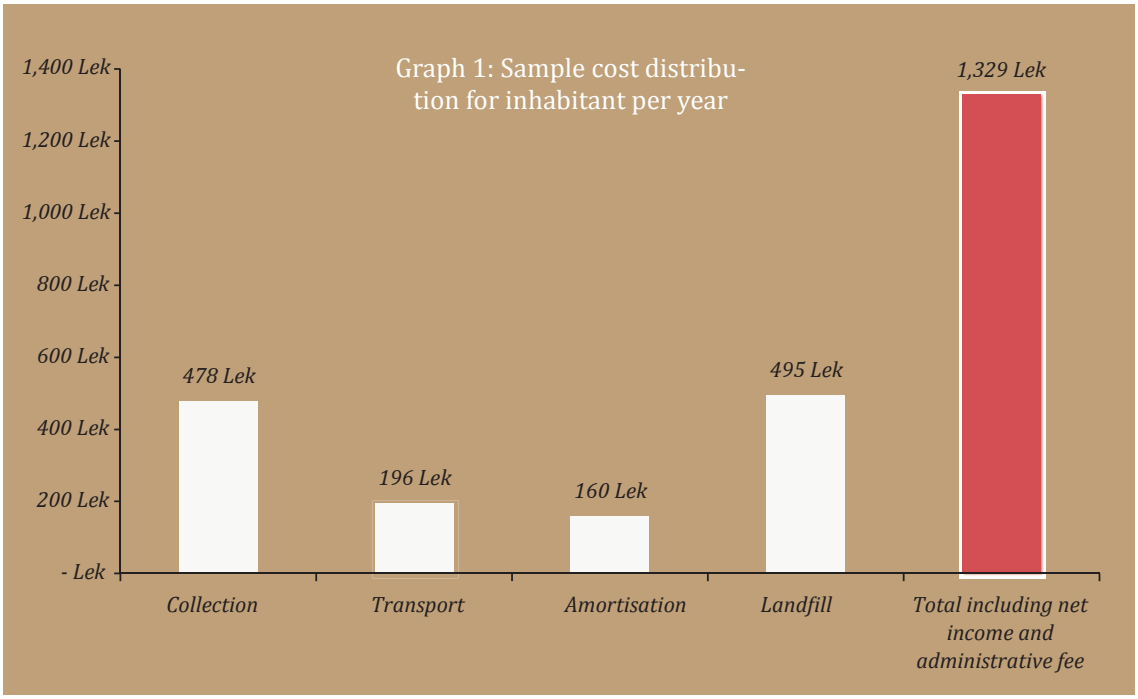
- **Collection**
- **Transport**
- **Amortization**
- **Landfill**

To do so, the manager must develop a table with the formulas explained in the table below.

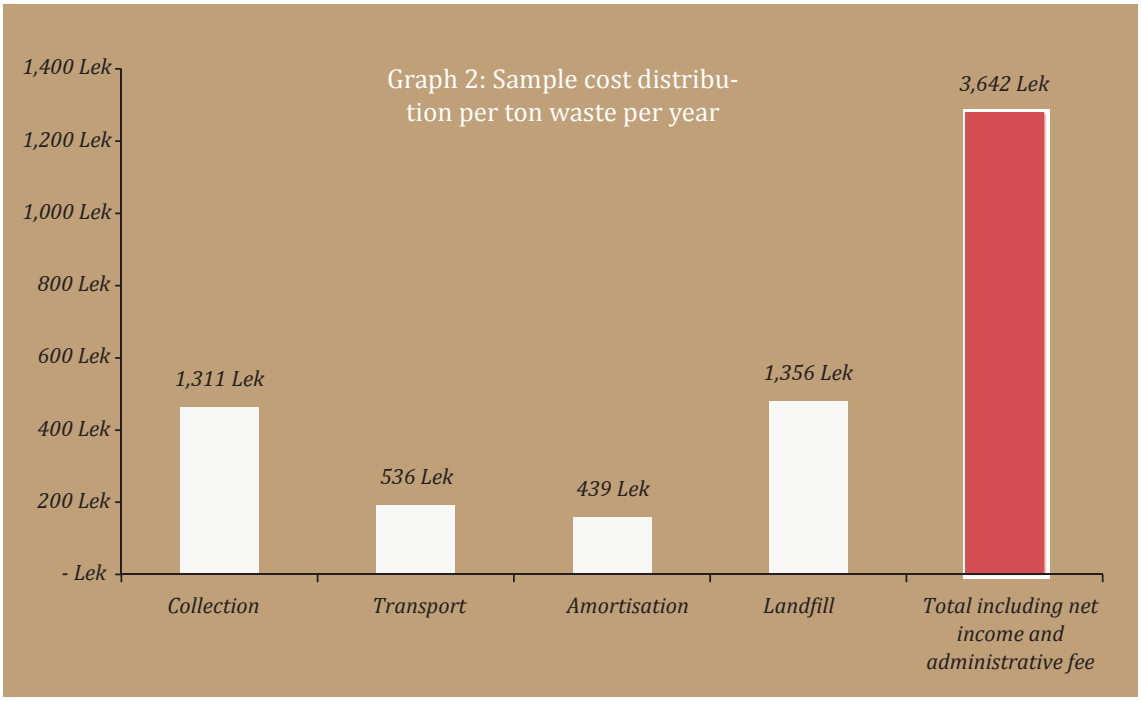
Table 10 – Distributing the cost for inhabitants

Ref.	Figure name	Measuring unit	Use of the figure	Comments
A	**Collection** *(includes collection, maintenance and personnel)*	*Lek/inb.*	Variable	This value is calculated by formula =(Total collection+maintenance+personnel) * (Percentage of administrative and net income) / Population
A1	**Collection** *(includes collection, maintenance and personnel)*	*Lek/ton*	Variable	This value is calculated by formula =(Total collection+maintenance+personnel) * (Percentage of administrative and net income) / Amount of waste generated yearly
B	**Transport**	*Lek/inb.*	Variable	This value is calculated by formula =(Total transport) * (Percentage of administrative and net income) / Population
B1	**Transport**	*Lek/ton*	Variable	This value is calculated by formula =(Total transport) * (Percentage of administrative and net income) / Amount of waste generated yearly
C	**Amortization**	*Lek/inb.*	Variable	This value is calculated by formula =(Total amortization) * (Percentage of administrative and net income) / Population
C1	**Amortization**	*Lek/ton*	Variable	This value is calculated by formula =(Total amortization) * (Percentage of administrative and net income) / Amount of waste generated yearly

Ref.	Figure name	Measuring unit	Use of the figure	Comments
D	**Landfill**	*Lek/inb.*	Variable	This value is calculated by formula =(Total landfill) * (Percentage of administrative and net income) / Population
D1	**Landfill**	*Lek/ton*	Variable	This value is calculated by formula =(Total landfill) * (Percentage of administrative and net income) / Amount of waste generated yearly
E	**Total cost including net income and administrative**	*Lek/inb.*	Variable	Calculated by formula **(A+B+C+D)**
E1	**Total cost including net income and administrative**	*Lek/ton*	Variable	Calculated by formula **(A1+B1+C1+D1)**



A graphic for a better visualization for the results is designed, which together with the table above, provide a simple but consistent sheet to be printed for use as reference by the LGU (see sample below).



4. Calculating costs for tourism season

As explained above the tourists and visitors in some of the LGUs constitute significant impact on waste management operations and costs. The amount of waste produced in a short time, can vary from below to the total for the LGU to times more. Therefore operations and costs are highly affected, thus producing a financial burden to the LGU.

As this amount of waste is not generated during the whole year, the costs related to the touristic season are strongly suggested to be treated separately and billed to the tourist by a strategy developed by the LGU.

For the calculation of these costs, the above developed system can be used, considering two variables:

- number of visitors per day (average per day of the total number of visitors from the previous year)
- official touristic season days (usually 30-90 days)

In the developed model, these data are added manually by the user in the specified sheets and green colored cells. This becomes clear in the annexes named Sheet 3 and 6, respectively [Data per LGU] and [Annex_Extra_Tourism], of this publication.

After this the system will provide the costs only for touristic season.

5. Annex 1 – How to use the Excel based modeling cost calculation system

The guideline comes together with the annexes, which are a detailed view of the interactive electronic system developed in Excel. Each Annex represents an Excel sheet, which are a result of interactions between them in a complete functional system. It is fully developed and adjusted to the Albanian conditions. Each LGU can use the system by entering its own data to the appropriate sheets and cells in green color explained below.

This cost calculation system has been developed to support the Local Government Units on calculating the cost for solid waste management service in their administrative area. It contains 7 sheets, which are completely interconnected to provide the cost and other figures important for the administrators of the service. The user of this model is required to provide data only on the sheet named (Data per LGU), the rest is automatically generated by the system and are provided in the sheets [COST-Calculation], [Results] and/or [Annex-Extra-Tourism] and [Results_tourismONLY].

For the sake of prevention of any misuse or damage to the formulas and other parts of the system, the sheets are protected, expect for the cells which require your input and are highlighted in light green color.

Content *(Sheet name)*	Purpose / Description
Index	Introduction to the model and the developers
Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	
Fixed variable	Defines all general data, which are important for the use of variables and formulas. This sheet requires no intervention from the user. Whenever in the sheets you see a cell in this background color, it means the data are collected from the Fixed variable sheet.
Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	
Data per LGU	Defines all specific data related to that exact LGU. This sheet is provided as such by the developer, but requires the user input in each cell, based on the specific conditions of the LGU. In order to keep safe the rest of the system, some of the data are provided as droplist for you only to select. Please note: The amount of waste produced, is an average of the waste produced from three sources: inhabitants; business and institutions.
Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	

Content *(Sheet name)*	Purpose / Description
COST-Calculation	This is the main sheet of the modeling. It provides all related number for infrastructure and operations and the costs associated. The model is self generated, by collecting data from the previous sheets [Fixed variable] and [Data per LGU]. If you LGU is not appearing on the first cell [C8], please click to open the dropdown list and select it. The rest of the modeling is locked for damage prevention and does not require any input from the user.
	Index / Fixed variables / Data per LGU / **COST-Calculation** / Results / Annex_Extra_Tourism / Results_tourismONLY
Results	This sheet calculates the cost related to the inhabitant, divided for each category of the service. This sheet does not require any input from the user as it is self-generated.
	Index / Fixed variables / Data per LGU / COST-Calculation / **Results** / Annex_Extra_Tourism / Results_tourismONLY
Annex-Extra_ Tourism	Applies to the LGUs which have an extra number of visitors/tourist and calculates separately the extra costs required to provide the service in the tourism season. The figures will be added to the appropriate cell in [Data per LGU] sheet. The number of trucks, bins and workers here are rented/hired only for this period and do not apply to the rest of the year. Basically an LGU which will have more than 10.000 tourists must use the annex and sum the cost the total yearly budget for the waste management, but not plan the cost for tourism season to be collected from the tariff for inhabitants. These costs must be billed to the tourists in the best way decided by the LGU.
	Index / Fixed variables / Data per LGU / COST-Calculation / Results / **Annex_Extra_Tourism** / Results_tourismONLY
Results_ tourismONLY	Indicative only. Provides information of the financial burden to the inhabitants if the cost for tourism will be billed to them.
	Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / **Results_tourismONLY**

Inside each sheet you will find cells with different colors, which have the following meaning:

Cells in Light YELLOW color collect data from [Data per LGU sheet]

Cells in Light GREY color collect data from [Fixed variables sheet]

Cells in GREEN color, require your attention/input

The other cells use formulas to calculate the results. Those cells do not require user input and therefore are locked to prevent any

6. Aneksi 2 – Sistemi i llogaritjes së kostos në modelin në Excel

Disclaimer

The present Model of cost calculation were done as a tool for helping the calculation of a first evaluation of cost and budget at local or regional level in Albania. It is based on practices, conditions and costs experimented in Albania in 2011-2012.

The model has to be used by professional only, having received a specific training of the use and conditions of the models.

The results must be analyzed with a professional regard and experience before to take any conclusion or decision.

The authors assume that the results of the present model will not be used for a purpose other than agreed upon and may not be applied to another object, country or to changed circumstances.

The authors don't take any responsibility for any decision based on the results of the model, taken without their active participation. If a third party uses the results of the present model in order to take decisions, the authors disclaim any liability for any kind of direct or indirect (consequential) damages.

Any user of this model is considered as having accepted these conditions.

Cost calculation system
Excel based model

CONTENT OF THE EXCEL FILE [SHEET 1]

Content *(Sheet name)*	Purpose / Description
Index	Introduction to the model and the developers
▼ Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	
Fixed variable	Defines all general data, which are important for the use of variables and formulas. This sheet requires no intervention from the user. Whenever in the sheets you see a cell in this background color, it means the data are collected from the Fixed variable sheet.
▼ Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	
Data per LGU	Defines all specific data related to that exact LGU. This sheet is provided as such by the developer, but requires the user input in each cell, based on the specific conditions of the LGU. In order to keep safe the rest of the system, some of the data are provided as droplist for you only to select. Please note: The amount of waste produced, is an average of the waste produced from three sources: inhabitants; business and institutions..
▼ Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	
COST-Calculation	This is the main sheet of the modeling. It provides all related number for infrastructure and operations and the costs associated. The model is self generated, by collecting data from the previous sheets [Fixed variable] and [Data per LGU]. If you LGU is not appearing on the first cell [C8], please click to open the dropdown list and select it. The rest of the modeling is locked for damage prevention and does not require any input from the user.
▼ Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	
Results	This sheet calculates the cost related to the inhabitant, divided for each category of the service. This sheet does not require any input from the user as it is self-generated.
▼ Index / Fixed variables / Data per LGU / COST-Calculation / Results / Annex_Extra_Tourism / Results_tourismONLY	

Content *(Sheet name)*	Purpose / Description
Annex-Extra_ Tourism	Applies to the LGUs which have an extra number of visitors/tourist and calculates separately the extra costs required to provide the service in the tourism season. The figures will be added to the appropriate cell in [Data per LGU] sheet. The number of trucks, bins and workers here are rented/hired only for this period and do not apply to the rest of the year. Basically an LGU which will have more than 10.000 tourists must use the annex and sum the cost the total yearly budget for the waste management, but not plan the cost for tourism season to be collected from the tariff for inhabitants. These costs must be billed to the tourists in the best way decided by the LGU.

Results_ tourismONLY	Indicative only. Provides information of the financial burden to the inhabitants if the cost for tourism will be billed to them.

SHEET 2 [FIXED VARIABLES]

FIXED VARIABLES

Waste production references			Remarks
Solid waste production, rural	0.6	kg/inh/d	read comment
Solid waste production large urban	1.0	kg/inh/d	
Solid waste production, Other urban	0.8	kg/inh/d	
Solid waste production, touristic/coastal	1.0	kg/inh/d	
Solid waste production, mountain remote areas	0.3	kg/inh/d	
Excluded areas	-	kg/inh/d	

Trucks			Remarks
Fullness factor collection trucks	85%	%	
Truck speed, average, on transport (not on collection)	60.0	km/h	
Fuel cost	190.0	LEK/L	
Truck amortization years (second hand)	5.0	y	byalbanianlaw
Transportation truck amortization years (TS to landfill, new vehicle)	5.0	y	byalbanianlaw
Urban 10t trucks			
Urban trucks tonage [t]	10		
Waste collection truck 10t urban	5,977,000	LEK	
Truck insurance + vehicle tax	150,000	LEK/truck/y	
Oil + filters	90,000	LEK/truck/y	
Tires	160,000	LEK/truck/y	
Mechanical maintenance	200,000	LEK/truck/y	
Parking lot	50,000	LEK/truck/y	
Estimated time to load a truck: 10 t in urban area	4.0	h/truck	
Distance covered during collection, urban	55.0	km	
Fuel consumption during collection 10 t truck	5.0	L/h	
Fuel consumption during transport 10 t truck	0.5	L/km	
Rural 5t trucks			
Rural trucks tonage [t]	5		
Waste collection truck 5t rural	3,588,000	LEK	
Truck insurance + vehicle tax	100,000	LEK/truck/y	
Oil + filters	75,000	LEK/truck/y	
Tires	160,000	LEK/truck/y	

Mechanical maintenance	200,000	LEK/truck/y	
Parking lot	50,000	LEK/truck/y	
Estimated time to load a truck: 5t in rural area	3.0	h/truck	
Distance covered during collection, rural	30.0	km	
Fuel consumption during collection 5 t truck	3.0	L/h	
Fuel consumption during transport 5 t truck	0.4	L/km	
Transportation trucks (transfer station to landfill)			
Transportation trucks	12,510,000	LEK	
Truck insurance + vehicle tax	150,000	LEK/truck/y	
Oil + filters	90,000	LEK/truck/y	
Tires	160,000	LEK/truck/y	
Mechanical maintenance	200,000	LEK/truck/y	
Parking lot	50,000	LEK/truck/y	
Fuel consumption during transport 20 t truck	0.40	L/km	

Bins			Remarks
Fullness factor for bins	85%	%	
Volume of the bins	1.1	m3	
Density of waste in the bins	0.11	t/m3	read comment
Weight of waste in a bin	0.10	t	
Waste collection bins (1.1 m3) unit price	35,000	LEK	
Bins amortisation years	5.0	y	

Landfilling			Remarks
Time to unload the collection truck at the landfill	0.3	h	
Time to unload the TS transport truck at the landfill	0.5	h	
Landfill fee per ton	1,200.0	LEK/t	read comment

Personnel (drivers and workers)			Remarks
Working days per week	7.0	d/w	
Working hours per week	40.0	h/w	
Working hours per day	8.0	h/d	
Maintenance [% of working time]	7.30	%	
Vacation	7.70	%	
Workers going to the landfill	yes	yes/no	read comment
Monthly salary of the drivers	27,000.0	LEK/month	
Tax rate for a driver's salary	0.48	%	
Monthly salary of the workers	25,000.0	LEK/month	

Tax rate for a worker's salary	0.48	%	
Number of workers per team, urban area (if >50.000 inhabitants)	3.0	-	
Number of workers per team, rural area	2.0	-	

Administration and net income			Remarks
Administration fee [% of total cost]	0.09	%	
Net income [% of total cost]	0.04	%	
Administrative cost for tax recollection [% of total cost]		%	read comment
Administrative cost for public awareness campaign [% of total cost]		%	read comment

Conversion factor LEK -> €			Remarks
1 EUR = x LEK	139.0	LEK/€	read comment

SHEET 3 [DATA PER LGU]

DATA PER LGU																		
LGU name	Type (Rural, Urban)	Population (cencus/registered)	% of population to be excluded (registered but not living)	Population extra (tourism) [avrg. /day]	Waste produced [kg/inh/d]	Roads (distance to Landfill [km]	Distance for collection for truck [km]	Time (h) to load the truck (5t and 10 t) [h]	Type of truck based on the type of LGU [t]	Fuel consumption rate during collection [L/h]	Fuel consumption rate during transport [L/km]	Truck maintenance					Waste collection truck unit price [LEK]	Collection frequency [-]
												Truck insurance + vehicle tax [LEK/truck/y]	Oil + filters [LEK/truck/y]	Tires [LEK/truck/y]	Mechanical maintenance [LEK/truck/y]	Parking lot [LEK/truck/y]		
Sample	Urban	113, 350	0%	0	1	16	15	4	10	5	0.45	150000	90000	160000	200000	50000	5, 977, 000	7

SHEET 4 [COST MODELING]

COST CALCULATION

MODEL

Base data

LGU Name	Sample	
Collection frequency (nb of collection per week)	7	*2 options: 2 or 7*
Type (Rural, Urban)	Urban	
Population (registered/cencus)	113,350	
% of population to be excluded (registered, but living outside)	0%	
Population served (receiving/considered for the service)	113,350	
Road (distance from Landfill one way) [km]	16.0	
Road (distance during collection for one shift for one truck) [km]	15.0	
Waste produced per person standard [kg/inh]	1.0	
Total waste produced [t/day]	113.4	
Total waste produced between 2 collections [t] according to frequency	113.4	
Total waste produced [t/y]	41373	

Trucks

Hypothesis : collection on all the LGU area, each day of collection		
Type of truck (types : 10t urban - 5t rural) [t]	10	
Fullness factor collection trucks [%]	0.85	
Truck capacity in tons (85% carrying cap) [t]	8.5	
Threshold for the number of shifts and trucks needed (taking into account the possibility of having completely full trucks to avoid buying a new one) [t]	1.50	
Number of shifts per truck per day [shifts/d]	2	*1 or 2 shifts*
Number ot trucks required	7.0	

Bins

Hypothesis : collection on all the LGU area, each day of collection		
Weight of waste in a bin [t]	0.10	
Number of bins (1.1 m3 type-85% carrying per bin)	1102	

Operating costs (collection, transport, maintenance, personnel)

Days in operation/YEAR (If less than 2t/day, coll. 2times/week)	365	

Fuel cost [LEK/L]	190.0	
Maintenance costs		
Truck insurance + vehicle tax [LEK/truck/year]	150,000 Lek	*1,079.14 €*
Oil + filters [LEK/truck/year]	90,000 Lek	*647.48 €*
Tires [LEK/truck/year]	160,000 Lek	*1,151.08 €*
Mechanical maintenance [LEK/truck/year]	200,000 Lek	*1,438.85 €*
Parking lot [LEK/truck/year]	200,000 Lek	*1,438.85 €*
Total maintenance costs [LEK/y]	5,600,000 Lek	*40,287.77 €*
Collection and transport costs		
Collection costs		
Time to load one truck at one time - Collection time [h]	4	
Total time collection (no. trucks * time/truck * no. of shifts) [h/d]	56	
Time to unload the truck at the landfill [h]	0.3	
Proportion of total time for collection [%]	83%	
Fuel consumed during collection [L/d]	301.0	
Total fuel consumed for collection [L/y]	109,865.0	
Total cost for collection [/y]	20,874,350 Lek	*150,175.18 €*
Transport costs		
Truck speed [km/h]	60.0	
Transportation time to landfill [h]	0.5	
Total time spent for transport (one day/all trucks) [h/d]	11.7	
Proportion of total time for transport [%]	17%	
Total km of transport per day all trucks [km/d]	448	
Fuel consumed during transport [L/d]	202	
Total fuel consumed for transport [L/y]	73584	
Total cost for transport [/y]	13,980,960 Lek	*100,582.45 €*
Collection and transport subtotal costs		
Time landfilling (dist.*2/speed+unload 0.30 h) [h]	0.8	
Total time spent for one truck to complete in one shift [h/shift]	4.8	
Total time spend for collection and landfill (one day/all trucks) [h/d]	67.7	
Total fuel consumed [L/d]	502.6	
Total fuel consumed [L/y]	183,449.0	
Total fuel cost for collection and transport [LEK/y]	34,855,310 Lek	*250,757.63 €*
Personnel costs		

Max working time [h/d]	8.0	
Max number of working days per week [d/w]	7.0	
Maximum weekly working time [h/w]	40	
Maintenance [% of working time]	7.30	
Vacation [% of working time]	7.70	
Drivers		
Calculation based on daily needs:		
Drivers quantity based on daily needs (taking into account the limitation with shifts = can't change driver in the middle of a shift)	14	
Calculation based on weekly needs:		
Working hours per week / driver (without maintenance and holidays) [h/w]	39.9	
Weekly time considered on maintenance [h/w]	2.91	
Weekly time considered on holidays [h/w]	3.07	
Working hours per week / driver (with maintenance) [h/w]	42.8	
Total drivers needed (taking into account the maximum working time per week)	15	
Working hours per week / driver (without maintenance and holidays) [h/w]	37.3	
Weekly time considered on maintenance [h/w]	2.72	
Weekly time considered on holidays [h/w]	2.87	
Working hours per week / driver (with maintenance) [h/w]	42.8	
Monthly salary of the drivers [LEK/month]	27000	
Tax rate [%]	0.48	
Drivers salary (incl taxes) [LEK/y]	7,192,800 Lek	*51,746.76 €*
Workers		
Number of workers per team (1 driver, x workers)	3	
Total number of workers	45	
Workers going to the landfill (Yes/no)	yes	
Working hours per week / worker (without maintenance and vacation) [hrs/w]	37.25	
Maintenance and vacation [h/w]	2.23	
Working hours per week / worker (with maintenance and vacation) [hrs/w]	42.84	
Monthly salary of the workers [LEK(/month]	25000	
Tax rate [%]	0.48	
Workers salary (incl taxes) [LEK/y]	19,980,000 Lek	*143,741.01 €*
Subtotal personnel costs		
Personel costs [LEK/t]	657 Lek	*4.73 €*
Personel costs [LEK/inh/y]	240 Lek	*1.72 €*

Total Personnel costs [LEK/y]	27,172,800 Lek	*195,487.77 €*
Total cost (Maintenance, collection, transport, personnel)		
Operating costs per ton [LEK/t]	1,635 Lek	*11.76 €*
Operating costs per inhabitant/year [LEK/inh/y]	597 Lek	*4.29 €*
Subtotal Operating costs (Maintenance, collection, transport + personnel) [LEK/y]	67,628,110 Lek	*486,533.17 €*

Capital investment

Trucks		
Waste collection truck unit price [LEK]	5,977,000 Lek	*43,000.00 €*
Waste coll. truck total for investment (large urban + 1) [LEK]	47,816,000 Lek	*344,000.00 €*
Bins		
Waste collection bins (1.1 m3) unit price [LEK]	35,000 Lek	*251.80 €*
Waste collection bins price total [LEK]	38,573,165 Lek	*277,504.78 €*
Subtotal capital investment [LEK]	86,389,165 Lek	*621,504.78 €*

Landfilling costs

Landfill fee [LEK/t]	1,200 Lek	*8.63 €*
Total cost for landfilling (total ton * cost per ton) per day [LEK/d]	136,020 Lek	*978.56 €*
Total cost for landfilling [LEK/inh/y]	438 Lek	*3.15 €*
Total cost for landfilling (total ton * cost per ton) [LEK/y]	49,647,300 Lek	*357,174.82 €*

Amortization costs

Trucks		
Truck amortization years [y]	5	
Truck amortization [LEK/y]	8,367,800 Lek	*60,200.00 €*
Bins		
Bins amortisation years [y]	5	
Bins amortisation [LEK/y]	7,714,633 Lek	*55,500.96 €*
Subtotal amortization costs [LEK]		

Total Amortization [LEK/y]	16,082,433 Lek	*115,700.96 €*
Total Amortization [LEK/t]	389 Lek	*2.80 €*
Total Amortization [LEK/inh/y]	142 Lek	*1.02 €*

Total costs		
Total operation costs (Maintenance, collection, transport, personnel, landfilling, amortization)		
Total operation costs [LEK/y]	133,357,843 Lek	*959,408.94 €*
Total operation costs (Maintenance, collection, transport, personnel, landfilling, amortization, administration fee and net income)		
Administration fee [% of total cost]	9%	
Administrative cost for tax recollection [% of total cost]	0%	
Administrative cost for public awareness campaign [% of total cost]	0%	
Administration (of total) [LEK/y]	12,002,205.87Lek	*86,346.80 €*
Net income [% of total cost]	4%	
Net income (of total) [LEK/y]	5,334,314 Lek	*38,376.36 €*
Total operation costs [LEK/y]	150,694,363 Lek	*1,084, 132.10 €*
Total operation cost per ton (complete cycle) [LEK/t]	3,642 Lek	*26.20 €*
Total operation cost per inhabitant per year (complete cycle) [LEK/inh/y]	1,329 Lek	*9.56 €*
Investment		
Investment total cost	86,389,165 Lek	*621,504.78 €*

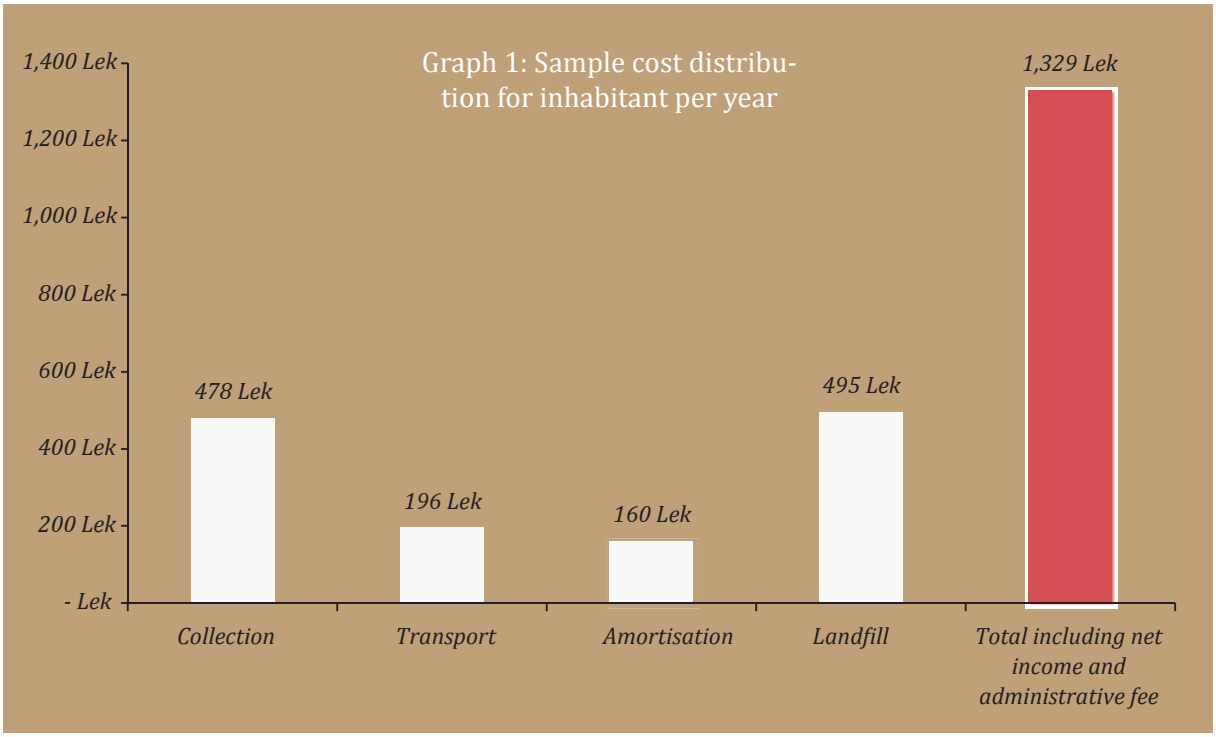
SHEET 5 [RESULTS]

RESULTS - COST PER INHABITANT / YEAR

Full waste management cost (excluding tourism)

LGU name **Sample**

Total cost for management [LEK/year] **150,694,362.55**



Cost of waste management per inhabitant per year		
Collection	478 Lek	3.44 €
Transport	196 Lek	1.41 €
Amortization	160 Lek	1.15 €
Landfill	495 Lek	3.56 €
Total including net income and administrative fee	1,329 Lek	9.56 €

Cost of waste management per ton per year		
Collection	1,311 Lek	9.43 €
Transport	536 Lek	3.86 €
Amortization	439 Lek	3.16 €
Landfill	1,356 Lek	9.76 €
Total including net income and administrative fee	3,642 Lek	26.20 €

SHEET 6 [ANNEX_EXTRA_TOURISM]

COST CALCULATION

EXTRA COSTS - TOURISM

Base data		
LGU Name	Sample	
Collection frequency (nb of collection per week)	7	*2 options: 2 or 7*
Type (Rural, Urban)	Urban	*Urban for all*
Visitors/toruists (different from residents, average per day)	-	
% of population to be excluded (registered, but living outside)	16.0	
Population served (receiving/considered for the service)	15.0	
Road (distance from Landfill one way) [km]	1.0	
Road (distance during collection for one shift for one truck) [km]	0.0	
Waste produced per person standard [kg/inh]	0.0	
Total days of touristic season (add here the days) [days]	90	◀ *add value*
Total waste produced between 2 collections [t] according to frequency	0	
Collection frequency (nb of collection per week)	7	*2 options: 2 or 7*

Trucks (tourism only)		
Hypothesis : collection on all the LGU area, each day of collection		
Type of truck (types : 10t urban - 5t rural) [t]	10	
Fullness factor collection trucks [%]	0.85	
Truck capacity in tons (85% carrying cap) [t]	8.5	
Threshold for the number of shifts and trucks needed (taking into account the possibility of having completely full trucks to avoid buying a new one) [t]	1.50	
Number of shifts per truck per day [shifts/d]	1	*1 or 2 shifts*
Number ot trucks required	0.0	

Bins (tourism only)		
Hypothesis : collection on all the LGU area, each day of collection		
Weight of waste in a bin [t]	0.10	
Number of bins (1.1 m3 type-85% carrying per bin)	0	

Operating costs (collection, transport, maintenance, personnel) (tourism only)		
Days in operation/YEAR (If less than 2t/day, coll. 2times/week)	90	
Fuel cost [LEK/L]	190.0	

Maintenance costs		
Truck insurance + vehicle tax [LEK/truck/year]	150,000.0 Lek	*1,079.14 €*
Oil + filters [LEK/truck/year]	90,000.0 Lek	*647.48 €*
Tires [LEK/truck/year]	160,000.0 Lek	*1,151.08 €*
Mechanical maintenance [LEK/truck/year]	200,000.0 Lek	*1,438.85 €*
Parking lot [LEK/truck/year]	200,000.0 Lek	*1,438.85 €*
Total maintenance costs [LEK/y]	- Lek	*€ -*
Collection and transport costs		
Collection costs		
Time to load one truck at one time - Collection time [h]	4	
Total time collection (no. trucks * time/truck * no. of shifts) [h/d]	0	
Time to unload the truck at the landfill [h]	0.3	
Proportion of total time for collection [%]	0%	
Fuel consumed during collection [L/d]	0.0	
Total fuel consumed for collection [L/y]	0.0	
Total cost for collection [/y]	- Lek	*€ -*
Transport costs		
Truck speed [km/h]	60.0	
Transportation time to landfill [h]	0.5	
Total time spent for transport (one day/all trucks) [h/d]	0.0	
Proportion of total time for transport [%]	0%	
Total km of transport per day all trucks [km/d]	0	
Fuel consumed during transport [L/d]	0	
Total fuel consumed for transport [L/y]	0	
Total cost for transport [/y]	- Lek	*€ -*
Collection and transport subtotal costs		
Time landfilling (dist.*2/speed+unload 0.30 h) [h]	0.8	
Total time spent for one truck to complete in one shift [h/shift]	4.8	
Total time spend for collection and landfill (one day/all trucks) [h/d]	0.0	
Total fuel consumed [L/d]	0.0	
Total fuel consumed [L/y]	0.0	
Total fuel cost for collection and transport [LEK/y]	- Lek	*€ -*
Personnel costs		
Max working time [h/d]	8.0	
Max number of working days per week [d/w]	7.0	
Maximum weekly working time [h/w]	40	

Maintenance [% of working time]	7.30	
Vacation [% of working time]	7.70	
Drivers		
Calculation based on daily needs:		
Drivers quantity based on daily needs (taking into account the limitation with shifts = can't change driver in the middle of a shift)	0.00	
Calculation based on weekly needs:		
Working hours per week / driver (without maintenance and holidays) [h/w]	0.0	
Weekly time considered on maintenance [h/w]	0.00	
Weekly time considered on holidays [h/w]	0.00	
Working hours per week / driver (with maintenance) [h/w]	0.0	
Total drivers needed (taking into account the maximum working time per week)	0.00	
Working hours per week / driver (without maintenance and holidays) [h/w]	0.0	
Weekly time considered on maintenance [h/w]	0.00	
Weekly time considered on holidays [h/w]	0.00	
Working hours per week / driver (with maintenance) [h/w]	0.0	
Monthly salary of the drivers [LEK/month]	27000	
Tax rate [%]	0.48	
Drivers salary (incl taxes) [LEK/y]	- Lek	€ -
Workers		
Number of workers per team (1 driver, x workers)	2	
Total number of workers	-	
Workers going to the landfill (Yes/no)	yes	
Working hours per week / worker (without maintenance and vacation) [hrs/w]	0.00	
Maintenance and vacation [h/w]	0.00	
Working hours per week / worker (with maintenance and vacation) [hrs/w]	0.00	
Monthly salary of the workers [LEK(/month]	25000	
Tax rate [%]	0.48	
Workers salary (incl taxes) [LEK/y]	- Lek	€ -
Subtotal personnel costs		
Personel costs [LEK/t]	- Lek	€ -
Personel costs [LEK/inh/y]	- Lek	€ -
Total Personnel costs [LEK/y]	- Lek	€ -
Total cost (Maintenance, collection, transport, personnel)		

Operating costs per ton [LEK/t]	- Lek	€ -
Operating costs per inhabitant/year [LEK/inh/y]	- Lek	€ -
Subtotal Operating costs (Maintenance, collection, transport + personnel) [LEK/y]	- Lek	€ -

Capital investment (tourism only)

Trucks		
Waste collection truck unit price [LEK]	5,977,000.0 Lek	*43,000.00 €*
Waste coll. truck total for investment (large urban + 1) [LEK]	- Lek	€ -
Bins		
Waste collection bins (1.1 m3) unit price [LEK]	35,000.0 Lek	*251.80 €*
Waste collection bins price total [LEK]	- Lek	€ -
Subtotal capital investment [LEK]	- Lek	€ -

Landfilling costs (tourism only)

Landfill fee [LEK/t]	1,200.0 Lek	*8.63 €*
Total cost for landfilling (total ton * cost per ton) per day [LEK/d]	- Lek	€ -
Total cost for landfilling [LEK/inh/y]	- Lek	€ -
Total cost for landfilling (total ton * cost per ton) [LEK/y]	- Lek	€ -

Amortization costs (tourism only)

Trucks		
Truck amortization years [y]	5	
Truck amortization [LEK/y]	- Lek	€ -
Bins		
Bins amortisation years [y]	5	
Bins amortisation [LEK/y]	- Lek	€ -
Subtotal amortization costs [LEK]		
Total Amortization [LEK/y]	- Lek	€ -
Total Amortization [LEK/t]	- Lek	€ -
Total Amortization [LEK/inh/y]	- Lek	€ -

Total costs (tourism only)			
Total operation costs (Maintenance, collection, transport, personnel, landfilling, amortization)			
Total operation costs [LEK/y]		- Lek	€ -
Total operation costs (Maintenance, collection, transport, personnel, landfilling, amortization, administration fee and net income)			
Administration fee [% of total cost]		9%	
Administrative cost for tax recollection [% of total cost]		0%	
Administrative cost for public awareness campaign [% of total cost]		0%	
Administration (of total) [LEK/y]		- Lek	€ -
Net income [% of total cost]		4%	
Net income (of total) [LEK/y]		- Lek	€ -
Total operation costs [LEK/y]		- Lek	€ -
Total operation cost per ton (complete cycle) [LEK/t]		- Lek	€ -
Total operation cost per inhabitant per year (complete cycle) [LEK/inh/y]		- Lek	€ -
Investment			
Investment total cost		- Lek	€ -

SHEET 7 [RESULTS_TOURISMONLY]

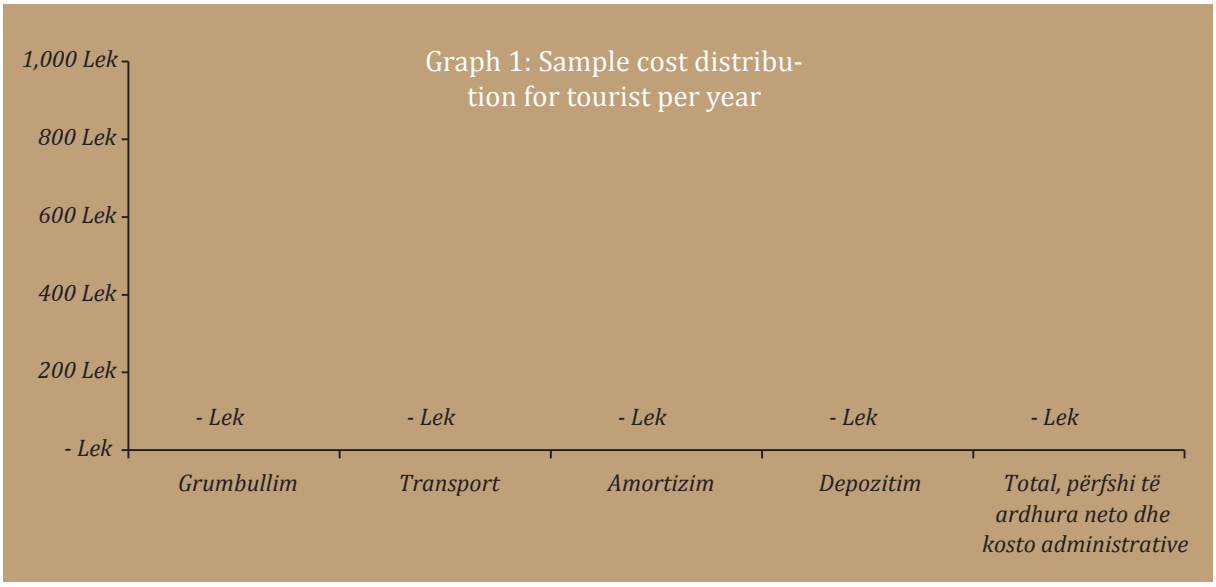
RESULTS - COST PER TOURIST/ YEAR

Related to tourism only, consider as additional costs

LGU name **Sample**

Total cost for management
for touristic season only [LEK/year] **0.00**

Total investment required
for touristic season service provision only [LEK] **0.00**



Cost of waste management per tuorist per year		
Collection	- Lek	- €
Transport	- Lek	- €
Amortization	- Lek	- €
Landfill	- Lek	- €
Total including net income and administrative fee	- Lek	- €

Cost of waste management per ton per year		
Collection	- Lek	- €
Transport	- Lek	- €
Amortization	- Lek	- €
Landfill	- Lek	- €
Total including net income and administrative fee	- Lek	- €