

Our Question and Quest :

Sustainable Cities Perspectives by Municipal Waste Sustainability Indicators Assessment. (Evaluation of Waste Management and Treatment in Attica Municipalities. Are we in a correct way to Cyclic Economy policies starting in local level ?)

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Until 2050 half **earth population** will live in large cities

As a result : an increase of **demands** for food, clothes, energy and services

Under the pressure of the **exaggerate natural sources exploitation, sustainable development** and **circular economy** implemented in local and international scale, is an acceptable key for preservation of natural environment and the **quality of**

Humanity has to consider that nature doesn't create wastes, waste is energy and material with potential for use. The imitation of nature's strategies, implemented to human technology and methodologies for waste treatment that leads to zDiWa as well as nature does

We just have to consider that nature doesn't create wastes. Nature uses full cycles of materials and energy through metabolic paths, with accurate quantification and recycling procedures.

On the other hand, humanity, only in the past 50 years, realized that natural resources are not inexhaustible and also, there are many ways to use a phenomenal useless material.

Environmental problems of today (Greece) :

Climatic change (!!)

Pollution and contamination in water and land,
water lack.

Need for pure and clean energy without exceeded
carbon emissions

Reliable plans and clean Waste treatment

European Union, considering the upcoming problems, **adapts policies in waste treatment**, (Direction 2008 / 98 / EU), and the states-members has the obligation to rearrange their methodologies and reduce the primary waste quantities throughout the increase of recycling behaviour, reuse or produce energy. According to the update policies of EU-29 and the aims until 2020, 2030 and 2050, disposal of any material, have to be the last stage after repetitive cycles of use and must be the maximum 30% of the primary waste quantity and incineration treatment must be less of these

Municipalities in Greece has enlarged responsibilities. According the law 3463/2006 (FEK 114/A/8-6-2006) municipalities has the responsibility to collect, transfer and use solid wastes according to the national plans. Also, **legislation** as the laws 3536, 4071 and 4042, determines the specific **frame that includes the partnership of the municipalities in the management of civil wastes.**

EVERY Municipality in Greece developed its

The question now is, **if the delivered plans on behalf of municipalities, are indeed reliable, effective and realistic.**

In that case, **the answer will come through the elements connecting the characteristics of every municipality plan** with its economy activities and infrastructure and of course the qualities and amounts of wastes production, and how the local treatment is included to the national plan and European acceptable goals and technologies

Does the municipalities **infrastructures** are adequate to accept the amounts of any kind of wastes ?

And also, what is a realistic timetable, schedule and methodology for a municipality to implement effectively its own plan ?

Sustainable management of the municipal solid waste, both on **topical** and **wider scale**, must take under consideration all **economic, social** and **environmental** constraints and also the carrying capacities of the ecosystem, aiming towards autonomy

The **heterogeneity** of the **materials** and their **quantities** is a function of the **geographic and demographic characteristics of each region**, the local and peripheral GDP, the technology used, the seasoning, the consumption patterns etc

In great **consideration** is the **connection** between central **state** and **local policies** implemented, because many time the nets and infrastructures are not parallel in country level and many gasps of synchronization appears and lead to policies failures.

Municipal solid waste is **classified** into two categories, **common municipal wastes** and **special wastes**, and these are classified into other sub-categories. Municipal solid waste is divided into **970 types**, **406 of which pose a risk** to the environment and public health.

In our study, we deal with **no hazardous**, common type of municipal wastes, coming mainly from households, gardens and trade stores.

A tool to evaluate the effectiveness of the treatment methodologies about solid wastes in municipalities, is specific designed Indicator

An indicators system constitutes the framework for monitoring and recording the environment's condition.

Sustainability indicators for municipal wastes developed for managing municipal waste is based on the competent bodied reported quantities. However, there is a significant uncertainty about the reliability of these data.

In our case, the **evaluation of municipal waste treatment**, is going to be throughout the plans that every municipality **elaborate and submit at the Special Intersectional Organization of Prefecture of Attica (ESDNA – SIOPA)** since 2015 and the progress that appears to achieved until today.

We develop **three indicators** using the latest official data available from **three major municipalities in Attica Prefecture**, Greece (66 Municipalities total). We proceed comparing practices, procedures and results obtained among these municipalities and some European capitals and municipalities in order to determine if the municipal solid waste management implemented in each one of the sampled municipalities is **considered sustainable and reliable or not.**

In our case, the meaning of sustainability is connected with **municipal policies in waste treatment.**

And additionally in the case of municipalities, sustainability is directly connecting with **cycling economy** and furthermore with **industrial or craft cohabitation OR collaboration between local municipalities entities.**

INDICATORS

Indicator: **MSW-P**

Municipal Solid Waste Production is the indicator representing the **ratio** of the **amount of municipal solid waste** produced to the municipal population at a **given time**.

This indicator provides a measure of the average waste quantity, a figure that is quite usable and

Indicator: **MSW-C**

Municipal Solid Waste Composition is the indicator recording the **weight percentage of the most known materials** included in **the reported amount of municipal solid waste**.

The indicator provides information on the **economic** and **ecological** utility **of the waste** as well as the **disposal** and **recycling** methods

Indicator: **MSW-R**

Municipal Solid Waste Recycling is the indicator measuring the **percentage of the municipal solid waste** that is **recycled** compared with the **total amount of municipal solid waste**.

Additionally, the percentage of all type of waste (i.e. glass, paper, plastic, etc.) is estimated in relation to the total amount of waste recycled.

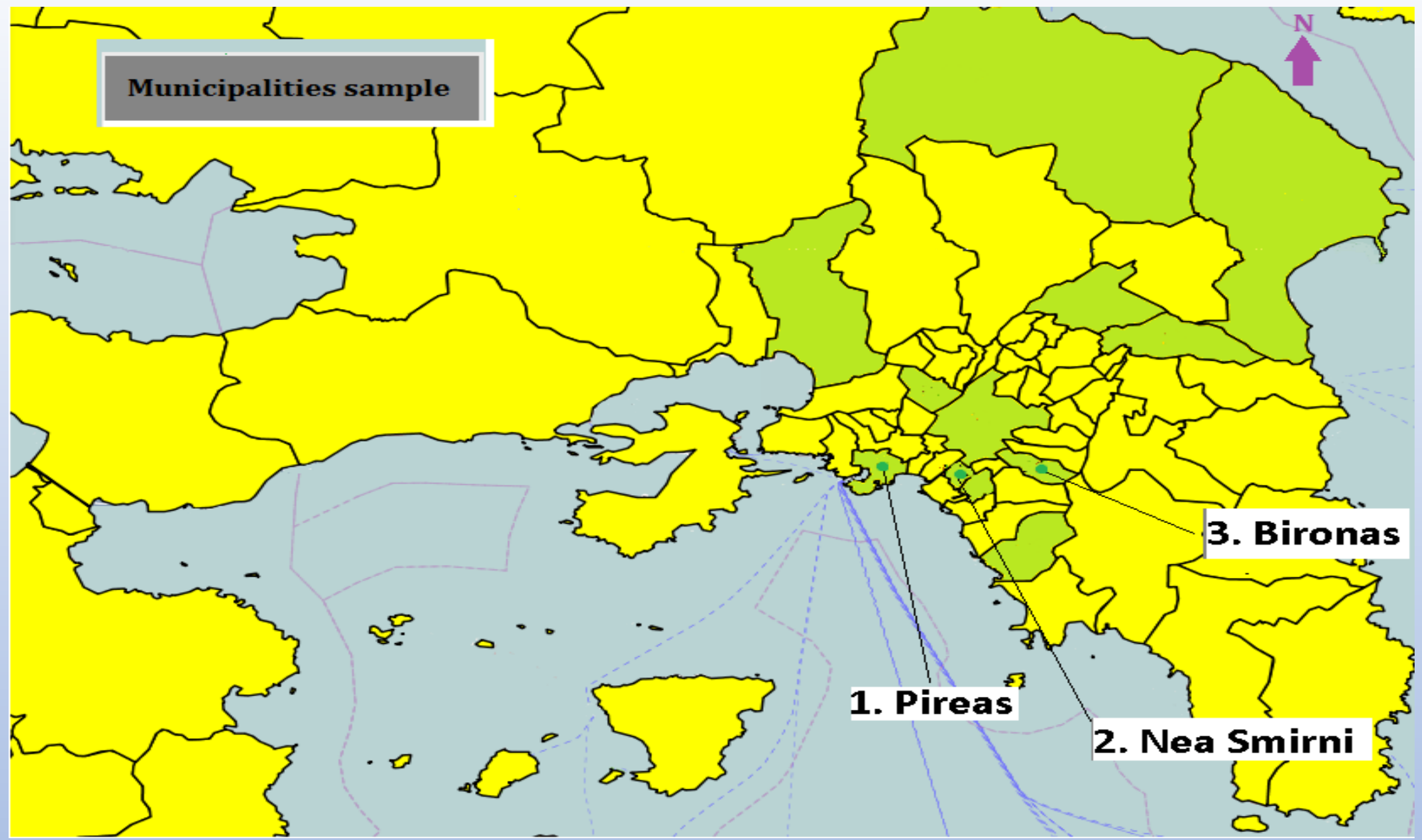
Municipalities sample



1. Pireas

2. Nea Smirni

3. Bironas



Municipality of Vyronas

Located at the foothill of mount Hymettus in the northeast of the Attica Prefecture. The municipality's area located close to mount Hymettus is a forest, while the southwest part is urban. The total area covered by is approximately 9.500 square kilometers. According to the latest census the population counts approximately 61.000 residents. Quite noticeable is that fact that even after 10 years the population number

Municipality of Nea Smirni

According to the Hellenic Statistical Authority's census, counts approximately 73.500 residents. According to calculations by the Municipal Authority, the real number of residents is estimated at around 97.000. Is a central urban municipality, near to sea, with second and third sector of economic activities. Main income of the inhabitants is low or medium. Currently, there is no city space left for horizontal expansion. The affinity with the municipality of Athens in addition to

Municipality of Piraeus

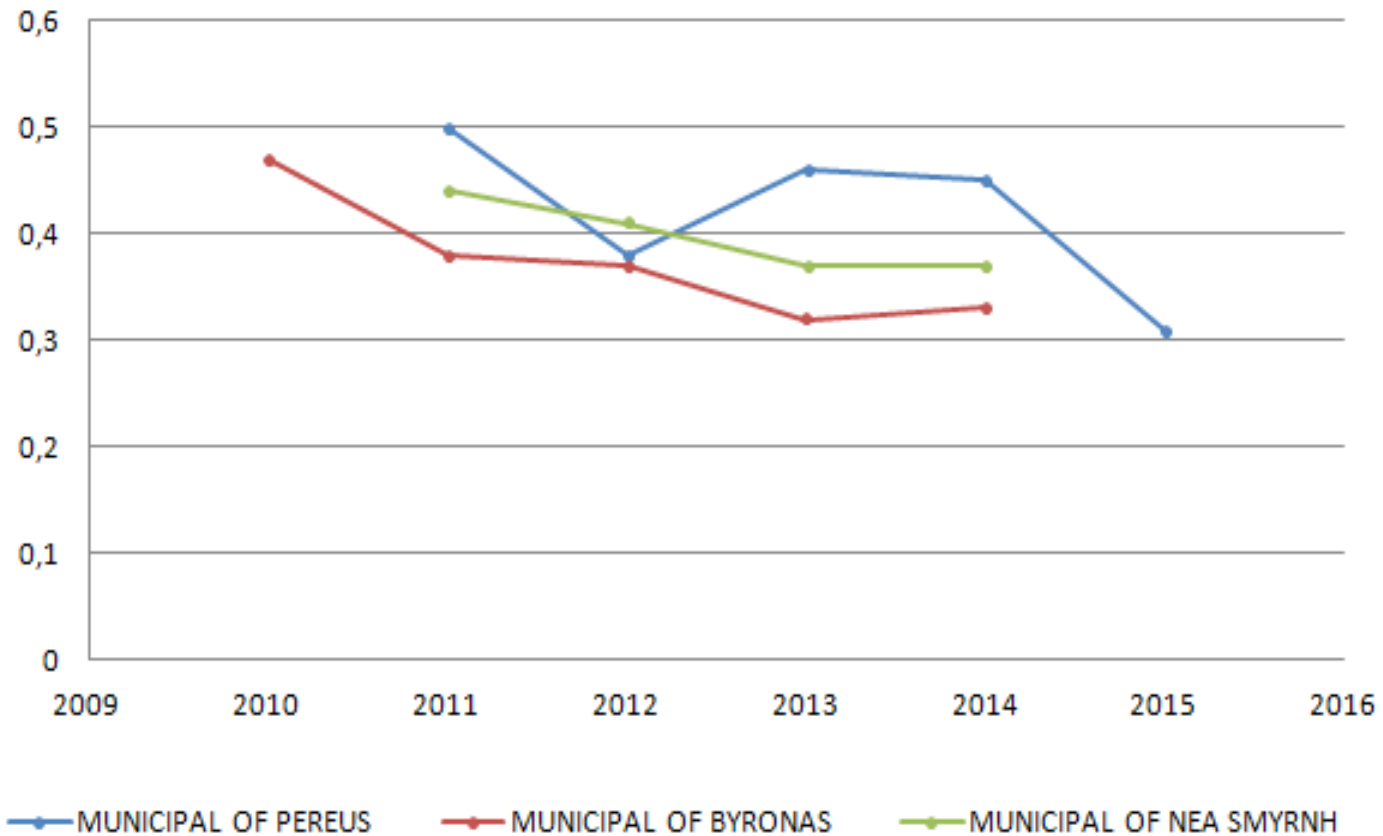
Municipality of Piraeus cover an area of 10.9 square kilometers and hosts approximately 164.000 inhabitants according to the latest census. According to the population the municipality of Piraeus is the fourth largest in Greece. Also, Piraeus is the most important industrial center and port of the country and one of the greatest in Mediterranean.

• o/n	• Municipality of	• Population 2011	• Surface (hectars)
• 9.	• Piraeus	• 163.668	• 1086
• 10.	• Nea Smyrni	• 73.076	• 352,4
• 11.	• Virona	• 61.308	• 9204

RESULTS

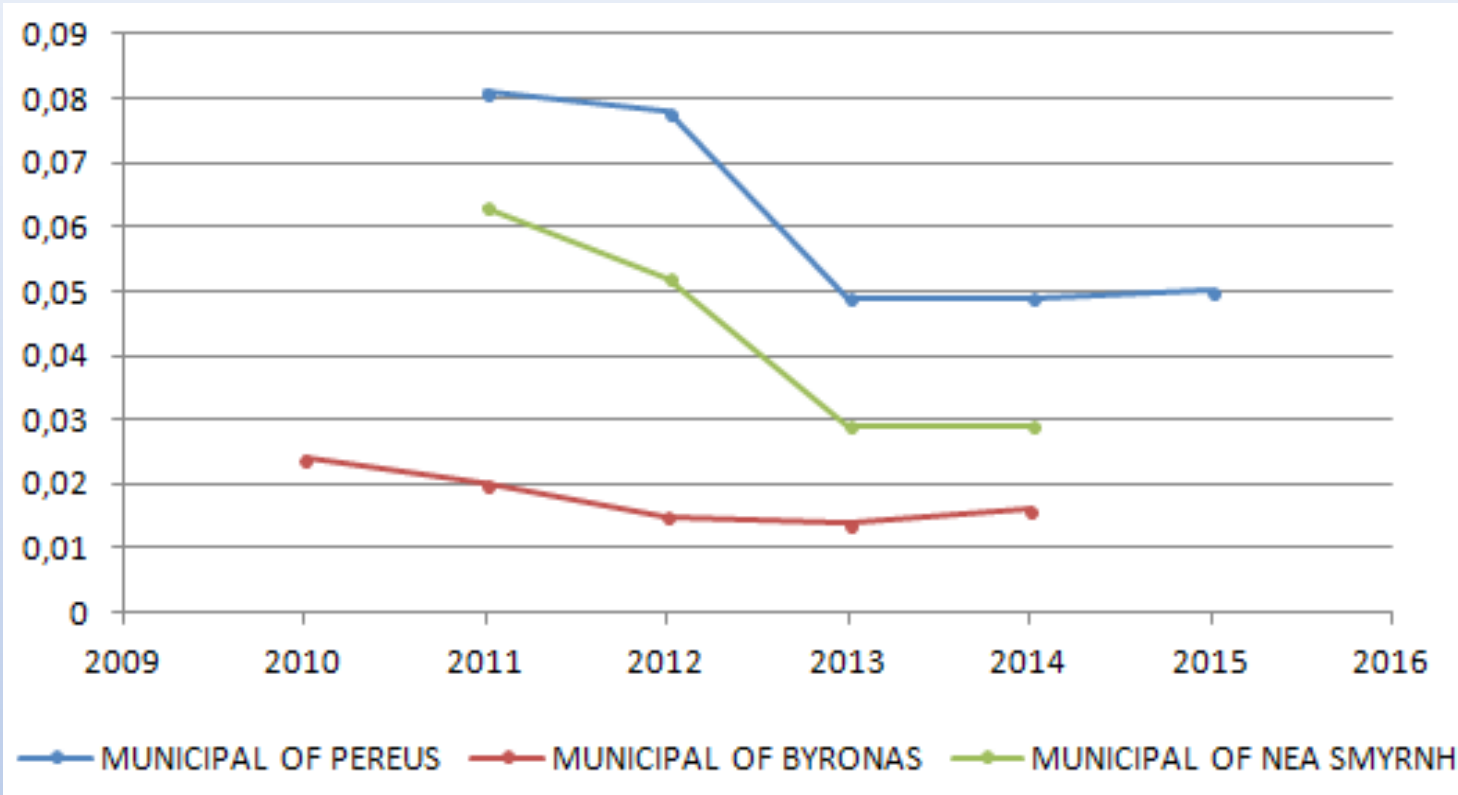
**For the tree Municipalities
Of
Pireas, Vironas, Nea Smyrni**

MSW-P



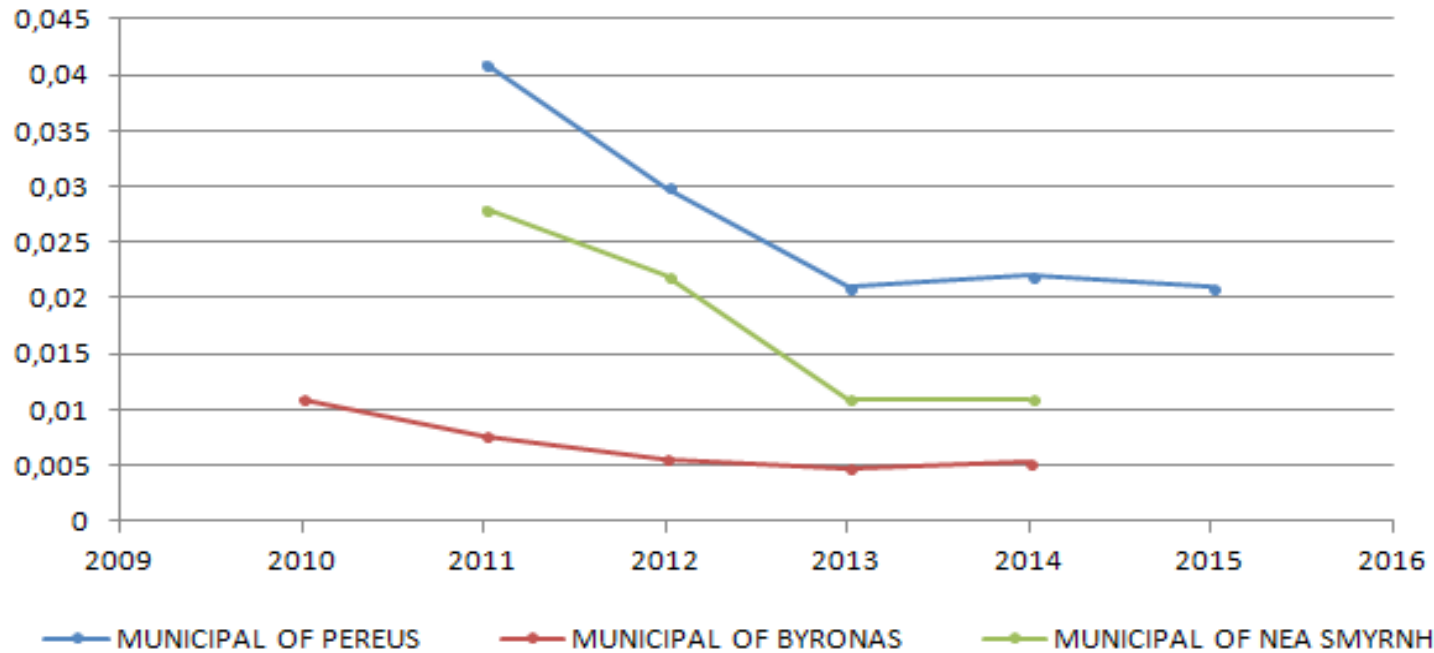
Year	Municipal of Pereus	Municipal of Byronas	Municipal of Nea Smyrnh
2010	*	0,47	*
2011	0,5	0,38	0,44
2012	0,38	0,37	0,41
2013	0,46	0,32	0,37
2014	0,45	0,33	0,37
2015	0,31	*	*

MSW-C



Year	Municipal of Pereus	Municipal of Byronas	Municipal of Nea Smyrnh
2010	*	0,024	*
2011	0,081	0,020	0,063
2012	0,078	0,015	0,052
2013	0,049	0,014	0,029
2014	0,049	0,016	0,029
2015	0,050	*	*

MSW-R



Year	Municipal of Pereus	Municipal of Byronas	Municipal of Nea Smyrnh
2010	*	0,011	*
2011	0,041	0,0077	0,028
2012	0,03	0,0056	0,022
2013	0,021	0,0048	0,011
2014	0,022	0,0053	0,011
2015	0,021	*	*

CONCLUSIONS

- Since 2015, municipalities had the above central goals :
- **Separately collection of biodegrading wastes and recycling wastes up to 50%**
- **Separate collection of glass, paper and metal at least at 65% up to 2020.**
- Rise of the collecting goal for biowastes up to 40% (10% before). (National Plan for Waste Treatment, 2014)
- According to the local plans, municipalities determine as immediate goals :
- **Community awareness and guidance about proper recycling.**
- Diminish the final disposal amount of wastes at landfills (XYTA).
- **Rise of the recycling amount at the source, up to 50% at 2020.**
- **In these frame, municipalities, set the below actions, through their local plans :**
- **Informative actions about recycling for the people. But without intense programme and feedback evaluation.**
- **Green spots (local and central). But without accurate quantitative evaluation and after storage use plans.**
- **Home recycling and composting. But with no intense promotion and awareness about the benefits in domestic and local community importance.**
- **Separate collection for biodegrading wastes and recycling wastes and volume wastes and electrical / electronical wastes., battery, oils, dangerous wastes, demolish wastes. But with no plans for farther use or with no state infrastructures to use it.**
- **Low degree of composting for some organic wastes. Depending on the local authorities perceptions about composting, methodologies and use.**
- **Equipment enforcement. Depending founding and state plan.**
- **Rise of the amount of collective wastes. Common goal for all municipalities but with no immediate connection with future population changes, economical activity transformations and internal community transactions.**
- Personalization of recycling in different ways. But with very low rate of implementation new technologies, because of great lack of infrastructures.

Our study, according to the above elements, the local municipal plans and the recent evaluation (May 2019) of the progress of implementing the plans of 2015, and the feedback recorded between local and state authorities, show that :

- **Many feature and uncertain actions.** Many actions of the plans are difficult to implement because of space (for infrastructures) or funding lack. Also it was obvious that the organization part appears many gaps of communication and necessary steps.
- **Uncertainties** of forecasts about the rate of waste production and economical activities (up or down). Until February 2019, the amount of final disposal wastes at landfills is up to 80% and the rate of rising cycle economy methodologies is extremely low.
- **Low rate of development for centralized infrastructures** on behalf of the state.
- Many **theoretical combinations** and calculations about the amount of future wastes and cost of treatment are not connecting with reality, because of high unemployment, immigration and low rise of consumption.

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- **Theoretical calculations of the beneficial** results for the Municipality, without considering the population increase or reduction or adapt new effective technologies for energy production and material reuse. Also its uncertain the implementation of reuse and recycle for domestic wastes.
- **Theoretical approach between goals and reality** in a common pattern for many municipalities.
- **Big present municipal personnel cost (>50%)**
- **Low cost benefits using same methodologies for every municipality** and with no intra municipal cooperation for strategic plans for waste treatment.
- **Persistence to low cost common equipment for local use and lack to strategic implementation of technology for energy use,** or composting or regenerate wastes
- **Thoughts for new municipality local taxes** with no immediate benefits for recyclers (par example personalization of recycling through bar cods for physical person or neighbourhoods).
- **Lack of plans for collaboration between neighbour - municipalities for green wastes, organics composting and energy plans.**
- **Great lack for proper spaces to implement infrastructures** for recycling and composting. No strategic plans. Resist to adapt new digital technologies for monitoring and controlling all the methodology of collecting and treat wastes.

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- **Many proposals and ideas without the presentation of the detailed steps to implement.**
- **Exposing plans and goals without the right scientific personnel for developing.**
- **No specialization among the plans of different municipalities.** That is no positive in general aspect, because every municipality has differences in financial activities, population synthesis, administrative structures and waste production (in quality and amount).. But that also reveals the lack of experience in developing waste treatment plans and lack of central applicable policies
- **All municipalities appears that they don't have detailed statistical data for the qualities and the amounts of collective wastes trough time.** That justifies why until today the 80% of wastes goes to landfills. It was the easy solution. Also reveals the failure to localize the landfills. Also there are frequent disagreements with the data of central state services (ESDNA and Ministry of Environment - MECC).
- **It is obvious that municipalities running programs for developing their municipal equipment for treating and composting wastes** but with low rate because of the financial problems and with no cooperation with central infrastructures and organizations.
- Until 2019 June, the progress of implementation of local municipal plans, is low enough to say that its difficult to catch the foreseen. But also, there are no central feedback with data to evaluate the results since 2015.

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- In all above, the tree indicators, could help for fast monitoring and evaluation of present state, also enriched with more indicators using indexes as surface, population density or degree of economical activities.