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SUSTAINABILITY OF WASTE MATERIALS IN AFFINITY WITH ECOLOGICALLY SUSTAINABLE DEVELOPMENT: A CASE STUDY OF KOSOVO

TRWAŁOŚĆ MATERIAŁÓW ODPADOWYCH W POWIĄZANIU Z EKOLOGICZNIE ZRÓWNOWAŻONYM ROZWOJEM: STUDIUM PRZYPADKU KOSOVO

Abstract: Using our natural resources, we produce much waste that can be recycled as a useful resource, which further contributes to climate change. Kosovo, generally produces a huge amount of waste, particularly Prishtina as the capital its capital city. The study presented in this paper investigated the high-rise buildings in Ulpiana neighbourhood of the city of Prishtina and waste disposals in Kosovo, focusing on the challenges of urban waste management, particularly on the recycling of high-rise urban generated waste. The research methods consist of empirical observation through urban spatial zone. Researched model of high-rise buildings, surveyed the land use, and recycling process of a total generated waste of 778.8 kg daily/per one structure. According to the conceptual and calculated findings strengthened with awareness for sustainable consumption, and proper urban strategy for implementing the recycling waste materials, it is indicated that the waste amount can be decreased and recycled for about 25 % from the total waste generated daily.

Keywords: ecologically sustainable development, waste, Kosovo

Introduction

Metropolis is a wide holistic system, and organism with specific and multiplex metabolism that transforms vast amount of energy, generates huge amount of waste, and emanate specific pollutants. Moreover, urban regions are spatially unique and very characteristic in affinity to the waste management. Hence, human communities have consistently made efforts to create a healthier environment [1]. Kosovo, generally produces a large amount of waste, particularly Prishtina as its capital city. Actually, there are no sufficient capacities of waste management engineering system to cover the waste disposal expanse. Waste management system in Prishtina represents one of the main ecological problem for urbanites and society, hence, we have to be conceptually clear, that everything we throw is not waste nor is the necessity to bury the waste in landfills, because by recycling it, we have more resources for economic and human development. Kosovo is devoted to the premise of reducing the waste impact to the environment, by reassuring for

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efficiency in urban strategies, aiming for the quality waste management system, and essentially using renewable energy resources [2]. The endorsement of sustainable development in relation to the waste management system is encouraged by the EU, through various environment regulations for healthier cities and municipalities. In Kosovo, the amount of waste increases continuously and expands monthly. While the waste management, and actual framework of arrangement are quite from being acceptable, the Kosovo environmental strategy, recognize the intentions, actions, and environmental clarifications for waste management healing procedures [2, 3]. Furthermore, the legal basis is presented by the Law on Waste No. 04/L-060, which constrain the conceptual strategy on waste management that consist of information and assessment of the actual situation on waste management. The waste management policy of the European Union is implemented through the waste management strategy, directives, regulations, and decisions, hence, as stated by the Cimdina et al. the efforts of the European Union to reduce the impact on climate change are going in two main directions. The first in order are the increasing the proportion of renewable energy resources, and the second are related to the quality of the energy efficiency [4]. According to the World Energy Council, governments, should recognize and include the size, scale, pace and the needed development in the energy sector and relations with the sectors. The government must also ensure that the energy strategy and policies are appropriate to the required tasks and coordination must be at the highest level [5]. Furthermore, Maczulak argues that: Communities notice waste when they see it, but, unseen substances are strong matters because they enter in environs quietly [6]. Further, Miller and Clesceri on the other hand state: The directness, ugliness and growing of a waste disposal scene encounter us with micro environs of nature [7]. Hence, nowadays studies have assuredly presented that waste sites manifest danger to the environment and public health. Moreover, regarding the challenges of waste treatment, Kosovo strategy on waste management arranges the objectives in the field of waste management for the next decade, whereas regarding the law enforcement on waste management, it is focused on [2]:

- Reduction of waste generation, reduction of the amount of waste at source;
- Development of infrastructure for the establishment of an integrated management;
- Reduction of risk in the environment from waste;
- Capacity building for waste management in urban zones;
- Education of public, promotion, and training of officials;
- Completion of legislation and standards.

The approved strategy shall administer and clearly define the management of waste, from its creation to its final disposal. The objectives are to establish a sustainable functional system for waste management, which will be in accordance with the standards and requirements of the EU, and national legislation on waste management. The principles of waste management to be undertaken according to priorities, are [2]:

- Avoiding and reducing waste production, thus, minimizing the risks from waste;
- If reduction at source is not possible, then the waste should be reused or recycled;
- Generating energy from waste;
- Waste that cannot be reused in a rational manner, must be disposed in the most environmentally acceptable manner.

Conceptually, what are the issues regarding the product of life cycles? Nakamura and Kondo, argue the issues related to product life cycles: The researched methods of input-output data endure weakness in conclusions, in continuity of research process that

does not consider the natural countenance of the life circle [8]. Regarding the above conceptual facts, we argue that new challenges should stimulate new studies, environmentally safe processes, especially when the standard biogenic composition easily grasp into the groundwater is nitrogen, in the nitrate condition [9, 10]. With the objectives towards the exploitation of all resources, in order to provide a better and higher quality of life. Spatial planning and the necessity of evolving the metropolitan urban zones, represent a much-needed holistic development of spatial framework, aiming to achieve a better public health for their urbanites, with a primary aspiration for the social wellbeing. Therefore, a qualitative waste management system strengthened with a sustainable urbanization and architectural design strategies determines the areas, location, waste management structures, and material processed framework, which essentially deliver the desirable solution for healthier living. The aim of this research is to evident and recommend ecological actions for municipalities to improve the material recycling efficiency, soil quality, public health, and urban sustainability. The paper presents a literature review, the standards of criteria and methods used for friendly eco-design, illustrations are presented as a visual design instrument to further support the preservation of the environmental.

Materials and methods

The study presented in this paper has investigated the waste disposal sites, waste management process of the city of Prishtina, and the strategy on waste management of Kosovo, focusing on urban design and environmental pollution issues. The research literature investigated the establishment of the eco-design framework of sustainable architecture and urban development, further environmentally interrelated with waste management. Methods consist of empirical observation through urban spatial zones. In order to receive clearer data and information, research was done within the holistic ecological context of waste site structures, quality of soil, waste pollutants, urban planning, with more focused on the environmental features regarding to the most polluted streets of the Prishtina. The research was conducted from the municipal urban plans, documentation and drawings. The collected data includes maps, plans for waste disposal zones, ecological attributes of the space, and additional data was based on the analysis of the existing state of waste management. Furthermore, research was made within existing state of recycled materials, with a primary objective to promote sustainable development in relation to the waste management. The objective of this paper is to address four dimensions that are interrelated to the sustainable development, ecology, urban planning in relation to the environment, waste impact according to the actual location, and distance of the municipal waste sites from the city of Prishtina. The dimensions mentioned above are interdependent, and represent sustainable actions as follow:

- Promoting the sustainability;
- Improving the quality of the environment, and urban land use;
- Evidencing the impact of waste sites on urban zones of Prishtina, and Kosovo;
- Implementing preferred waste management according to the EU standards and regulations;
- Preserving and promoting ecology, and spatial environmental development.

Spatial development of Prishtina

Spatial development of Prishtina in the past has not been the objective of research in professional and scientific programs. Chronologically, it is important to highlight the actions of spatial arrangements of urban planning of Prishtina [11-13]:

- Prishtina Urban Development Plan (1937). Treated the area of 192.72 ha, and was programed 16,000 inhabitants,
- The second Urban Development Plan (1948). No trace of the existence of this plan;
- General Urban Plan (1953). The plan dated up to 1980, and the town was planned for 50,000 inhabitants in the area of 950 ha,
- Directive Plan - Traffic and Dedication of City Zones (1967). Plan for 100,000 citizens,
- In 1969, the Directive Plan for Traffic and Dedication of City Zones was replaced by the General Urban Plan of Prishtina.

The overall urban and spatial development plan in 1988 were approved for a timeline to year 2000, covering the area of 4335 ha for 225,000 inhabitants.

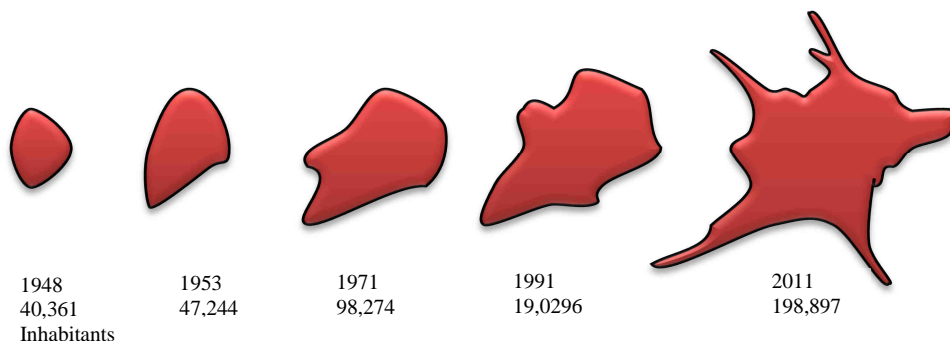


Fig. 1. Spatial changes of land morphology, and number of inhabitants through decades, city of Prishtina [12, 13]

The demographic, and urban boom in 2000, the process of uncontrolled growth of the city are a result and characteristics of major cities, after major crisis. According to the survey of the OSCE the city of Prishtina in 2000 had 545,477 inhabitants [11-13]. The new millennium began with crucial activities for Prishtina, in conditions of demographic and environmental development. The city had experienced a multidimensional change in all possible fields. Being the capital city of Kosovo, in a very short time the population of Prishtina has nearly doubled, adding every day approximately another 30 % of the population coming here for work, or possible settlement and migration [12]. The uncontrolled growth of the city, has made the solid waste management a serious problem. Prishtina had encountered many restrictions with landfill waste and garbage collections, in this context, city faced many ecological challenges: low collection coverage, lack of contemporary treatment and unsuitable waste management from recycling and disposal structures. All this impact on environment has resulted with air pollution, degraded quality of water, and overall risk for public health.

Generated waste

The amount of generated waste per inhabitant in Kosovo in 2008 was 167 kg, in 2009 was 193-297 kg, in 2010 and 2011 was 335 kg, and in 2012 was 334 kg. These data show a significant increase in the amount of waste per/capita. Compared to other regions, the region of Prishtina has the largest annual amount of waste generated per inhabitant. In 2008, the daily average waste generated per inhabitant was 0.9 kg, in 2009 it was 1.2 kg, in 2010 1.4 kg, in 2011 1.3 kg, and in 2012 it was 1.4 kg. In other regions, on the other hand, the average daily waste generated in 2008 and 2009 was 0.3 kg to 0.6 kg, in 2010 was 0.8 kg, and in 2011-2012 was 0.7 kg, as presented in Table 1 [14, 15]. The data presented in Table 1, show that the largest amount of waste is collected 'door to door', while according to the collective housing, the service of collecting is smaller. This difference between the amount of waste collected by 'door to door' and service of collecting is very common in other regions, compared to the Prishtina region. Hence, by using our essential resources, and through ineffective energy efficiency, we have outcome of much waste that can be recycled as an appropriate resource, which further enriches the climate change [14].

Table 1
The amount of municipal waste collected per/inhabitants, [kg/yr; kg/day] 2009-2012 [15]

Site collection	2009			2010			2011			2012		
	Assembling quantity	Waste	Waste/ Inhabitant/ Day	Assembling quantity	Waste	Waste/ Inhabitant/ Day	Assembling quantity	Waste	Waste/ Inhabitant/ Day	Assembling quantity	Waste	Waste/ Inhabitant/ Day
Unit	1000/ Mg	kg/ Inhabitant		1000/ Mg	kg/ Inhabitant		1000/ Mg	kg/ Inhabitant		1000/ Mg	kg/ Inhabitant	
Prishtina Region	218	436	1.2	222	511	1.4	230	488	1.3	248	515	1.4
Other Regions	187	117	0.3	293	223	0.6	352	278	0.8	352	269	0.7
Kosovo Total	405	193	0.5	515	297	0.8	582	335	0.9	606	334	0.9

Percentage of waste by type: Pristina [16]

	Type of waste	Prishtina [%]
1	Biodegradable	41.00
2	Wood	1.20
3	Paper	12.80
4	Plastics	14.80
5	Glass	4.50
6	Textile	3.50
7	Metal	1.20
8	Dangerous remains	0.40
9	Inert waste	7.20
10	Other materials	13.40

Table 2 shows the waste structure according to the types of waste in the Prishtina city, where municipal plans are developed for waste management in Pristina. Moreover,

comparing the structure by types of waste in Prishtina for 2003, comparing to 2012, it is evident that the structure according to the kinds of waste has changed enough. As presented in Table 3, in the percentage on the volume of industrial waste from businesses with seven or more employees, the largest amount of waste is generated in the production sector for food and beverages, 49 % in industries with more than seven employees.

Table 3

The amount of waste generated, and hazardous waste from companies with seven or more employees [16]

Group	Type of industry	Waste not dangerous [Mg]	Waste dangerous [Mg]
14	Mining and quarrying	172.68	35.5
15-6	Manufacture of food products and beverages/ Manufacture of tobacco products	297.17	550
17-19	Tannin or leather covers; bag production, handbags, saddlery, harness and footwear	297	-
20-22	Publishing, printing and reproduction of media Registered organizations	445	85
23-25	Manufacture of rubber and plastic products	3451	-
26	Manufacture of other non-metallic products	94.49	34
27-29	Manufacture of machinery and equipment	415	-
30-35	Manufacture of other transport equipment	-	-
36	Manufacture of furniture	47	30
37	Recycling	15.32	-
40	The supply of electricity, gas, steam and hot water	11	-
41	Collection, purification and distribution of water	244	-
Total		566.66	36.9

Furthermore, based on the presented data it is clearly evident that large amounts of waste come from the mining sector, and it must be evidenced that the mining sector mainly generate large amounts of dangerous waste. The medical waste can be considered as a dangerous and special waste and it can be defined as a waste generated as a result of the diagnosis, treatment and immunization of humans or animals. In many cases, hospital waste can be considered as hazardous waste, which can cause or contribute to presenting serious illness or death, or when its exposure increases the risk for public health or the environment if not properly managed or disposed properly [16]. Medical waste is mainly divided as follows [16]:

- Biological crops and their residues and stocks of contaminated substances;
- Human blood and its products, materials contaminated with human blood;
- Sharp materials such as syringes, pipettes, sharp blades, utensils and needles;
- Contaminated medical devices, in contact with infected material;
- Contaminated left over from infected materials.

Kosovo landfill waste status

Efficient waste management is of crucial importance to preserve the environment and public health. Eliminating waste disposal and advanced management of sanitary landfills in general are of fundamental importance. Kosovo as a country aspiring to European integration process, must progress not only in the management of sanitary waste landfills, but also in all segments of other waste management in accordance with the relevant EU Directives. In general, municipal and regional landfills waste are managed by public

enterprises, and there were ongoing problems. Furthermore, despite these problems present in Kosovo, landfill closure would not be as an alternative solution to the problems, because it would create even greater illegal landfills [16].

Landfill waste in Prishtina

Regional sanitary landfill in Prishtina is located in the municipality of Obiliq, in a place called Mirash. The construction of this landfill began in 2004, and it started to operate in 2005. The construction of the landfill was funded by the European Commission. This waste landfill collects waste from the municipalities of: Prishtina, Obiliq, Lipjan, Fushe Kosova and Drenas. The size of the collecting landfill is about 40 hectares. Its lifespan is estimated to be 15 years, with a total capacity of 3,500,000 m³, and the monthly capacity of 6000 Mg (tonne). During the site visits and research done, it was concluded that the landfill is not in a good condition. The biggest problem evidenced are the malfunctioning of pumps, which has resulted in the creation of a wastewater basin, totally mixed with surface water and groundwater. Hence, there are no oppression and compacting of waste, and linkage of polluted water is a common occurrence. This has affected the space of waste to be reduced [15-17].

Table 4

The amount of municipal waste collected per inhabitant 2014-2015 [15]

Prishtina	Waste/ Inhabitant/ Day [kg]	Waste/ Inhabitant/ Year [kg]	Kosovo	Waste/ Inhabitant/ Day [kg]	Waste/ Inhabitant/ Year [kg]
2015	0.59	214	2015	0.48	177
2014	0.50	193	2014	0.40	140

There are no licensed incineration plants for burning hazardous waste in Kosovo. Before 2008, only 20-30 % of these wastes were burned in the furnace, while the rest was thrown into municipal waste areas. Most of these incinerators have been out of operation since 2008, partly due to failure and due to non-compliance with environmental standards.

Table 5

The approximate amount of medicinal waste generated "per capita" in Kosovo [18]

Type of waste	Daily amount [kg/capita]	Annual amount [kg/inhabitant]	Annual amount [Mg]
Medicinal waste	0.0024	0.876	2014.5

Same situation is in the University Clinical Centre of Kosovo in Prishtina, where part of the medicinal waste ends up in the waste landfill in Mirash, while a more sensitive part that can be extremely dangerous to the health of citizens are buried alongside to the Prishtina cemeteries in the Arberia neighbourhood. Furthermore, medical remains from the University Clinical Centre of Kosovo, mostly from the Pathological Institute and the Gynaecology Clinic, are sent to the Prishtina cemeteries. Hence, remnants of the placenta, remnants from the ambulatory Pathology Institute, and specimens from the examinations performed at the Pathological Institute actually are not processed in the hospital incinerator, simply because they are out of operation. According to the survey of the civil society organisations, burial of the Prishtina hospital waste in the city cemeteries is inadmissible. Collection of hospital waste and their coverage is in contravention of legal norms and

international practices and that these wastes should be treated differently, since in this form the life of the citizens is endangered. On the other hand, it is also difficult to estimate the exact number of injuries and infections, which are interconnected in contact with hazardous waste, since there is no accurate evidence of infections and data taken from hospitals.

Table 6

Quantity of medical waste treated in sterilization plants [19]

Institution	Waste	2011 [kg]	2012 [kg]
University Clinical Centre of Kosovo. Prishtina	Self-generated	133,360	113,800
	Contracted	7,757	15,057
	Total	141,117	128,857

Table 7

Average of medical waste [kg] treated at plant in relation to the number of patients [19]

Institution	2011	2012
University Clinical Centre of Kosovo. Prishtina	1.57	1.31

The form of combustion waste treatment, are limited and not implemented by the healthcare institutions, because the incinerators have not met the environmental criteria's. Insufficient functioning of the incinerator as a burner in health institutions and the lack of other alternative waste management forms has caused inadequate treatment for certain types of waste, waste that cannot be treated in any other plant, or other way. Hence, how these types of waste are treated? Inspected actions of the Auditor General has noticed that the initial separation of medicinal waste is not done in every case, among other things, the contracting company does not make regular supplies with these tools that serve for the initial classification of the waste. According to the Auditor, there are cases where sacks, partition vessels, and containers are missing, even, in some cases medicinal waste are mixed with other common waste [19]. In absence of incinerators, for the treatment of the pathological waste of human origin, actual situation discloses that the burial of medical waste represents the only solution, health institutions have contracted municipal waste management companies to handle medical waste. However, there are legal facts that even those companies dealing with waste treatment, are licensed only for common waste management. Furthermore, the law of waste management foresees that all companies to be licensed for the types of waste they treat, as well as the persons who manage them.

Table 8

Waste quantity for Kosovo, Croatia, and Slovenia [2]

	Total amount of waste [Tg]*	Total amount of waste in municipalities [Tg/year]	Total amount of waste in municipalities per year [kg/capita]
Kosovo	2.504	0.4	192
Croatia	12.6	1.2	270
Slovenia	8.4	0.8	400

* Tg = 10¹² g = million tonnes

Waste management in Kosovo endures serious and obvious problems. Delays in solving the difficulties of managing the different types of waste have resulted in the current

situation, which in terms of management is deficient, and financially it is very difficult. The enormous challenge is the creation of a waste management system at the local level, with which the entire management system will organize collection of waste from their territory. Furthermore, the main of the challenges so far was the legislation, legal under acts, and the division of competencies for waste management. Environmentally crucially, there are no incinerators for the waste management in the municipality and region levels, the same situation is reflected in the medical waste treatment, incinerators have been operational till 2008 in the health institutions.

Table 9

Waste treatment and disposal in Kosovo [2]

	Collected waste for recycling [%]	Collected wastes for biological treatment [%]	Accumulated waste for incineration [%]	Collected waste for landfills [%]
Kosovo	9	1	-	90

Table 10

Waste quantity from Prishtina's regional, and municipal sanitary landfills [Gg/year]* [16]

City	2009	2010	2011	2012	2013
Prishtina	84.661	87.742	81.817	78.394	89.806

*Gg = 1000 Mg = 1000 tonnes

Debris on the urban structure of Prishtina has been a common view for many years. Actually, in this research are identified three crucial reasons for this situation:

- The municipality of Prishtina does not have all the proficiency needed to process a complete contemporary waste management strategy,
- The municipality lacks on the needed assets and resources to keep the city clean,
- The urbanites themselves do not contribute on a requested level of their role in the process of keeping the city clean.

Moreover, the municipality of Prishtina lacks sufficient experience in the field of waste management and contemporary treatment of modern waste. It is argued that Prishtina is actually one of the dirtiest cities in the region, why is that so?

Discussion

From the site survey and research done, there are evidently ongoing problems with the operation of waste in landfills. Furthermore, the biggest problem evidenced is the malfunctioning of pumps, which resulted in the creation of a wastewater basin, totally mixed with surface water and groundwater. Furthermore, there is almost no oppression and compacting of waste, and linkage of polluted water is a common occurrence, which has affected the space of waste landfill to be reduced. Even the burning of waste in landfills was often evident. It is crucial to study, adopt, adapt and implement adopted strategies for waste management, which will enrich efficiency of waste treatment and reduce hazard of public health. In Kosovo, there are official companies that operate with the collection of specific types of waste, such as: paper, plastics, metals, batteries, cans, tires and oils. In the absence of structures for waste recycling and processing, some of these companies only operate with the collection of specific types of waste to be exported in other countries in the region, which have facilities for recycling such waste. Waste collection companies are

various, although many in number, they have little capacity and many of them are not licensed to legally operate [16].

Waste recycling

Waste recycling is a process where technical benefits derive from waste, ecologic and economic part. The importance of recycling lies in the reduction of the amount of industrial and municipal waste, which are sent to sanitary landfills. Through waste treatment with recycling method is created a new opportunity, using secondary raw materials by creating new products, further reducing the use of new natural resources for the same purpose. In Kosovo, there are few facilities for recycling, mainly for recycled plastics and paper. There are several small companies that benefit through the recycling of paper packages for deployment of eggs, and toilet paper packages. Another example, that can be mentioned in a positive context is the project for collecting and recycling water bottle caps, for securing wheelchairs for persons with disabilities [16].

Reuse of waste in Prishtina

Some products are designed and manufactured in a way that can be used several times. EU regulations clearly suggest that manufactures should consider the possibility to reuse the packages. In other cases, products can be processed for the same or similar use, the reuse of plastic bags or glass jars are common examples. There are several reasons for the reuse of products:

- Save energy and raw materials,
- Reduced cost for storage,
- Reduced cost for merchants and consumers.

In Prishtina, there are cases of reuse of PET bottles for water, but also for packaging milk and selling it in the local market. Also, there are companies which reuses bottles for refilling and gives the consumers compensation for their return. There are more and more initiatives for opening of shops with used products including clothing, electronic equipment, used tires, and other items. In most cases these products are imported from western countries, and this is a positive aspect in the process of reuse, a positive action since many of these items go to waste, which impacts and clearly increases the amount of waste.

Burning the waste

Another form of waste treatment, common in Kosovo is by burning the waste. This is usually done to reduce the amount of infectious waste or actions to finally destroy them. Frequent cases are burning drugs seized by customs or those with expired use or burning of various items seized by customs as part of suspicious goods. Burning is done in controlled landfills that have an environmental authorization from Ministry of Environment and Spatial Planning. There are also examples of burning of oil waste used mainly for energy recovery heating, although such action is not allowed, as well as cases of burning waste in landfills are considered illegal [16].

Promotion of urban Ecologically Sustainable Development

Environmentally, the need to reduce waste, increasing the amount of recycled materials and implementing a sustainable use of material resources is a crucial directive,

which are approved by all levels of government. For a sustainable human development, we have an obligation to have effective actions for the waste management. Furthermore, the actual services are not well established and the collection concept is not the most preferred, and it needs to be enhanced.

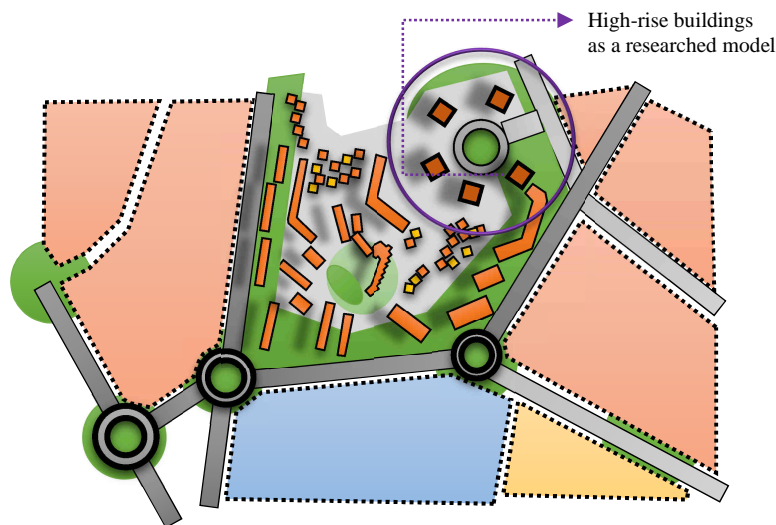


Fig. 2. Locations of high-rise buildings in Ulpiana, Prishtina [14]

Qualitative waste utilization and waste reduction cannot be accomplished unless the environmental actions are supported from the municipality of Prishtina. Furthermore, it is argued that the improvement in waste separation and collection systems is an essential factor [14, 16]:

- To promote awareness of households recycling and disposal;
- To identify the real issues of the waste management, specific to high-rise housing;
- To promote urban culture awareness for waste, and contamination;
- To promote the practical actions of waste collection.

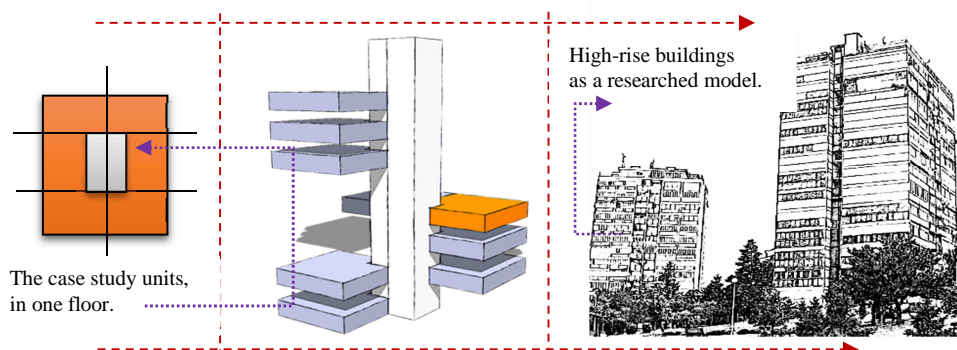


Fig. 3. The case study units, for the research in the high-rise structures, Ulpiana, Prishtina [14]

Table 11

Area, size and structure of the investigated housing units [14]

Unit Structure	Story No:	Area Story [m ²]	Units/per Story	Inhabitants/per Unit	Inhabitants/per Structure
1	11	384	6	4	264
2	13	Cca: 384	6	4	312
3	13	Cca: 384	6	4	312
4	9	Cca: 440	6	4	216
5	9	Cca: 440	6	4	216
Total					1320

This case study aims to investigate households of Ulpiana neighbourhood as presented graphically in Figures 2 and 3, in high-rise buildings for recycling environmental actions. Further, it permanently promoted in the neighbourhood, the environmental understanding of waste recycling in practice, accompanied with practical guidance for the implementation of those actions. The case study presents the importance of environmental approach to promote urban health culture, hence, a new strategy is required to implement urban environmental actions in a full cooperation with the municipal authorities. Promoting recycling actions are the most obvious actions to achieve truly sustainable waste management, especially in medium and high rise architectural structures with design parameters as presented in Table 11, which are the best environmental models for collective collecting of urban waste, thus, aiming simultaneously in recycling urban, and quality waste management of wide neighbourhood actions. Conceptually were identified the four phases during the collective collecting of urban waste of the neighbourhood waste containers:

- Inhabitants deposit the waste to the containers, sorting the materials to collection dedicated containers, thus, making the recycling process easier;
- Inhabitants deposit the waste to the containers: sorted waste are site processed, and loaded into the dedicated vehicles;
- After the loading of sorted waste into the dedicated vehicles, close zone must be cleaned from possible left debris, and other waste which was not processed;
- Finally, the close zone and containers must be cleaned, this is especially important for possible attractive zone for animals, seeking for food. Moreover, the qualitative cleaning of the waste containers, represents the first and most preferred hygienic prevention of spreading infectious diseases.

Table 12

Municipal waste collected in 2014 [15]

Site Collection	Collective housing	Door to Door	Total
	[Gg]		
Prishtina Region	17,446	77,283	94,729

In this research, was estimated that urbanites included in case study zone, the five structures in Ulpiana neighbourhood in Prishtina, five high-rise building with 1,320 inhabitants, according to the research data for 2015, have generated 778.8 kg waste daily, in relation to the collective housing as presented in Table 12. It is argued that according to the conceptual findings in this paper, it is possible to sort the recycling in dedicated containers, amount of circa 25 % of total daily waste disposal. Furthermore, it is

concluded that in the studied high-rise structures, these environmental actions can go further in using biodegradable plastic bags, which can strengthen more those environmental urban actions. Thus, the amount of total 778.8 kg daily waste, can be reduced for about 190 kg daily dedicated for recycling/per structure.

In order to succeed those environmental friendly actions, there must be some stimulating measures for the urbanites involved in this sustainable framework, moreover, there must be clearly defined what are the benefits of the urbanites for participating in waste recycling management, and finally those benefits must be kept continuously and promoted widely to be attractive. The data presented in Table 13, the production and export of waste treated, recycled, and used in Kosovo in 2015, was 16,382 Mg of metal debris, 66 Mg of paper and cardboard, 2,606 tons of plastic waste and 36 tons of disintegrated devices. The total input was 19,107 Mg. The total amount of processed waste was 19,090 Mg. The amount of exported metals waste was 14,643 Mg, while the total waste in the country which was processed was 1,739 Mg.

Table 13
The amount and destination of waste [Mg], managed by recycling companies in Kosovo [15]

Waste/Material	Total	From which	
		Exported	Processed/used
Metal, metal waste, metal waste with colours	16,382	14,643	1,739
Paper	66	60	6
Plastics	2,606	2,072	0.534
Equipment, fragmented parts of vehicles, electronic equipment, batteries	36	16	20

Conclusions

The research model of high-rise housing, surveyed for waste management in recycling process with a total generated waste of 778.8 kg daily, according to the conceptual and calculated findings, with a proper urban strategy for the implementation of recycling waste materials, indicates that the waste amount can be decreased and recycled for about 25 % of total daily generated waste. Furthermore, recycling can go up to 30 %, in a year compared to the actual state. In regard to the actual environmental conditions in Ulpiana neighbourhood, it is expected that those urban actions will be visually noticed in relation to the dirty streets. Based on the research findings presented with the best practices of literature review, it is recommended that ecological awareness for qualitative environmental waste management, and awareness for recycling processed materials, originate a non-negotiable ecological development strategy. Moreover, it should be especially implemented in high-density housing, and it can be explained also by the thermal conditions [17], as predecessor model of future hybrid high-rise architectural structures. Furthermore, the recommendations of this study are as follows:

- Promoting, developing and implementing ecological actions for sustainability;
- Implementing the incinerators for burning the medical and common waste;
- Implementing projects, and programs for recycling, treatment and reuse of the waste;
- To increase inter-institutional cooperation in the sustainable development;
- Raising awareness to youth, about waste disposal in appropriate places and perform obligations to communities;
- Building the waste treatment plants in every municipality of Kosovo.

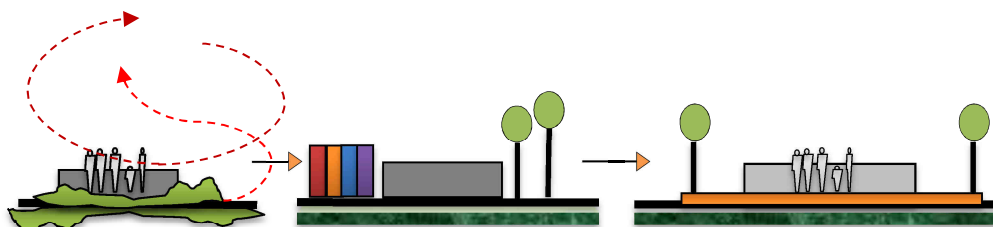


Fig. 4. Differences in use from sustainable awareness: technical solutions aimed at minimizing the negative impact of the landfills on the environment, and environmental friendly actions for sustainable waste recycling

Moreover, for technical solutions aimed at minimizing the negative impact of the landfills on the environment [20, 21], must be taken the engineering works in implementing the insulation layers from geotextile, plastic wraps, or clay in landfill structures, which will prevent the drainage of wastewater, thus preventing leakage from the regional landfills into the environment. Environmental protection from the wastewater pollution should be made through a drainage system, where the contaminated wastewater stream must be controlled and directed from the landfill to the waste treatment plant as presented graphically in Figure 4.

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