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**WATER POLLUTION AND WASTE MANAGEMENT  
IN SPAIN AND ARMENIA**

Thesis in: Environmental Legislation

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## Abstract

During last years the ecological problems increasingly recognized as a crucial process for humanity in all over the world. A great number of emerging pollutants have been found in the atmosphere, the drinking water resources, wastewater and sewage system, marine ecosystems, and in human and animal organisms. To prevent this problem, it is very important to develop relevant strategies and policy for sustainable waste management providing health and clean environment. Hence, the accurate and targeted waste management will assist to overcome many of difficulties in contemporary life. Waste management is an important issue which impacts on different features of economy and society. The key attention of this thesis is focused on Spain and Armenia that gave an opportunity to study the relevant issues and problems on waste management. This thesis presents a comparative study that observes the differences of waste management accomplishment and legislative frameworks in a developed country (Spain) and a developing country (Armenia). Therefore, through analyzing of the waste-use problems in these countries it is possible to recognize the ways of proper and effective waste management.

## **Index**

### **Glossary and Acronyms**

**EU** - European Union

**UN** - United Nations

**SDGs** - United Nations Sustainable Development Goals

**MPs** - microplastics

**IUCN** - Union for Conservation of Nature

**INE** - National Statistics Institute

**WHO** - According to World Health Organization

**PPE** - Personal Protective Equipment

**WFD** - Water Framework Directive

**IRWM** - Integrated Water Resource Management

**EEC** - European Economic Community

**UNEP** - United Nations Environment Programme

**WH** - Waste Hierarchy

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## CHAPTER 1

### 1.1. Introduction

Water ecosystems are highly exposed to pollution in the result of human activities. One of the main factors is the waste dumping and accumulation in the seas, rivers and lakes due to increase of the population on coastal areas and tourism development. Most of the environmental pollution cases investigated are related to the water pollution which has a great influence on coastal environment. This problem comes from the past as during a longtime especially the oceans, seas and rivers has been considered as a dumping place of waste from different sources, such as garbage, industrial, chemicals, wastewaters etc.

The coastal ecological surroundings are also significantly impacted by water state in cities because of industrial and domestic outflows which are discharged into the water, thus contaminating the environment and resulting deteriorating impact. Furthermore, the anthropologic factor deteriorates the water quality in the result of agricultural activities, irrigation, use of pesticides and fertilizers, animal husbandry, deforestation, mining, etc. Chemicals used at industry, in agriculture and at home, can be spread in the environment via wastewater. The main sources of wastewater may be categorized as agricultural, industrial and municipal.

The development of up-to-date remote sensitive technologies and tools allow to reach the spatial data and the environmental quality data which gives a chance and to get more information on detailed picture and progress on waste in the water. However, there is still lack of information regarding the waste sources and ways as well the chemical and biological interconnection in the environment. For this reason, it is very important to establish waste related regulations and strategies in order to avoid possible threats and risks, and at the same to fight against this problem. Proper waste management policy will provide an opportunity to escape the waste at the phase of production and manufacturing and to limit or prohibit the use of those materials which are non-recyclable and replace them with bio-based ones.



It should be specified that waste mismanagement has impacts at three levels: municipal or local impacts, such as soil and groundwater pollution, spread of diseases due to animal vectors (mosquitos, rodents) and air contamination; regional impacts, due to pollution of waterbodies used for agriculture and household purposes; global impacts, such as global warming and marine littering. Therefore, a common front should be organized for reducing these impacts globally, for improving environmental conditions and sustainable development. (Ferronato and Torretta, 2019: 21).

Waste is strongly connected to a scope of other worldwide challenges, which are climate change, poverty decrease, health, food security, and sustainable consumption. In order to overcome various challenges worldwide, in 2015 the UN adopted 17 Sustainable Development Goals which are included in the UN Agenda for Sustainable Development 2030. The Agenda's Goals focuses on decrease of poverty, clean water, good health, quality education and other global issues. The United Nations Environment Programme and International Solid Waste Association (2015) establishes 5 Global Waste Management Goals which will help to implement the United Nations Sustainable Development Goals (SDGs).

So, the first two Global Waste Management Goals are: (1) to ensure, by 2020, access for all to adequate, safe and affordable solid waste collection services; and (2) to stop uncontrolled dumping and open burning. Goal (3) takes this one step further, by 2030 to achieve sustainable and environmentally sound management of all wastes, particularly hazardous wastes". (Wilson and Velis, 2015).

## 1.2. Scope of the Research

The goal of this thesis is to investigate the challenges in water area problems due to waste management in Spain and Armenia and provide an overview from different perspectives drawing up new recommendations for smooth and sustainable environmental management.

Within framework of this thesis, it was presented water framework directive, wastewater treatment and water reuse regulations, solid waste and hazardous waste management issues and legislative framework in above mentioned countries.

Mainly the relevant legislation agreements and directives on waste management issues as well as the differences of waste management laws and practices between Spain and Armenia were pointed out in the thesis. Furthermore, by analyzing waste-use problems in these countries it is possible to understand the ways of properly and effective waste management and to solve water-related issues in both countries.

In a whole both Spain and Armenia are facing a number of environmental problems and the waste mismanagement such as: fully or partly polluted environment which threatens the human health, improper waste disposal, unresponsive public's attention on the waste, strict policy and actions for establishing selective disposal and collection, lack of updating of operational waste management systems and facilities, insufficient state funding, etc.

The aim of this work is to examine on which points are the European Union (EU) directives on waste management applies to Spain and Armenia. As a non-European and a post-Soviet country, Armenia holds a numerous of problems related to the waste management than Spain has, so that is why the thesis focuses more on the problems of Armenia. So, in order to achieve adequate waste management in Armenia it is actual to change the public's awareness on waste and education.

It is worth to point out that this problem is impossible to solve totally but it is possible to prevent with forward out several actions, laws and regulations. Therefore, a general common policy should be implemented in order to reduce these impacts globally and to improve the environment for further sustainable development.

### 1.3. Methodologies

#### 1.3.1. Description of study area

The study areas of attention are Spain and Armenia. These two countries are enough different, but despite of this they have many cultural similarities. The political and economic situation in these two countries is considerably different. Armenia is situated in the Caucasus and has small area and population, and Spain is located in Europe surrounded by the ocean and seas. A comparison study and relevant analyses were conducted between the water bodies of Armenia and Spain. The main target of this research is the waste management issues and challenges regarding these two countries, as well as the water pollution problems arisen in the result of improper waste management policy. In the course of the study, it was used a variety of literature, research data sources, such as articles, publications, reports, books etc. It is important to indicate that laws, regulations, and policies changes often in many countries. Along with new amendments in laws and regulations the government officials are also replaced with new ones, and in parallel to this, the waste management policy changes too. However, it was presented appropriate facts and consequences clearly and effectively, hence the focus was on the most common and important measures that provides the legitimacy of this research.

Also, it has been noticed some restrictions and complications during the examination of data base and relevant information on Armenia. The most significant issues are the following:

1. Lack of data (an accurate statistical data on waste is absent for Armenia, because still there is no relevant and detailed research about waste management)
2. Outdated data (as to Armenia, there are no complete up to date available data base about several issues)
3. Untrustworthy sources with insufficient data (several updated records available on waste issues in Armenia are not true or incomplete).

It is worth to mention that in the center of attention of this thesis are the water pollution problems commonly for both countries, and as well as the waste management systems issues. But after spending time on data collection, it was found out that it is impossible to take Spain as a whole and compare it with small Armenia because of enormous differences between them as they are completely different by their geographical

areas, dimensions, and the economy. For this reason, it has been decided to focus on Armenia as a whole and compare it with related aspects and sides of Spain where there are in correspondence with. Particularly, the attention was drawn to Spain's water pollution problems due to waste in regions of the vicinity of Barcelona, Gulf of Alicante, Alboran Sea and the Canary Islands, and Armenia's water pollution problems due to waste in Sevan Lake, Hrazdan river, "Yerevanyan Lich" reservoir. A literature review shows that the maximum waste amount in Spain is found on the Mediterranean beaches. The most waste detected on Spanish beaches is the result of tourism activities (Canary Islands, South Atlantic, Strait and Alboran demarcations) Levantine-Balearic and the navigation (North Atlantic demarcation). The geography and diversity of the seabed are also one of the main factors why Spain is prone to the waste increase in the bottoms. "Spain is the second deepest country in Europe, after Portugal, and is particularly worrying due to factors such as the large number of marine geological formations present and the high depth of its seabeds (more than 3000 m. on average)" (Martín-Lara et. al., 2021: 17). It is worth to mention that in Spain there is a great biodiversity and because of waste accumulation the ecosystems can be vulnerable. Also, the waste pollution may threaten the main sectors of economy particularly the fishing and the tourism. The tourists can be discouraged because of contaminated beaches, and they can seek for another country to visit. This may also have a negative impact on the economy.

## 1.4. Spain

Spain is located southwestern Europe (Figure 1) on the Iberian Peninsula. The country is covered by water on three sides and it is the fourth largest country in Europe with population of 47.1 million people. Spain has a surface area of 505,992 km<sup>2</sup> and its coastline is about 8000 km. The 4 marine areas are: Cantabrian, Mediterranean, Macaronesian Atlantic (Canary Islands) and peninsular Atlantic. The country has borders with France, Andorra, the tiny British Overseas Territory of Gibraltar, and Portugal and shares marine borders with Morocco, Algeria and Italy. Spain has 1,800 rivers and streams from which the Tagus has more than 960 kilometers long.

Spain's climate is varied because of its geographical location. It has four main climatic zones: Mediterranean, Continental, Subtropical and Oceanic.

The economy of Spain is one the largest in the world. It ranks at 14<sup>th</sup> place among the world's economy. The main industries of the country are the following: tourism, agriculture, manufacturing, and the energy industries.

“Spain is a social and democratic country. The political form of the Spanish State is that of a parliamentary monarchy” (Spanish Constitution, Article 1, 1978: 9).

Spain became a member state of the EU since January 1, 1986. The country is also a member of the North Atlantic Treaty Organization, United Nations, the Development and the World Trade Organization and Organization for Economic Co-operation.



Figure 1. Map of Spain (<https://geology.com/world/spain-satellite-image.shtml>)

## 1.5. Armenia

The Republic of Armenia is a mountainous and landlocked country which is situated in South Caucasus region (Figure 2). Armenia's climate is highland continental. The country occupies 29,743 km<sup>2</sup>. It has borders with Turkey and Iran in the west and south

and with Georgia and Azerbaijan in north and east. The total population of Armenia is 2,965,300 from which 64% lives in urban areas. “76.5% of the republican territory is on the height of 1000-2500 m above sea level. More than 60% of the territory is covered by stratum of different type of volcanic rock and tufa” (Geographic Characteristic of The Republic of Armenia, 2009: 6). There are 49 cities and villages in the country. The country is divided into 10 regional administrative divisions, and the capital Yerevan has special administrative status. In 1991 after the collapse of the Soviet Union Armenia obtained independence. Currently Armenia is a developing country.

Armenia has large volume of water resources that play an important role in the development of economy. “About 96 percent of the water used for drinking purposes and about 40 percent of water abstracted in the country comes from groundwater” (Cestti, and Lee, 2015: 1). The country totally gets 18 km<sup>3</sup> of water yearly particularly from precipitation and the most volume of which disappears in the result of evaporation.

About 400 rivers are located in Armenia. Lakes of Armenia are mainly small and mountainous apart from Lake Sevan which is the biggest freshwater. Due to permanent water withdrawal from its basin during last decades Sevan has been recognized as an environmental disaster. Armenia withstands to different water management challenges, such as water resources disproportion, uncontrolled water withdrawal, large volume of water loses for irrigation and other purposes, increasing environmental pollution, etc.



Figure 2. Map of Armenia (<https://www.gov.uk/foreign-travel-advice/armenia>)

## 1.6. Brief History of Waste

Although the waste is one of the important environmental problems in the existing society and its history and roots go back to the far away in the past. The first controlled landfill started about 3.000 years BC in Greece. The Crete islands inhabitants were digging out holes from outside city for waste disposal, and in Athens somewhat like waste collection system and landfills had been created with simple tools.

The Roman Empire was the first to create waste collection service, Romans worked hard on construction of appropriate sewage systems which was called “cloaca maxima.” This was a subsurface drainage and open canal systems for waste disposal. Europe had repeated this method and built the same system which was used until the Middle Ages. Ancient India and China as well developed their own clean up systems and tools.

With population increase in the Middle Ages the amount of waste became much larger than in the period of ancient times, so gradually surface runoff systems and holes had started to be constructed also in the cities. Of course, the ancient people did not know how to treat with waste without harming environment. For example, up to the 13<sup>th</sup> century waste was thrown out into Seine River in Paris, France. At that time an awful waste smell was spread all over cities and streets in Paris city. The 1<sup>st</sup> Law that prohibited to dump uncontrolled garbage into streets had been adopted in England in the beginning of 14<sup>th</sup> century.

So, because of large amount of garbage in streets of cities threat inhabitant’s health and under these conditions the health rate was very low in cities until 18<sup>th</sup> century. New modifications on waste disposal system and management had started only after 18<sup>th</sup> century. In the beginning of 19<sup>th</sup> century people had started to realize that the result of the rate of high mortality was the contamination of the environment. So new constructive tools and management policies had started to be implemented in Europe. The “age of sanitation” had started in 1842 when the states realized that there is a big relation between the human diseases and unclean environment. Since then, the European governance

bodies had been started to draw their attention at waste management problems to avoid from further possible negative effects.

The waste collection service procedures come from the mid of 19th century, while the controlled dumping appeared on the agenda just during the 1960s. The developed countries began to work in this direction during the period from 1970 to 1980 to remove the uncontrolled dumping.

As to the issue of Ocean and seas dumping it has started to be investigated only after 1960s. Before that countries were dumping their chemical by-products into water bodies. In the 1960s, more than 100 million tons of waste was discovered in the oceans. This waste was consisted of industrial, chemical, radioactive wastes, and sewage waste.

At these times people did not pay enough attention to harmful impacts of waste disposal on the environment. They could not even guess of possibilities of recycling of these materials. Wastes were permanently dumped into water, and they were thinking that marine waters had an unbounded capacity to mix and disseminate wastes.

In the past there was no relevant records available on these materials volumes and types, several reports indicate a vast magnitude of historic ocean dumping. In the result of uncontrolled dumping into the ocean the oxygen levels in some ocean waters have been depleted.



## CHAPTER 2

### 2.1. Water Framework Directive in Europe and Spain

The Water Framework Directive (WFD) was set up in 2000, the aim of which was to deal with the important water problems related to water use and quality problems. WFD is one of the most important EU legislations in water management issues and it promotes an updated conventional framework directed to general policy and objectives for the water management of Europe. According to the WFD the water is not considered to be as a commercial product, therefore it should be treated and protected. The major aim of WFD is the enhancement and protection of water environment in the European Union thus achieving in good ecological status for all water bodies, as well effective execution of fundamental standards of sustainable water management. In this context, the main point of WFD is to govern and improve the water quality in community through detecting and regulating the contaminants and activities affecting the water status, thus protecting the water supply. The WFD helps also to reduce problems connected with disproportionate water withdrawal problems, water contamination and floods. It incorporates the water use and water resources under one common policy to protect hydraulic ecosystems, groundwater and surface water resources.

Thereby, the WFD is the guiding principle of Integrated Water Resource Management (IRWM). IRWM aims to promote social, economic and environment sustainability. Particularly, the global aim of the WFD is to achieve a “good status” in all European communities. It is focused on regulations, which refer mainly to the River Basin Management Plans development. The water resources are managed in parallel to IRWM ideology on river basins level.

The WFD legally regulates the major points of river basin management which incorporates ecological and economic issues and involves stakeholders and public for decision making in water governance. WFD working plan is 6-year which includes the

assessment of the chemical, ecological, and quantitative status of waters, and establishes environmental objectives implementation and monitoring process.

The WFD transformation to the Spanish regulation was done by the Law 62/2003 which was inverted into Spanish law. The new Directive's approach has been changed according to the new requirements which are directed to the development of the chemical and biological data directed to evaluate the water bodies status. This helps to understand the quality of groundwater and surface water resources. The WFD (2000/60/EC) is a new water policy in Spain which directed to a new management model and is the most significant regulation on water policy in EU countries. This regulation set up standards for water protection and prevention from pollution, promotes to the water sustainable use, and is directed to improvement of water ecosystems.

The WFD principles the Spanish water policy should be based on are: (i) Sustainability; (ii) Subsidiary; (iii) Effectiveness and (iv) Participation. The sustainability Principle (no deterioration) is based on: (i) to prevent damages; (ii) to protect and improve the status of aquatic ecosystems and (iii) the integrated management at the watershed level to improve the ecological status. Estuaries, deltas and coastal waters are included (López, 2008: 49).

The information exchange among EU countries have been enhanced which was one of the main actions. For this purpose, WFD Circa (internet-based platform) has been established for public access for common water management policy. In the framework of this platform important information exchange and systematic meetings will be planned to identify agreements for protection the cultural, historical and climatic areas around of the Mediterranean zone.

## 2.2. Wastewater Treatment and Water Reuse Regulations of Europe and Spain

Wastewater treatment facilities get a huge amount of water daily via the sewage network including from household wastewater which is one of the major causes of environmental contamination. The treatment plants get water composed of high amount pollutants resulted from cleaning products, plastic industry, personal care products, cosmetics, paints, etc. In the seas and oceans about 70-80 % of pollutants emerges from land through rivers and the other 20-30 % emerges from marine sources.

Spain has been making efforts for wastewater issues for a long period of time. The first attempt of wastewater reuse was realized in 1970 in Gran Canaria utilizing recycled water for agriculture and irrigation. This experience was later applied to the rest of municipalities (Islas Baleares, the Islas Canarias, Costa Brava). Later wastewater plants were built also in the other regions.

The first regulation on reusing water in Europe was Directive 91/271/EEC on urban wastewater treatment. The article 12, paragraph 1, defines that “treated wastewater will be reused where appropriate. Disposal routes will minimize the adverse effects on the environment” (Council Directive of 21 May 1991 concerning urban wastewater treatment). The main regulation in UE is Directive 2000/60/EC – Water Framework Directive, which is an important challenge for the management and sustainable use of water. Directive 2000/60/EC states “With regard to pollution prevention and control, Community water policy should be based on a combined approach using control of pollution at source through the setting of emission limit values and of environmental quality standards”.

It should be noticed that the starting point of wastewater reuse in the legal system of Spain goes back to the Water Law of 1985 which was a significant progress related to the sustainable use of water including the water reuse. It has developed a new strategy related to the pollution and the discharge policy control.

Reuse procedure of water in Spain was ratified through Directive 91/271/EEC and it was transferred into the Spanish legal system, via Royal Decree Law 11/1995, about urban wastewater treatment and Royal Decree 509/1996. After amendments the Law 11/2005 became the final Spanish law regarding wastewater reuse. Based on the legal framework for the reuse of treated water “the Government shall establish the basic conditions for the reuse of water, specifying the water quality required for treated wastewaters according to the uses considered” (Spanish regulations for water reuse Royal Decree 1620/2007 of 7 December 2011: 1). Therefore, Royal Decree 1620/2007 in Spain at last set up the legal framework for reusing reclaimed water. This ratification considered to be a significant action towards the treated wastewater reuse regulation through creating quality standards for water reuse and defining the responsibilities of public administrations. Based on Royal Decree 1620/2007, “reuse of water” is defined as: “the application, prior to returning the water to the Water Public Domain for a new private use that, having been used by who derived them, have been subjected to a treatment process or processes established in the corresponding holder of discharge authorization”. Moreover, a new legal definition of reclaimed water is also introduced: “treated wastewaters which have been subjected to an additional or complementary treatment process that enables to adapt their quality to their intended use.”

In 1986 Spain joined to the European Economic Community (EEC) its approaches were changes, as Spain had to act in accordance with the European standards related to the water quality. So, the comprehensive cleansing works began with the National Plan of Sanitation and Water Treatment. “During its implementation period, the total volume of treated wastewaters in Spain changed from 0.13 m<sup>3</sup> /inhabitant/day in 1996 to 0.31 m<sup>3</sup> /inhabitant/day in 2006” (Jodar-Abellan, 2019: 5). In 2018 the country was at the top with the peak rate of wastewater reuse in the EU and it is among top ten countries in the world.

Despite the fact, that in recent decades Spain has failed to implement several European requirements regarding the water treatment and got many sanctions from the EU, however at the present the country shows one of the highest rates of wastewater

reuse in Europe and worldwide. “The annual total volume of wastewaters reused in Spain currently varies between 493 hm<sup>3</sup> /year and 268 hm<sup>3</sup> /year” (Jodar-Abellan, et. al., 2019: 18). Therefore, Spain is the greatest reuser of water in Europe. A large amount of treated water is used for agricultural purposes. Water reuse is very actual for Spain because of water shortage. On national level Legislation is accomplished by complete guidelines evolved by specific regions (for example Balearic Island, Andalusia, Catalonia). Generally, The European Commission water reuse Regulations are close to the Spanish legislation but anyway the Spanish legislations is more comprehensive according to its quality monitoring, and requirements. The Spanish legal national frame on water reuse is enough developed and points out common adequate criteria for quality and risk management measures.

Despite of growing water problems in the EU on treated wastewater, the water reuse process is still unregulated and limited in several Member States. At present Spain is one of the EU countries that has relevant standards on water reuse legislation.

### 2.3. Solid Waste and Water

In last decades the use of plastic has brought social and economic advantage, but the intensive use of disposable products led to serious environmental problems.

Plastics easily enter rivers and ultimately oceans and seas. The microplastics (MPs) come from primary and secondary sources from which the primary sources are the industrial materials, and the secondary sources are micro-plastics from the breakdown waste. The most micro-plastics in the aquatic environment come from household sewage discharge. The harmful effects of micro-plastics and nano-plastics usually are of mechanical and toxicological nature. They have negative impact on various levels on living organisms (on cellular and molecular levels).

Marine pollution which emerged in the result of plastics disposal has become a critical problem. The open dumping led to the contamination of surface water due to uncontrolled leachate and flows of various materials. Marine pollution caused mostly by

plastic waste is more noticeable on the seas and oceans. “Approximately 6.4 million tons of plastic are dumped into the seas and oceans each year (80% of all marine waste) in the form of “macroplastics” pieces larger than 2.5 cm, or “microplastics”, pieces of plastic smaller than 5 mm. (Martín-Lara et. al., 2021: 1). Micro-plastics (MPs) pollution has become a very important problem because this is a potential risk for marine fauna and humans.

Based on the research done by the International Union for Conservation of Nature (IUCN), due to improper waste management the macro-plastics compose 94% of total plastic waste in the environment.

Once the plastic reaches the sea or the beaches it is gradually degraded and turned into MPs, which are mostly deposited in sediments. For primary microplastic, tyre dust is the largest source of leakage (53%), followed by textiles (33%), microbeads in cosmetics (12%), and production pellets (Martín-Lara et. al., 2021: 2).

Marine litter is an increasing problem from which 80% consists of plastics and put forward guidelines and principles to decrease the plastic waste. This problem requires joint actions at all levels of environmental management of states. According to European Commission it is suggested that all plastics will be recyclable or reusable by 2030. In 2015 an international agreement has been signed by United Nations member countries in the framework of the agenda 2030. It presents 17 Sustainable Development Goals which are directed to the environmental, economic and social challenges. According to this Agenda the SDG aims to develop and protect the sustainable use of the marine resources.

In 2020 the European Commission suggested a new strategy for sustainable and modern plastics industry which helps to decrease greenhouse gas emissions, as well as provide jobs in Europe.

## 2.4. Plastic Pollution in Spain

Currently with growing concern over plastics production and use and as well the emissions pollution on worldwide level, Spain is in the center of attention. Spain is a lively touristic country, where the tourism is becoming one of the major causes of marine contamination year by year. The accumulation consequence is enough well observed in the seas. The MPs problem on the Spanish coastline of Mediterranean Sea composes for about 54% of plastic pollution.

The researchers indicate that the three areas with the highest presence of plastics are the Alboran Sea, the Gulf of Alicante and the vicinity of Barcelona, where in the Alboran Sea the presence of marine litter is high near the coast due to the fact that the narrow continental platform that leads to an accumulation of all types of litter in the coastal area (Martín-Lara et. al., 2016: 1).

Also, according to the Government's annual monitoring activities done on entire coast in Spain it was found out the high point concentration of microplastic contamination in the Canary Islands.

According to data from the National Statistics Institute (INE, 2020) the urban waste management companies collected 22.7 million tons of waste in 2018, 0.8% more than in the previous year. Of this, 18.3 million tons were mixed waste, and 4.4 million tons were collected separately. In per capita terms, 485.9 kg of waste were collected per person and year in Spain. With regard to plastic waste, in 2018, 2.5 million tons of post-consumer plastic waste were collected through official plans to be treated, 41.9% of which was recycled (13% more than in 2016), 19.3% was used for energy recovery (12.2% more than in 2016) and 38.8% was deposited in landfills (3.6% less than in 2016) (Martín-Lara et. al., 2021: 2).

“The new Directive (EU) 2018/852 on packaging and packaging waste sets recycling targets of 50% of plastic packaging by 2025 and 55% by 2030” (Martín-Lara et. al., 2021: 2).

In the last year's enormous works has been done regarding the plastic waste reuse in Spain, so in 2018 about 40% of plastic waste has been recycled. These activities are in the process up to now and have a big potential for positive direction and development. Spain is close to achieve objectives standards of the European Commission's on plastic waste.

The source of marine waste is primarily related to marine shipping or transfer, as well as fishing activities (South Atlantic and North Atlantic districts) and agricultural activities (Strait and Alboran demarcation - Almeria and Murcia).

The researchers indicate that the three areas with the highest presence of plastics are the Alboran Sea, the Gulf of Alicante and the vicinity of Barcelona, where in the Alboran Sea the presence of marine litter is high near the coast due to the fact that the narrow continental platform that leads to an accumulation of all types of litter in the coastal areas. In addition, due to the high level of maritime traffic entering and leaving the Strait of Gibraltar in open waters, the distribution of marine litter influences this area (Martín-Lara et. al., 2021: 3).

Many ecologists and representatives of ecological NGOs in Spain are working together to highlight the problem and annually implement environmental research of the about 8000 km of Spanish coastline, which covers 10 coastal sovereign communities including Ceuta and Melilla. Starting from 2015 two flags have been put in all provinces - first for pollution, and the second for the poor environmental management addressed to industrial activities, urban planning, water discharge, sanitation and purification, aquaculture, biodiversity, oil spills etc. According to the "Black Flags 2020" report, 48 black flags were put in various Spanish beaches. So, they found out that the more serious problem is the water discharge and the mistreatment on Spanish coasts.

According to World Health Organization (WHO) the above-mentioned issue should be studied thoroughly and it is important to examine micro-plastics in our environment including the drinking water and food. The health authorities in Spain have worked hard on investigation of the MPs influence on the health taking into account all risks as the MPs



micro-parts were found not only in the environment but also penetrate into the human and animal organs causing severe threats to health.

The European strategy establishes 3 main challenges to ensure the circular economy of plastics:

- by 2025 integrate 10 million tons of recycled plastics in Europe
- by 2030 modify plastic packing recyclable
- Eliminate all plastic waste which is dumped in nature.

## 2.5. Covid-19 as a New Type of Marine Waste in the World and in Spain

COVID-19 Pandemic spread all over the world and this is also can be considered as a negative impact for marine ecosystems, but still this direction is not fully investigated. However, the Coronavirus waste can be considered as a new type of marine waste. This was a considerably new challenge for humanity and the industry in the period of pandemic. So, updated regulations were developed on safe operations for cruise ships in EU regarding the COVID-19 pandemic which includes updated guidelines and procedures on how to deal with a covid related waste produced on board ships. It is worth to mention that in the period of COVID-19 pandemics the volume of medical waste was increased for 40%.

The use of Personal Protective Equipment (PPE) has grown up significantly such as face protective suits, gloves, masks, test kits, boots, plastic containers and bags etc. Plastic waste such as PPE increase pollution in the seas and oceans. This waste presents a new form of pollution called coronavirus waste and was a serious challenge for the environment, especially to the marine ecosystems. The biggest threat are the face masks which may become a source of MPs floating or sinking into marine waters.

During the pandemic a huge amount of masks and gloves were generated waste also on Spanish coasts. In the period of long-lasting months of the COVID-19 pandemic it was found out the high amount on single-use plastics.

For example, if 2/3 of Spain's population throw an old plastic personal protective equipment (PPE) as two days (mainly masks), it would be equivalent to around 476 million PPE per month. If 1% of those PPE are not properly disposed, it would be equivalent to around 57 million of PPE littered per year, many of which would end up in the coasts (Martín-Lara et. al., 2016: 4).

The problem of coronavirus litter was greatly noticeable in Spanish cities as well. So here we understand that the health crisis turned into social, economic and the environmental threat.

## CHAPTER 3

### 3.1. Waste Legislation of Spain

“Awareness of environmental issues arose only after the first environmental groups were established after the end of the Franco dictatorship in 1975” (Pelimskaya, 2005: 26). Environmental legislation was developed later in 1986, when Spain has been involved in the European Union. Spain has adopted European Union legislation and environmental directives. The Article 45 of Spanish Constitution of 1978 states: “Everyone has the right to enjoy an environment suitable for personal development, as well as the duty to preserve it.” (The Spanish Constitution, 1978).

Spanish Constitution of 1978 assign waste management responsibilities between the government, the local administrative bodies and autonomous communities. According to Article 149 of Spanish Constitution the Ministry of the Environment provides environmental legislation on the national level. “Despite the fact that Spain has implemented most of the EU environmental directives, Spanish policies concerning waste remain complicated and inconsistent” (Pelimskaya, 2005: 28).

The 1<sup>st</sup> Spanish Waste Law was adopted in 1985 which was directed to municipalities to draw attention on waste problems and take actions for the environment protection. 1997 Packaging Law (11/1997) and 1998 2<sup>nd</sup> Waste Law (10/1998) were adopted to announce obligations and responsibilities of relevant parties who are involved in procedures on waste management process.

The Municipal Solid Waste Plan covered 2000-2006 period which was supported by the 2<sup>nd</sup> Waste Law. This Plan presented exact targets and promoted funds allocation for infrastructures development and enhancement of public awareness.

Later on, in December 2008, The Integrated National Waste Plan for the period of 2008-2015 was approved by the Council of Ministers. This plan provided a comprehensive

investigation on waste management issues which includes waste plans for 17 autonomous regions. The plan includes a lot of targets to be gained by 2012.

In July 2011 the new Law on waste and contaminated soils was set up which transfers the Waste Framework Directive (2008/98/EC) into Spanish Legislation.

The legislation on waste in Spain is managed by appropriate management at various levels. On the national level, the duty of the Ministry of Agriculture, Food and Environment is to authorize and inspect the waste shipments to outside EU and from EU for the national plans. At the regional level, the duties of autonomous regions are the proceeding of strategic waste management plans for all relevant regions. These regions also are responsible for the inspection, authorization and sanction of waste management implementation and shipment. On the local level, the duties of municipal management are the governance of the municipal waste, including collection and transfer.

### 3.2. Solid Waste Management in Spain

“The Spanish population distribution further complicates municipal waste management. Only 0.8 percent of Spanish municipalities have more than 100,000 inhabitants, whereas 60 percent have less than 1,000 inhabitants” (Hidalgo, 2016). Special attention will be drawn on the Spanish islands. Waste generation in the islands grows up parallel to the tourism development. Municipal waste is originated from households and various institutions, office buildings etc. “Municipal solid waste is only a small share of total waste generated (about 10%), but its management and treatment often represent more than one-third of public sector financial efforts to abate and control pollution”. (OECD, "Environment at a Glance: Circular economy, waste and materials", 2020: 7). “Material recycling tripled since 2000, but it still covers only 17% of municipal waste. Two-thirds of waste in Spain is still landfilled” (OECD, Environmental performance reviews, Spain, 2015: 4).

In 2008 the total amount of municipal waste (household and equivalent) generated in Spain reached almost 25.3 million tons 55 kg per capita. A total that in 2013 reached 20.9 million

(455 kg of waste per capita. The result is a decrease, in 5 years of 17.3% (18.2% in terms of per capita) (Hidalgo, 2016).

Waste pollution increased notably with tourism development in islands. In Spain the urban waste collection, treatment, transfer and the removal are considered to be a public service which is mandatory in all municipalities. The waste legislation in Spain is under the management of relevant authorities acting on various administrative levels.

On the national level, the Ministry of Agriculture, Food and Environment is responsible for the national plans. On the regional level the autonomous communities are responsible for issuing strategic waste management plans for each specific region. On the local level the municipal management is responsible for the urban waste (domestic, industry and commerce, offices and services) including collection and transportation. (Almasi and Milios, 2013: 5).

“In Spain 76% of the waste collection market is provided by private companies and 24% is under municipal management” (Hidalgo, 2016). There are 162 islands in Spain with 3.2 million populations. The most of these islands are unpopulated and 99.8% of people lives in the Canaries and the Balearics, which are situated enough far from the Mainland. The factor of far distance from the Mainland also has an impact on the waste governance for these areas. The waste issue is an important problem that the environmental management faces on the Spanish islands.

The waste management implementation for tourism activities has a separate definition to carry out the proper management of waste, connected with seasonality. One of the main obstacles of the Balearics regarding the waste management is the oceanic algae on beaches, which is emerge in the result of the tourism activities. The removal of this kind of waste makes a problem for municipal services causing a negative influence on coastal ecosystems.

### 3.3. Hazardous Waste

“On the national level, Spanish legislation recognizes two classes of waste: hazardous and municipal” (Pelimskaya, 2005: 27). Hazardous waste generated due to industrial production activities is a growing and significant challenge for the international regulation. “In Spain hazardous waste production grew significantly from 1990 to 2000, increasing by almost 80 percent over the decade” (Pelimskaya, 2005: 29).

All waste which is not considered as hazardous is grouped as municipal waste. The municipal waste is not qualified as hazardous because of its specific composition.

Hazardous waste comprises of items such as construction and demolition waste, mining waste, old vehicles, electronic waste, used batteries, sludge from wastewater treatment facilities, and animal waste from slaughterhouses.

Hazardous waste can cause the most environmental harm and impact on human health, that is why it is more than actual to establish proper and accurate management procedures for the hazardous waste. Waste proper management means the following: to separate and sort the waste according to their nature and composition, and do not mix them, pack and label waste containers, put down related records on information regarding the waste quantity and composition, present regular reports on these records to the relevant department. It is necessary to take into account the strict management of collection and storage of the hazardous waste and at the same time develop risk-prevention plans.

### 3.4. EU Waste Regulation Framework

In recent years the public awareness for the environmental protection is increased and the demand for the clean environment became more and more important. The European countries have started to take measures for the waste reduction and thus contributing to the circular economy.

Several attempts are implemented to develop more comprehensive and global regulatory international frameworks on waste management issues as follows: OECD Council Recommendation on a Comprehensive Waste Management Policy (1976), UNEP's Cairo Guidelines and Principles for the Environmentally Sound Management of Hazardous Wastes (1987).

In 1990, the EU adopted first Community Strategy for Waste Management to guide waste management policy for member states. Following a Commission review of the Strategy in 1997 the Council adopted a revised Community Strategy for Waste Management, and in recent years' new measures have been adopted to supplement the original Directive 91/689/EEC on hazardous waste. (Sand et al., 2018: 572).

Since the 1970s the environmental protection issues have become one of the critical policies at the international agenda. When the costs for toxic waste disposal increased the traders started to look for cheaper ways to eliminate dangerous wastes. The cheapest method was to export the waste mainly to African or Eastern European countries. Randomly and improperly dumped waste led to polluted water, poisoned land, and contaminated air, in the result of which serious health and environmental problems occur. The Member States and policymakers have started to take more control at the waste management. In 1975 in response to alert of developing countries the Hazardous Waste Directive were adopted by the European Commission in order to regulate the waste issues. According to EEC on March 22, 1989, the United Nations Environment Programme (UNEP) adopted the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal which was signed by 53 states and the European Economic Community which aims to assist for regulation of the trade of hazardous waste and toxic shipments.

The main article of Basel Convention is the Article 4, which states:

Parties exercising their right to prohibit the import of hazardous wastes or other wastes for disposal shall inform the other Parties of their decision (b) Parties shall prohibit or shall not permit the export of hazardous wastes and other wastes to the Parties which have prohibited the import of such wastes, when notified pursuant to subparagraph (a) above. (c) Parties shall prohibit or shall not permit the export of hazardous wastes and other

wastes if the State of import does not consent in writing to the specific import, in the case where that State of import has not prohibited the import of such wastes. (Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, UNEP).

The principal and general aim of this Convention is to protect the environment and human health towards the impact of hazardous waste in the result of trans-boundary movements.

According to the European Commission, the main organizations who are in charge of the waste governance policies, are the European Commission, the Council of the European Union and the European Parliament. European Commission suggests a strategies and policy which protect the environment, keep water clean, provide proper waste disposal and enhance knowledge on hazardous waste and support to the development of sustainable economy.

Many other legislations on waste were adopted and updated, and one of them is the Waste Framework Directive of 2008 which sets a basis for organizing waste management in EU Member States to minimize generation of waste and to develop proper waste management. The EU's policy on waste management is built around the waste hierarchy. EU legislation sets up precedence for waste management. Thus, the Article 4 of the Waste Framework Directive put forward five-step hierarchy of waste management which should be adapted by EU Member States according to the following precedence: waste prevention, preparing for reuse, recycling, treatment, disposal.

The Directive draws out the policy on establishment of relevant system of waste management facilities to prevent the illegal actions and act in consistent with the waste hierarchy. The Directive enhances the effective use of resources and recycling of items. According to the European Commission the Directive supposes the adoption of waste management plans and waste prevention programs by Member States. Also all EU waste policies and legislations should be aligned with waste management hierarchy.



### 3.5. Problems and Recommendations for Spain Waste Management

The management of hazardous waste in Spain is very actual issue and it is in the center of authorities' attention. The management of waste is very important problem to be evaluated. Trustworthy data are important to evaluate the status of waste management and to establish relevant legislation which is the first step on improving the waste management problems. The data-collection process on waste production, transfer and treatment would be fully monitored and evaluated. The promotion of research by the state and private entities may enhance the process of collecting data. Spain possesses a widespread system for regulating and managing of waste, but even via proper legislation the enforcement of recently implemented regulations and laws quite weak. Spain is working hard to reduce the waste quantity and has a "National Hazardous Waste Plan" but still several decisions of this plan are not implemented properly. The management, prevention, and the recycling are the main actions to prevent the hazardous waste. In this case it is very important to enhance the public awareness the level of which is low in Spain, and this is one of reasons of water and air pollution. In Spain the recycling culture of waste is as well low. The Spain government considers that the waste management issues are relatively unimportant, and they do not put strong pressure on those who commit environmental crimes. The solving of this problem is the activities on enhancement of public awareness with specific campaigns in schools, universities, and in other institutions.

Spain's quick development of the economic in recent decades put a great pressure on the environment. Although the inhabitants in Spain are becoming more conscious for the clean environment, but anyway the waste management gets low public attention than other environmental problems. In Spain a regulatory regime for waste should be established to measure and protect the environment. Non-compliance with the waste regime is considered as a violation depending on the damage caused to human the health and environment. To ensure this compliance the authorities have a right to close the facilities or cease their activities.

## CHAPTER 4

### 4.1. Armenia - Water Pollution due to Improper Waste Management

#### 4.1.1. Case of Lake Sevan

The increasing pollution of the hydrosphere in Armenia due to anthropogenic activities has become one of the serious and fully unsolved environmental problems and Lake Sevan is a vivid example. Sevan Lake's problem was a disquiet topic started from the late 1960s due to water level release and pollutants leaking into the Lake. During these years the water resources were inadequately managed, and Lake Sevan gradually became polluted and considerably has started to shrink because of permanent overexploitation of its water resources. Lake Sevan has suffered also from growing increase of pollution during the last 30 years. A peak on the surface water pollution was recorded in 1985, the minimum pollution was registered in 1995 when industrial enterprises were practically dead. The extensive solid waste problem influences negatively on the water quality of Lake Sevan basin. Although the most industrial enterprises which were the main sources of pollution in the past are now inactive, but the effect of previous pollution is still present. The pollution control system is a remainder from the Soviet era which was based on maximum allowable concentrations and maximum acceptable emissions. Most agricultural, industrial and domestic wastes are permanently released into Lake Sevan. Especially the agricultural activities are the greatest source which pollutes the Sevan Lake basin. In the result of human activities, the concentration of phosphorus in Lake Sevan permanently increases because of overloading of biological substances coming from sewage. Most people who live nearby the Lake, the animal husbandry and farms cause the flowing of the wastes to flow directly into the Lake. Also in the process of agricultural activities any other non-organic wastes which are plastic containers used for poisonous items, fertilizer bags which appear in the fields and become as well a cause of pollution. Untreated sewage water, coming from near shore buildings, resorts and hotels, leaks into Sevan Lake and arise the similar danger. Many industrial plants located on the catchment of Sevan Lake basin discharge about 40 to 60,000 cubic

meters of wastewater to the Lake per day. This considerably exceeds the total capacity of Lake which is less than 10,000 cubic meters. This situation is seen not only at Sevan Lake shore-side areas but also in the other reservoirs shore-sides which arise serious ecological pressure.

The coastal part of Sevan Lake is under significant pressure from the polluted waters of Gavaraget River which flows into the Lake. This part of Lake faces considerable pressure by intense diffuse pollution of domestic and agricultural wastewater by nearby buildings and settlements which is one the causes of the Lake's blooming. In the result of uncontrolled nutrient pollution, the lake's phytoplankton status has changed, and it has covered with blue-green algae, which caused huge negative impact on lake's ecosystem and environment (figure 3).

"The Government of Armenia recognizes the importance of rehabilitation of Lake Sevan ecosystem and for over two decades has invested into setup of institutional and regulatory framework and plan of actions towards ecosystem rehabilitation" (Environmental protection of lake Sevan, EU4Sevan, UN, 2020 :3). Therefore, Lake Sevan basin management is an important issue to overcome the environmental problems.

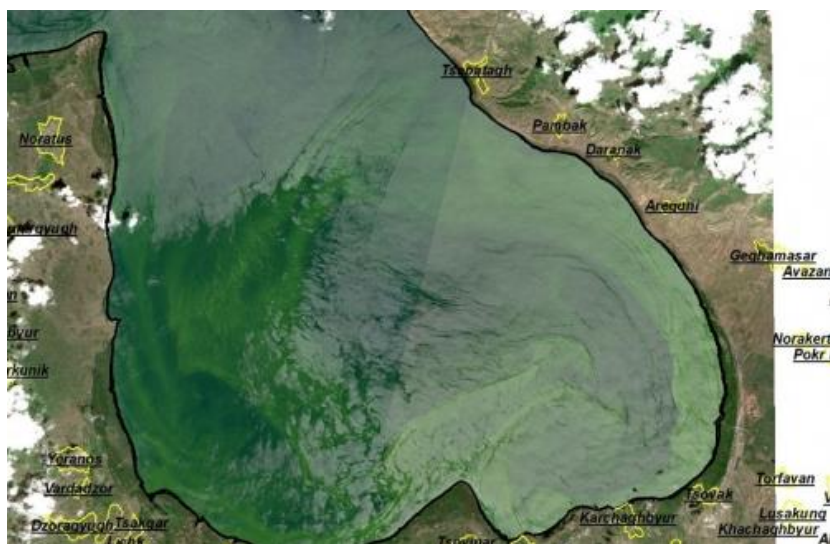


Figure 3. Blooming of Lake Sevan (<https://www.ecolur.org/en/news/water/blooming-in-lake-sevan-has-unprecedented-scales-satellite-images/11259/>)

## 4.2. Case of Hrazdan River and Yerevanyan Lich Artificial Reservoir

The increasing pollution of the water flow system and morphology of rivers also has been affected causing pressures on ecosystems and biodiversity. Again, the hydro-ecological state of rivers has changes in the result of disposal of waste, organic and non-organic substances etc. Pollution of rivers in Armenia was extensive especially during the Soviet period which had negative affect on the water quality.

Hrazdan river is one of the abundant rivers in Armenia and is the longest stream (141 km) of transboundary river Araks. “Yerevanyan lich” reservoir, built on Hrazdan river canyon, is of high importance for Armenian economy development because these waters are used for energy production, irrigation, industrial and other purposes.

Hrazdan River flowing through Yerevan City also suffers of anthropogenic pollution due to insufficient management of the disposal and discharge of waste and wastewater. Urban discharges flowing into Hrazdan river make negative affect on the hydroecological state of the river ecosystems and as well “Yerevanyan Lich” reservoir. There is worth to point out that there are a number of private houses, restaurants and entertainment centers operating next to Hrazdan river, from which all waste and sewage leaks into the river then moving to the Lake. Especially Yerevanyan Lich gradually became terribly polluted and it remains as an unused site out of state attention. There were much of public domestic waste, construction and medical waste, plastics, etc. which cause the pollution of the environment on the lake (figure 4). After cleaning works of the reservoir started this year by Municipality of Yerevan it was stated that over the last decade’s various kinds of waste was dumped into the lake and around its shores. The cleaning works volume was very big. According to the investigations done by Municipality, it was found out that the main reason of the pollution is the household waste and the construction activities done nearby the lake due to uncontrolled behavior of inhabitants.

According to the project of Yerevan Municipality, the waste catchment facilities will be installed on Hrazdan river hindering the waste leaking into the lake as many plastic

bottles and any other garbage were seen on the lake surface. After this construction all leakage of the waste coming from Hrazdan river will be stopped. In the result the water level will be increased which gives opportunity to use the water for various purposes.

However, the investigation of the pollution of Hrazdan River and “Yerevanyan Lich” reservoir due to human pressure in Yerevan City is urgently needs to be improved. The ways for the environmental improvement of ecologically unhealthy situation should be regulated by legal initiatives and the law.



Figure 4. “Yerevanyan Lich” reservoir pollution (<https://www.ecolur.org/en/news/waste/13609>)

## CHAPTER 5

### 5.1. Armenia - Solid Waste Management

Poor management of solid waste in Armenia is a consequence of country's hard economic situation. The volume of the solid waste in the country is defined with the population number, socio-economic situation, climate, and the inhabitants' working conditions. With economy's development more and more waste appears in trash stream which creates problems in legislative, financial, and social areas.

The three main categories of solid waste in Armenia are the following: industrial, urban, rural where each category generates waste of various composition. The collection, transportation, treatment and disposal of municipal solid waste have not realized for several years because of inadequate resources. In the developed countries all categories are managed properly in order to decrease the harm to the environment or human health, but in the developing countries the waste is being removed all together in same landfills.

The low level of municipal solid waste management services leads to social, environmental and cleanliness problems. Among the reasons of insufficient waste management in Armenia may be considered the following factors which led to the pollution of water and air and may spread out various disease:

- More than 300 dump places where the garbage is not abolished but permanently burnt and which is makes danger for people and animals.
- Lack of landfill leachate systems
- Mixed garbage's are uncontrolled and unsorted
- Burning of agricultural items /mainly plastic containers/ thrown in the fields

These factors harm not only the nearby community inhabitants, but as well the life and health for the rest people living enough far from these places.

## 5.2. Plastic Waste

Plastics compose about 40 % of general waste volume which led to environmental, health and economic problems. The budget income generated locally is not enough to support municipal waste management services. In the result, the municipal waste management is unable to render funds for many communities in Armenia. There are only several towns in Armenia that have established infrastructures for waste sorting. There are no relevant facilities for plastic waste recycling into secondary materials, so the waste is thrown up directly into dumpsites. It is crucial to reduce plastic waste in Armenia through the municipal waste management improvement and the public awareness enhancement.

Stable governance of solid waste is mainly depending on exact information and data base access. However, the waste statistics is considered to be one of the most problematic and challenging domains regarding data collection. According to UNDP, Armenia produces about 6,000 tons of recycled plastic waste annually (UNDP, Feasibility assessment of Agricultural Waste to energy Potential and Opportunities for Armenia, 2017). According to the calculations done by the Statistical Committee of Armenia on “Environment and natural resources in the Republic of Armenia for 2018” regarding the quantity of municipal solid waste inclined into landfills for the capital and 10 regions based on the number of populations per region is 13kg waste per person. Based on the National strategic plan from 2012 to 2015 the waste calculations for Armenia is the following: 274 kg per person and per year for Yerevan, and 219 kg per person and per year for the cities bigger than 100.000 population and 146 kg per person and per year for all other rural communities.

## 5.3. Agricultural Waste

The unstable management of the agricultural waste also brings to several environmental and health problems, and in the result the water basins are being polluted as we already have seen in case of several Armenian lakes and rivers. The increased development of agriculture deeply changes the condition of surface and ground water,

and in the result the water basins become more and more polluted. The intensive production of agriculture has deep influence on the materials biological circulation which in its turn changes the condition of surface and ground water. This process led to water pollution with poisonous items in the water basin.

## 5.4. Hazardous Waste

According to the Law of Environmental Protection of Armenia the main point is the waste management. According to the Decision /2006, N. 430/ of the Minister of the Environmental Protection, the wastes in Armenia are grouped into the following types according to their dangerous level: 1, 2, 3, 4. The most dangerous wastes are the items grouped under the first point. The fifth group items are not very dangerous. This list is based in accordance with the directory approved in Bazel Conference. Besides, Armenia has adopted a waste directive on banned items import to Armenia where the wastes are categorized according to their dangerous level and nature.

Although the criteria for waste use and regulations are considerably improved but still there is no a single hazardous waste management entity to regulate the recycling and removal of such items are lamps, thermometers, batteries that contain a mercury. There is no available a legal document that defines a proposal on design the construction of this kind of entity. A number of hazardous waste (alkali, zinc, lithium batteries) due to its mixed removal into trashes that effects on human life, can be prevented by sorting and classification in advance. When proper organization of this process the collection and remove of batteries is a simple action with low risk, but without proper, unregulated supervision of mixed waste can bring to ecological and health problems which is enough higher.

Primary internal threats include uncontrolled exploitation of hazardous substances and waste. There is no disposal site for hazardous industrial waste, nor any regulatory basis for hazardous waste disposal. Many industrial enterprises store hazardous waste on their premises and later transfer them to public landfills although this waste requires special safety measures and protection to prevent the impact on people's health.



Based on Bahia Declaration (2000) of Inter-governmental Forum on Chemical Safety, the Armenian Ministry of Nature Protection has proposed “National Profile on Management of Chemicals and Waste” which was adopted by the Armenian government (RA Government Protocol Decision N26, dated 08.07.2004 on Approving “National Profile on Management of Chemicals and Waste”). This is considered to be one of the important phases towards the progress in sustainable development of the country.

## 5.5. Waste Legislation of Armenia

The proper operation of waste management requires the establishment of relevant legislation and laws. The Armenian waste legislation includes about 50 laws, 21 sub-legislative acts regarding waste management. Armenia has adopted about 10 and international agreements regarding the waste. level became. One of the priority issues for Armenia is to coincide the implementation of waste legislation to European standards.

The Armenian “Law on Waste” adopted in 2004 determines the state policy on the waste use. It is directed to prevent the harmful impact of waste on people health and ecology. The Armenian Waste Code set regulations on the waste collection, transportation, storage, processing, recycling, volume reduction, removal, treatment, and other relations as well as for implementing of the following objectives and principles (Article 5):

- a) definition of joint state policy in the field of waste treatment
- b) definition of conditions and requirement on actions policy for ecological and safe treatment of the waste taking into account the economic potential for resource safe activities
- c) prevent formations of excessive waste, influence of the waste’s disposal and decrease of negative effects for human health and the environment
- d) development of legislative base for regulation on the waste treatment.

But unfortunately, these points have not been implemented properly in the practice.

It is important to mention that in the Law on Waste is misplaced the definition of Waste Hierarchy (WH) while the Waste Hierarchy establishes a theoretical framework which is agreed with the principles of Circular Economy. Still the law does not clearly define the priority order for the WH tool.

Currently Armenia is realizing some activities on implementation of major reforms on the waste management. Different documents which reflect the development of solid waste management strategy and policies directed to eliminate the negative impact of solid waste on human health are as follows:

- A policy on enhancing the specialists' level of education on waste management issues which include modernization of technologies, collection, transfer, recycling, and treatment.
- A policy on the effective land use and organic agriculture development. This will ensure a relevant management of agricultural waste.

To implement the requirements of the waste legislative framework and provide an adequate management, a Center for Waste Investigation was established within the Armenian Ministry of Nature Protection in order to assist the waste management strategy implementation in Armenia.

## 5.6. Problems and Recommendations for Armenia's Waste Management

It is important to mention that in the Law of Waste of Armenia is missing the definition of waste hierarchy. Although it contains all parts of the waste's hierarchy but there is missing the list of its priorities. This is particularly related to the biological wastes, waste administration, collection, sorting, recycling. There is also a lack of national policy and strategies for promoting Waste Hierarchy approach on national and local levels. There are no as well effective mechanisms for the implementation of the above and covering the gaps. There is not as well development of waste management plans with strict requirements of sorting. The definitions of the circulated economy and the sorting of

recycling items are not put in the Law. Unfortunately, the regulation documents do not contain any special demands on waste classification. Therefore, the classification of waste in Armenia is not fully encouraged according to the Armenian Legislation although the Law on Waste defines that the head of communities are responsible for collection and sorting of waste. There are no relevant encouraging systems and responsibilities to develop waste management plans in case of that this problem is critical and is a national strategy for the country. The legal framework for waste management is incomplete, contradictory and unclear in Armenia. The rights and obligations of waste agencies responsible for solid waste management are not definite.

The statistical data based on investigation research have a key role to develop further strategic plans and future actions, but the existing inaccuracy and lack of proper information hinders the sustainable and steady improvement of the waste development process. There is a lack of accurate information and transparency on solid waste collection and using, the reason of which is the lack of relevant funds and technical basis. The data base on the waste presented by the Armenian State Statistical Committee is not sometimes enough accurate. There is no sufficient organized work and accurate management. Furthermore, there is no accurate information exists on composition and quantity of industrial waste. Most industrial enterprises were in poor economic condition and now they are not able to deal with the waste management adequately. The existing national strategy implements its activities very slowly. The works done up to now are not sufficient as do not include all sectors of the society and are not implemented in all Regions of Armenia. **The amount of hazardous waste is having been increasing year by year, because there is no treatment of hazardous wastes.** The municipal and industrial wastes are mixed up and dumped into open landfills that does not appropriate to the environmental legislation standards such exists in the European Union. The culture on the waste management awareness and services is also very low which led to social, natural protection, and health problems in the country.

However, the adoption of new approaches presume for new challenges as there is still a huge amount of work to be done. In order to provide the availability of relevant data base it is important to develop a reliable system of evaluation and monitoring that will

include all stages of works related to waste management such as: generation, collection, prevention, reduction, recycling, disposal, etc. For the targets implementation it is actual the information exchange, joint coordinated activities among different economic fields of country. In this process it is essential to follow the development and performance policies, as well as to do adequate planning of infrastructures and establish a regular review system on solid waste composition and quantity in Armenia.

There is a need to develop a national effective strategy which will guide to eliminate the negative effects of the waste for further development of the country. There is also a need to carry out drastic changes on waste management policies and practices, as well as in the environmental law so that in the future the situation will look more optimistic.

## 5.7. Environmental Legislation of Armenia

In the course of transition period towards a market economy Armenia had faced with rapid changes including environmental issues and problems which were of an immediate focus. Many of these problems are transmitted from the Soviet period while others are the results of the country's political and economic transformations. After collapse of the Soviet Union a number of environmental problems in Armenia became vital, and unfortunately among huge problems (the war, electricity shortage) the environmental related concerns became less prominent and were not of great priority. There was a lack of regulations and monitoring over the freshwater ecosystems - rivers and lakes, which were critically deteriorated in all over Soviet period.

The Armenian environmental protection directives based on old Soviet system laws, and they became updated very slowly through various reforms in the course of many years. The public awareness of environmental issues increased in Armenia during recent years.

Although there are environmental fines set up for violations of laws but due to lack of monitoring system only a minor part of these fines is paid. All available information is not reliable because of the lack of a monitoring system for the past twelve years.

One of the significant steps to the water sector improvement in Armenia was the adoption of new Armenian Water Code (July 4, 2002) which regulates the State control and management on water use protection. In this code “Waste is defined as sewage, industrial waste, municipal waste, recreational waste, agricultural waste, waste heat, or other waste that may cause impairment of the quality of water in the state, including storm waters” (Water Code, Chapter 30, Regional waste disposal). One of the main objectives of the Water code should be the collaboration activities with public agencies, to ensure accurate and controlled collection, transfer, treatment, and disposal of waste to prevent possible water pollutions.

## CHAPTER 6

### 6.1. Results

The comparison between Spain and Armenia points out that the governments of both countries possess of information on EU waste policies and strategies. The comparison also shows that Spain's regulations and policy on waste differs from the Armenian ones, as Spain is an EU member, while Armenia is still in the process of its way to adjust the EU laws. Spain's economic and social conditions are more convenient for efficient waste management (comprehensive waste policies, updated waste treatment technologies, etc.), than Armenia. This is not an unexpected result, as Spain, being an EU country, would govern waste more efficiently than Armenia, a non-EU country which has less developed economy and politics. The key findings specify that the waste management policy and tools in Armenia are outdated with its all facilities and therefore needs to be improved. Armenia does not have sufficient facilities for the waste treatment to overcome the existing problems. There is no accurate waste sorting or recycling in Armenia according to their type and composition, and Armenia does not have entirely equipped landfill or any other types of fully operated waste treatment sites that has related technologies needed for the waste treating. This would significantly change the current situation to solve the waste problem in the country because these modern technologies would have mostly served for the waste treatment in the whole. Further results point out that there are no recycling technologies available in the country for the waste productive sorting/recycling in all over Armenia. Current waste management system in Armenia is in poor condition and does not put into action its responsibilities accordingly. It is important to mention that the realization of strict measures, actions, and regulative activities on waste management, and as well as the establishment of operational waste management and treatment technologies are of desperate need to be improved in Armenia. There is also lack of professional staff which is need of appropriate training in this sphere.

## 6.2. Discussions

In the previous chapters it was presented the Waste Framework Directives (2008), the Circular Economy Strategy and ideas of waste hierarchies. The study results indicate the significance of the Waste Framework Directive from 2008 and the Circular Economy Strategy from 2014, the waste hierarchy concepts, and their definite goals and targets.

One of the main goals of any strategy in each country first of all a detailed analyze on waste situation should be done. This strategy includes legislation, awareness and investigation of substructures' capabilities, availability of information on waste quantity and quality. The strategy is considered to be a plan for waste management which defines special targets. In order to achieve a better result in implementation of these targets it is very important the awareness of international experience and practice.

While comparing of the policy and legislative framework currently effects on the waste management in these two countries, it is noticeable that there is a need on more effective implementation of the waste laws and regulations in both countries: Spain has to execute the all EU regulations more efficiently, while Armenia first of all needs of complete modification of all the laws and regulations on waste appropriate to the EU's ones, and then seek for new ways and outlines for their proper implementation.

The fact that Spain is EU member, the main policies, institutions and the regimes currently have an effect on waste management are those of the EU. In the result of all works done in Spain the waste management system has been improved during the last years but still it will need of more efficient monitoring and assessment. This indicates that there are still difficulties with the performance for all strategies and tools on the waste management issues. However, the comparison of both countries again points out that Spain should improve its conditions for implementation of more adequate waste management. So, Spain has different policies and regulations on waste management issues in accordance with the EU Law as EU member, but Armenia is still in the process of adjusting to the international regulations and still in the working process to move on.

Furthermore, it is not enough simply to set up the state regulations in compliance to the EU policy without their adequate full execution in the practice. Armenia will not possess a constructive waste management policy until it begins properly apply to all mandatory measures set up by the EU legislation, and the country is at the start of its way of adjustment to the EU regulations on the waste management system. The relevant data shows that the main problems on the way for efficient waste management are the lack of comprehensive measures, monitoring, adequate policies, professional strategies, and the clear perspectives. It is also important to take actions for organizing staff trainings to provide the professionalism, transparency of works, and the sustainability.

In addition, it is worth to mention that there is no reliable and adequate statistical data on waste in Armenia and it is impossible to rely on the existing data fully as with replacing of every new state regime the policy of the waste management changes appropriately and everything starts from zero point.

The analyze of the current situation on the waste information access in each city/country is very important factor on the waste management system. The management of integrated waste is supposed more and more public participation and involvement in the community development activities which may lead to enhancement of the country's image. The strategy will include special targets which are evaluated by criteria on various directions, specifications, recycling, and the removal. In order to define and achieve these criteria it is necessary to have information on the international practice and using this in Armenia.

The waste management problems currently are of high priority for Armenia since there are still unsolved problems on waste management due to weak economic system. In the whole the relevant awareness on environmental issues problems is still low among the Armenian public. It is worth to mention that recently the waste management in Armenia has been a little improved and moved forward in small steps.

However, the waste management in Armenia is still on low level and currently only few activities are done, and several projects are implemented to start developing of this sphere. This study results once again confirm that a critical need for changes in all



Armenian cities/villages on the waste management policies and practices will be realized as soon as possible so that the situation in the future will become more optimistic.

## CHAPTER 7

### 7.1. Conclusion

Waste is considered to be one of the serious challenges for environmental management of our times. The rapid population growth and as well the tourism development led to the environmental threats year by year. This thesis is a narrative review on water pollution problems and waste management issues in Spain and Armenia.

The outcome of this study pointed out that the sustainable waste management may serve as an exclusive engine to start changing the society as a whole. Results show that without relevant attention to the pollution activities it is impossible to solve completely the water pollution problems. The proper waste management practice and change of behavior are key aspects of various solutions including the water pollution problems. Lots of people should stop considering the waste as a non-useful material to throw away and understand the value of waste how to use it for useful and constructive purposes. When everybody will realize the advantages of its use, the waste generates transformations across the society especially in developing countries where awareness and education on waste are still lower.

The waste problem is essential which requires joint efforts of authorities and individuals. To combat against this problem on international level many agreements were signed which are directed to develop policy, relevant monitoring and evaluation actions. Definitely planned strategies and policies would considerably reduce environmental pollution. The enhancement of public awareness and education is also crucial to solve out these problems. Therefore, the effective waste management should be one of main priorities in all countries.

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