

# EVOLUTION OF EUROPEAN WASTE MANAGEMENT PRACTICES: AN INFORMAL SECTOR PERSPECTIVE

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## Abstract

Human progress has been intrinsically influenced in time by the availability and seriousness by which mankind treated the issue of cleanness and sanitation of human settlements, in general of wastes. Given the direct negative impact on public health, the improper waste management affected the history of mankind in different ways, causing, from epidemics of incurable diseases, up to falls of great empires. The research on the evolution of waste management practices pursues to identify the factors that have generated the development of waste management methods and techniques, the determination of the manner in which the technical progress and innovation have contributed to the modernization of the practices in the field, to the analysis of the part played by the public authorities and society in general in the proliferation of coherent waste management practices, to the evaluation of the informal sector's contribution to the evolution of waste collection systems and to the comparison between various perspectives of the impact that wastes have on the environment and human health. This research used the indirect observation research method by analyzing the foreign literature and the various documents available in the virtual environment, on the websites of certain organizations involved in the wide and complex issue of waste management.

**Keywords:** informal waste sector, history of waste, waste management practices, waste collection, waste recycling.

## 1. INTRODUCTION

Science and education are two of the vital components that contribute in a decisive manner to the safety and security of the environment that we are living in. The negative impact of wastes on human health and on the environment compromises the life quality level and determines an additional awareness that the decisional factors and the society in general should have as regards the efficient management of the waste issue. There rises, therefore, the need to investigate the phenomena, the factors and the trends that have marked the evolution of the waste management practices in time in order to identify the area and the origin of the wastes, the causes generating them, the measures that could be considered to reduce waste generation or to limit their increase, how we may influence a certain type of approach/behavior/culture of the society in relation to the waste collection and recycling practices. The

historic importance to investigate the dynamics of the progresses made in the field of waste management in the European space is actually justified by the fact that past experiences determine the present reality and by the challenges that waste management must face in the future.

The essential goal of the research on waste management evolution is to analyze the determinant factors of the modernization of waste management systems and the manner to correlate them with other phenomena and trends in the economic, social, political, legislative, cultural, technical environment, happening throughout history.

## 2. RESEARCH METHODOLOGY

The research of the evolution of waste management practices at the European level did not require such varied methods and instruments, and it was generally based on the indirect observation in virtue of the analysis of international scientific literature and of document analysis.

The brief incursion into waste management started from the analysis of specialized literature, of book chapters and articles indexed in international databases, in the field of waste management, focusing on the sections dedicated to the evolution/history of waste management throughout the development of mankind. In the second stage of the research, the target was to supplement the previously collected information by means of document analysis; mainly, the articles, studies and information sheets available online, on web pages concerned with the waste issue have been considered. The information thus collected from various sources has been analyzed, correlated and grouped according to their contribution and relevance for the approached topic.

Finally, the data, deeds and trends that have been validated following the content analysis process have been systematized in four periods of maturity of the waste management process, in chronological order. Throughout the research, the objective was to provide the relevance of the analyzed information in terms of the major issues directly or indirectly correlated with the perspective of the informal waste sector: the impact on the environment, the provision of public health, the contribution and involvement of the authorities, the possibilities to capitalize the generated wastes. The results of the research on waste management practices at the European level, as they have evolved in time, are shown in the following sections.

### 3. FAILURE OF HUMAN SETTLEMENT SANITATION MEASURES SINCE PREHISTORIC TIMES UNTIL THE MIDDLE AGES

The prehistoric man wandered the Earth from one end to the other in search for shelter and food. The wastes of those times consisted in the remainings of his hunting, fishing and daily food preparation activities; the structure of wastes included, without any doubt, human excrements as well. When wastes accumulated in large quantities in the proximity of their human settlements, giving off unpleasant smells, the population migrated in search of new places where to settle down. The impossibility to treat residues and the temporal and spatial limitation of the normal conditions of living justifies the nomad life style of the prehistoric man.

In the following evolutionary stage, mankind started to live in caves and wastes was accumulated in the proximity of the access ways into the caverns. When the space became insufficient to store residues, the communities moved to other caves. The matters resulting from the natural processes of decomposition of residues abandoned at random on the ground were in small amounts compared to those of present times; therefore they could be assimilated by the ecosystem. Most certainly, the slow pace of growth of the population of those times did not cause the specific issues associated to wastes and dirt that we are facing today (infections and serious diseases, air pollution, pollution of drinking water sources or soil contamination), or if they did exist, they were most probably insignificant.

Around the years 9.000 B.C., mankind started to abandon the nomad life style, getting organized in stable, permanent communities. People improved their lifestyle, developed their skills to provide and prepare daily food; they stopped the intense hunting and fishing and they reoriented towards agriculture and crafting. Pichtel (2005) believes that this was the moment that marked the beginning of an intense period of civilization and urbanization; the issue of the permanent increase of the amount of wastes generated and abandoned at random triggered the occurrence of harmful effects on the environment and on human health. Giving up their nomad life style caused the accumulation of large quantities of wastes in the immediate proximity of human settlements and implicitly the occurrence of issues related to cleanness and public hygiene.

Archeologists discovered and examined prehistoric human settlements also in order to analyze the living manner of mankind, and they focused on researching the piles of litter, kitchen tools and tombs. William and Murphy (2001) claim that the evaluation of the samples taken from the archeological diggings helped identifying and understanding certain interesting aspects concerning the diet, customs and rituals, manner to organize settlements and social order of inhabitants at the beginning of

mankind's existence. Alexander (1993) specifies that archeologists have discovered that certain categories of wastes were reused in other activities; in the structure of the foundation and walls of temples were found broken vessels, pieces of glass and other ceramic objects, which were said to have been used in addition to the construction materials traditionally used for the works of those times. Therefore, there are prehistoric roots of waste recycling activities.

If in 9000-8000 B.C. the garbage was stored at random on the ground, outside human settlements, the practice of burying residues appears in the interval between 3000-1000 B.C., when the garbage was collected in pits that were dug deeply in the ground and periodically covered with layers of soil resulting from the diggings (Billitewski et al, 1997). Diaz et al (2007) explain the manner in which the old civilizations of South America, India, China and Japan intensely practiced agriculture, by using human and animal residues to fertilize the soils.

In 2100 B.C., the cities of Crete island were connected to a centralized system of waste collection sewers, including wastewaters, and in the Egyptian city of Heracleopolis, wastes were collected only in the areas inhabited by the society elite, being discharged into the Nile. Vesilind et al (2002) specify that the first regulations addressing the population in relation to the proper management of wastes are documentarily attested around the years 2000 B.C. and come from Israel, where the communities periodically received recommendations related to the way in which they should manage their own residues. Wilson (1976) specifies that elementary hygiene norms and imperative instructions on cleanness are included even in the Bible. The Deuteronomy (23): vv 12-13 says: „You shall have a place outside the camp, and you shall go out to it. And you shall have a trowel with your tools, and when you sit down outside, you shall dig a hole with it and turn back and cover up your excrement.”

During the 5<sup>th</sup> century B.C., in the Greek settlements, certain places were established to collect the garbage (Barbalace, 2003). The collection points were built and maintained out of the care of the local authorities, and the citizens were required by law to daily sweep the streets and access ways next to their dwelling.

The Bronze Era is the period when the first forms of informal waste collection appear, by the slaves and members of the lower social classes, who were entitled to search through the garbage in exchange of the obligation to carry it as far away as possible from the city. Waste Watch (2004) provides the example of Athens authorities, which, in 500 B.C., adopted a law which set the obligation to carry the wastes to at least one mile away from the city; the piles of garbage near the city walls were so tall that they represented an opportunity for the invaders who wanted to climb up the fortress walls.

The Greek and Persian literatures were among the first that tried to establish an association between personal hygiene, contaminated water, food residues and pest holes and outbreaks of epidemics (Alexander, 1993). In the years 400 B.C., Hippocrates and Ibn Sina suggested for the first time the relation of causality between wastes and human infections and diseases known until that time, proposing a series of precise methods to prevent epidemics.

In Ancient Rome, the garbage was discharged into the Tiber, left at random in the street or stored in open pits outside the city. Vesilind et al (2002) specify that in the year 14 in Rome, organized manpower was created, properly trained to collect the wastes generated inside the city as well; to collect and transport the piles of garbage, the teams of workers used horse-drawn carriages. Pichtel (2005) mentions the single initiative of that time related to waste discharge, belonging to the Roman Senate, forbidding the storage of excrements in open pits in the immediate vicinity of housings and requiring their delivery to the landfill built outside the city.

The negligence and ignorance of the Roman authorities contributed to the outbreak of various fever epidemics in the year 23 B.C. and in the years 65, 79 and 162, but the Romans had not yet identified the causal connection between garbage, dirt and infectious diseases. Billitewski et al (1997) specify that, in the first century after Christ, the Roman emperors understood that the removal of residues generated inside the communities should be treated as an essential priority to ensure people's health, and they provide the example of the hygiene and public cleaning measures adopted during the rulings of Emperors Domitian and Vespasian.

Researchers like William and Murphy (1992) believe that, due to the large amounts of wastes accumulated in time inside the human settlements, the authorities of those times would have decided to bury whole cities and to rebuild them either on the same location, or in other locations. Interesting scenarios concerning the clauses of the decline of the Roman Empire are provided by several historians, who believe that the intense odors given off by the wastes that had become impossible to manage in a proper way would have determined the migration of aristocracy towards mountain settlements or along the coast. The phenomenon generated the decentralisation of power due to the nobility's migration to various areas, which would have sped up the Empire's downfall. On the other hand, the piles of garbage accumulated near the walls of Rome would have compromised the defend capacity of Roman Empire capital city.

#### 4. FORMALIZATION OF WASTE COLLECTION PRACTICES, SINCE THE MIDDLE AGES UNTIL THE INDUSTRIAL REVOLUTION

The downfall of the Roman Empire has caused the loss of any form of organization and discipline previously instituted by the law and by the presence of the military power that was active in all the areas conquered by the Romans. Consequently, in the interval between the Middle Ages and the end of Renaissance, there was no improvement in the waste removal practices, their disposal in the streets remaining a widely spread habit.

The waste related issues were becoming stringent on the European continent due to the obvious trend of increased demographic growth and of intense urbanization of human settlements. The cities of those times were built on wooden structures, thus making impossible to burn household wastes; the current practice consisted in collecting the garbage in specific locations, without submitting it to any technological process, only to natural decomposition.

Waste collection and in general public sanitation in of the large settlements had become so stringent that at middle of 12<sup>th</sup> century, pigs, dogs, cats and ravens were declared protected animals by the law, because they fed on household wastes. Pichtel (2005) describes an unprecedented case that happened in Paris, where in 1131 a resolution was passed, forbidding the release of domestic animals at random on city's streets. The decision was adopted after the young King Philip, son of Louis the Fat, died in a horse-riding accident caused by a pig left unwatched; the monks of a monastery in the city disputed this measure and protested against law, obtaining a derogation, but the controversies related to the prohibition of animal release in the streets continued for years.

The London authorities' efforts regarding the organization of waste management activities intensified and were translated in the order issued in 1354, instituting the obligation that the litter deposited in front of the houses should be cleaned and removed every week in an organized manner (Waste Watch, 2004). The municipality hired several workers called „rakers”, whose job was to weekly collect the litter and the manure off streets and from in front of the houses, and to carry it outside the city by means of 12 horse-drawn carriages (Alexander, 1993). A common practice during the medieval times was to discharge garbage in waterways (Maczulak, 2010); it is assumed that the plague that burst in middle of 14<sup>th</sup> century, which ended the life of millions of Europeans, was intensified by the habit of the population living in settlements situated on waterways to discharge domestic residues in riverbeds.

Contrary to all the adopted measures, the mountains of domestic residues discharged at random continued to threaten the health of the inhabitants of European cities. In such a context, the authorities

were forced to take the strangest measures to prevent and combat the random discharge of wastes. The clerks in London hired „informers” who would report to the administration cases and offenses concerning the failure to observe the provisions related to public cleaning. Pichtel (2005) describes the case of a London citizen who, in 1421, was fined for the damages and discomfort caused to his neighbors by throwing food leftovers by the window directly into the street, after being reported by the employees of the grocery store in the area. Paris and several other medieval German cities were using methods that could be classified both ingenious and strange; Waste Watch (2004) explains how the merchants that were bringing into the city goods and products necessary for public consumption were forced to load certain amounts of wastes in their own carriages, which they had to carry towards the rural areas that they were coming from. Similar practices also existed in Florence, where merchants of agricultural products returned home with altered, unsold merchandise, the remains of vegetables or other organic residues collected from the city, to make them compost and subsequently use them in their farming works (Diaz et al, 2007).

The piles of garbage bordering the entrances to the cities constituted a potential danger for the safety and defense of communities, the case of Paris being the most relevant (Barbalace, 2003 and Maczulack, 2010). The authorities crossed an acute period of crisis in terms of garbage removal; even with the efforts of the specially hired workers to clean the large streets and the central marketplaces, the London authorities could not change the totally improper habits and behavior of its inhabitants in terms of public sanitation and hygiene. Paris, however, was one step ahead of London, instituting, in 1506, the payment out of public funds of all the workers involved in the city activities of cleaning and garbage collection.

The 16<sup>th</sup> century marked the beginning of certain interesting measures in terms of material recycling encouragement (Waste Watch, 2004); for instance, most copper mines in Spain used scrap iron to cement copper. In the light of the same idea of recycling, Elizabeth I of Great Britain decided in 1588 to grant privileges to all those who collected scrap paper to manufacture paper; two hundred years later, across the ocean, in Philadelphia, paper started to be manufactured out of cellulosic fibers resulting from newspapers, magazines and other paper wastes (Barbalace, 2003). Another example of waste recycling is that of wastes produced by the maintenance works of parks and gardens in Edinburgh, which were sorted and later cremated or composted, as the case may be.

The middle of 17<sup>th</sup> century does not bring major changes in the current practices of waste management in Europe. The London Fire of 1666 contributed to the cleaning of the urban environment and to the reduction of garbage piles off city streets. Pichtel (2005) specifies that the large European cities also

faced the problem of manure, due to the appearance and extension of transport means drawn by animals in the city; subsequently, it was forbidden to cremate the stables litter inside the cities and people were forced to transport manure outside the cities, but only on certain days and only by 19:00 hours.

## 5. THE TECHNOLOGIZATION OF WASTE MANAGEMENT ACTIVITIES, FROM THE INDUSTRIAL REVOLUTION TO THE END OF THE MODERN ERA

The industrial revolution began in the 18<sup>th</sup> century, when the availability of raw materials, doubled by the intensification of trade exchanges, stimulated the discovery of new inventions, generally consisting in vehicles and manufacturing machines and contributing to work mechanization. The industrial production had become a priority both for the authorities, and for the business environment, and aspects like public health and environmental protection, which were minimized until that moment, were left in the background. Public services and utilities such as drinking water supply and discharge of wastewaters were provided in an improper system. Vesilind et al (2002) give the example of the city of Manchester, where there was in average one toilet for 200 persons, and the sixth part of the population lived in basements or dirty housings, in the misery caused by the primitive practices of residue discharge.

The United States registered remarkable progress in the field of public cleaning. Franchetti (2009) acknowledges Benjamin Franklin's significant contribution, who in 1757 instituted in Philadelphia the first service of street cleaning, providing the regular collection of wastes off the streets. In Europe, the administrations of cities such as Vienna and Berlin provided the public cleaning by means of prostitutes, who were bound by the law to collect the wastes off the streets, in virtue of the fact that it was the place where they were carrying out their activity (Reiner et al, 1995). Lemann (2008) specifies that the local authorities of Bern were using the services of the female prisoners of Witzwill prison to perform street sanitation works; in exchange of the working hours in the service of the community, the prisoners benefited from significant punishment reductions.

At middle of 19<sup>th</sup> century, the research of scientists like Loius Pasteur and Robert Koch demonstrated for the first time the direct connection between bacteria and viruses and the incidence of diseases specific to the lack of hygiene (Billitewski, 1997). Understanding the pathology of infectious diseases contributed in a decisive manner to the improvement/ modernization of practices specific to waste management, aiming at treating wastewaters and at properly storing wastes. Barbalace (2003) considers the Law of 1875 on public health in London as a landmark in terms of laws contributing to the formalization of waste collection practices.



Towards the end of the 19<sup>th</sup> century, the first technical solutions are provided in terms of energy recovery from waste. Lemann (2008) specifies that in 1870, the first waste incinerator of Europe was commissioned, serving the Paddington district of London, and between 1876-1877 new facilities were built to thermally treat wastes in Leeds, Manchester and Birmingham; in the next 30 years, over 250 facilities for the thermal treatment of mixed collected wastes were incorporated in Great Britain waste management system. The waste incineration technologies quickly extended to other European states as well, so that, by 1912, 17 facilities had been built in Europe, to recover electricity by burning household wastes. Vaughn (2009) specifies that in the '80s of the 19<sup>th</sup> century, several facilities had been built in Germany for waste incineration process, serving cities like Berlin, Hamburg, Frankfurt and Munich, the latter providing the processing of almost 300 tons of wastes per day.

Despite the technical progress registered towards the end of the 19<sup>th</sup> century in terms of the design and building of facilities and technologies that are specific to waste management, the non-ecologic practice of discharging domestic wastes in waterways had not been completely abandoned. The cholera epidemics of Hamburg, which caused in 1892 the death of over 9000 people, was developed as an effect of the fact that the drinking water supply of the population was provided by collecting water from the Elba River, which was intensely polluted by wastes and excrements of human and natural nature (Billitewski et al, 1997).

## 6. MODERNIZATION OF THE WASTE MANAGEMENT PRACTICES IN CONTEMPORARY TIMES

The Europe of the beginning of 20<sup>th</sup> century was enveloped by a wave of pragmatic measures destined to the improvement of waste collection systems. When in Switzerland was inaugurated in Zurich the domestic waste incinerator, the population was provided with special containers for waste collection, designed and manufactured by the engineer G. Ochsner. Lemann (2008) describes the success of the invention: in 1906 the collection system was implemented in Bern, and in 1910, it was also adopted in Rorschach. The system subsequently extended throughout the entire Switzerland, and the containers were periodically re-designed and modernized, and successfully used until the '70s, when they were replaced by plastic bags.

In the same period in France there were similar concerns to identify the most appropriate option regarding waste collection in households. The Mayor of Paris of the end of 19<sup>th</sup> century – beginning of 20<sup>th</sup> century, Eugène Poubelle, designed a steel container, equipped with wheels, handles and a curved

lid (Lemann, 2008). Beginning with 1937, a company from London would produce similar containers at a large scale, called „poubelles” (dustbins), which were rented to the households of the Kingdom to pre-collect domestic wastes. Similarly, across the ocean, the American cities whose population exceeded 10,000 inhabitants had domestic waste collection systems in various stages of evolution and modernization (Vaughn, 2009).

The two World Wars and the period between wars are characterized by a neglect of the environmental protection issues, in general, and by the waste management, in particular. After the Second World War, the issue of wastes did not constitute a priority neither for the population, nor for the authorities; consequently, the waste management activities were not sufficiently regulated and controlled. There were, at that time, multiple cases of pollution by hazardous substances that gradually led to the proper focus on the control and strict supervision of waste removal, especially for hazardous waste (Williams, 2005).

The second half of the past century lies under the sign of issuance of specific legal regulations concerning the waste management issue. At the middle of '60s, in Germany were adopted the legal framework for properly waste disposal, by which the local authorities were becoming responsible to remove the generated wastes, or else they would be subject to legal sanctions (Williams, 2005). In 1965 was passed in the United States of America the first specific law on waste management, aiming at regulating the essential aspects of waste removal by storage (Barbalace, 2003). Together with the accelerated evolution of technical progress throughout the 20<sup>th</sup> century, multiple machines and technologies specially destined for urban waste management activities occurred and developed. Vaughn (2009) provides the example of waste incinerators of USA, which, by middle of '30s, were serving between 600 and 700 cities. In 1935, the first waste disposal site was opened, considered to be the predecessor of the modern ecological deposits of our times, serving the town of Fresno in California.

At middle of century, the energy recovery waste incinerators appeared in Switzerland. Lemann (2008) specifies that in Bern was approved in 1951 to assign the necessary funds to build the facility, and in 1954 the incinerator became operational, providing the thermal energy required for deliver heat in two hospitals and one education institution. If by the end of the '60s of the past century, the wastes generated in Germany were removed from the illegal deposits, due the exaggerated growth of the produced amounts, at the beginning of the '70s, the specific infrastructure was modernized and continuously diversified. Billitewski et al (1997) show that, at the level of the entire country, there were, beside the approximate 50,000 small size landfills, 130 regional ecologic deposits, 16 facilities to

compost wastes and 30 incinerators, all of them providing the treatment and removal of only 37% of the generated wastes.

The energetic crisis of the '70s of the past century enhanced the interest in identifying alternative sources to produce energy, so that the research on rendering more efficient the technological processes to obtain energy from waste intensified. In the United States of America, the moment of the energetic crisis overlapped the obvious trend to close waste landfills, so the energy-recovery waste incineration became the predominant option of waste removal; according to Tammemagi (1999), at the beginning of the '80s, more than 100 facilities were in use, and another 200 were being built. Similarly, Germany started to build 42 urban waste incinerators that were commissioned in 1981. Due to the dangerous toxic gas released into the atmosphere, in the interval of 6 years, considerable efforts were made to equip incinerators with performing filtering systems of hazardous substances (Billitewski et al, 1997).

The end of the 20<sup>th</sup> century and the beginning of 21<sup>st</sup> century mark the most important progress of the development of waste management practices, from the conceptual and pragmatic, technical, socio-economic and ecological point of view. This is the period when, in the context of intense economic development, of exponential growth of the population, of the hallucinating technical progress, of stimulating the irrational consumption and of the obviously low interest in ecologic matters, the quantities of generated wastes reach alarming heights worldwide and at the continental, regional and national levels.

## 7. CONCLUSIONS

The research on the waste management evolution has led to the understanding of important lessons related to the occurrence of waste management and material recycling systems. The incorporation and operation of formal waste collection systems was not possible until mankind discovered the causal link between the sanitation of human settlements and people's health. The concerns and involvement of the authorities of European cities in stimulating a certain type of behavior of the community members in terms of effective management of the generated wastes were extremely modest until the specialists Pasteur and Koch analyzed the pathology of infectious diseases; after that moment of awareness of the causal link between filth and infectious diseases, the authorities' involvement in the improvement and modernization of waste management practices intensified, in the sense that, for example, wastewaters started to be treated, and wastes started to be properly collected and deposited. From this point of view, we may believe that there is a historic relation of interdependence between the improper waste

management and people's health, especially for the workers directly involved in the informal waste collection.

The determinant factors of the evolution and development of waste management practices recorded variations of intensity in time, with most interesting trends. If the results of the research related to public health have led to the creation of formal waste collection systems in the 19<sup>th</sup> century (and it continues to be a key-factor in the developing countries), the issue of the impact on the environment has been brought into the foreground barely in the '70s of the past century; the initial focus was on limiting the uncontrolled storage of wastes and later on the systematic increase of the requirements related to environmental standards.

The general perception following the study of the waste management evolution is that, including at present, certain states have not reached the maximum level of maturity of the standards and measures related to the prevention of the impact of wastes on the quality of environmental factors, provided there are multiple other environmental challenges that mankind must face, among which the climatic changes.

The existence of certain categories of materials included in the wastes allowed people to collect and recycle part of the residues produced in human settlements; this is an essential determinant factor of the evolution of waste recycling practices, which paradoxically remains valid today in the developing countries, according to Ciocoiu and Târțiu (2012). The same as in the past, today there are categories of persons that are socially marginalized or vulnerable groups getting involved in informal activities of waste collection and recycling in order to ensure a minimum level of quality of life, which constitute the informal waste sector.

From the informal sector's point of view on waste management, the practices used in the waste management systems registered a sinusoidal evolution, characterized by alternating the level of involvement and importance of the informal waste recyclers. A wide pallet of measures and practices of conviction is noticed, but most particularly of coercion of the unprivileged social categories to participate in the removal of garbage from human settlements in the Middle Ages. Before and including the Middle Ages, there was a relatively high involvement of the informal sector in waste management specific activities, caused by the authorities' incapacity to properly organize and supervise the collection and removal of wastes from human settlements. In the period between the Middle Ages and the end of the modern era, the formal sector is the one that contributes significantly to the development and modernization of waste management systems. Towards the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century, the informal sector comes back in force and regains its importance, part and contribution together with the formal sector of waste management.

The research of the evolution of waste management practices allowed to emphasize an extremely interesting aspect: the occurrence, extension and modernization, throughout the last century, of multiple techniques and technologies specific to waste management have not reduced and even eliminate the informal activities. Moreover, the two waste management sectors, formal and informal, coexisted in the past and are also coexisting in the present, and they are linked by relations of complementarity.

Wastes are no longer an isolated issue; they are a real challenge whose solution requires (according to the tendencies revealed by the research on the evolution of the waste practices) a deep social-economic approach, beyond any other technical, legislative or ecologic perspectives. The present context characterized, on the one hand, by the incapacity of the formal systems to collect and recycle all the generated wastes, and, on the other hand, by the insufficient consistency of the social policies addressing the vulnerable groups and by the constant diminishing of their level of living, determined the intensification of the concerns related to the research on social dimension of waste management.

The possible research directions that may be developed in relation to the social aspects of waste management aim at amplifying the behavioral dimension of the waste producers and informal waste recyclers, at analyzing the methods to evaluate the part and contribution of the informal sector of waste management in waste collection and recycling or at evaluating the actual possibilities of formalization of the informal recycler's activity.

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