

ENVIRONMENTAL AWARENESS AND MANAGEMENT

WORK-ORIENTED TRAINING COURSE

ENVIRONMENTAL AWARENESS

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LO 9: ENVIRONMENTAL AWARENESS: RECYCLING, REUSE AND WASTE MANAGEMENT

1. Introduction

The new EU 2020 strategy for waste legislation sets a new 50 per cent recycling to be coupled with EU funding investment, so that the new member states will be evolved into real recycling societies within a decade.

Waste minimization is one of the most important world problems of our age and has been placed at the top of the solid waste management hierarchy of issues that have to be solved urgently. In the meantime, organisations attempting at finding solutions of the problem have thoroughly considered business risks in recycling and reuse of waste.

Solution to the problem involves two basic operations: source reduction and recycling. Recycling preserves environmental sources and prevents materials from entering into the waste stream. Great efforts are being made by the European Commission and European countries to assess the costs of material recycling and to compare them to other methods of waste management, such as landfill, incineration, composting, and others. The comparison of the results of the two methods shows that material recycling has the strongest environmental benefits.

Benefits and income of both situations are also considered in the business risk assessment. Recycling facilities have economic, environmental, social and ecological advantages besides their benefits of reducing quantities of waste that have to be disposed to landfills. Recycling of waste prolongs the life span of sanitary landfills and reduces environmental pollution. In addition, there are many manufacturers that use recycled materials instead of fresh raw materials.

The organisations dealing with waste can start by analysing and finding solutions to the following problems firstly and then proceeding with their business.

The following problems with management of municipal waste have been identified:

- Society's insufficient awareness about environmental problems.
- Insufficient separation of household waste.
- Lack of instruments for separation of solid waste.
- No charge for storage of mixed municipal waste.
- Lack of a uniform system for observation of the municipal waste generated.
- Very low level of selective storage of municipal waste.

- Lack of penalties for local governments that fail to meet their legal obligations.
- Lack of waste recycling/reduction programs.
- Insufficient treatment of leachate;
- Lack of systematic tests of waste content.
- Lack of markets for waste recycling and reuse.
- Lack of foundation for waste management.
- Lack of sanitary landfills; due to the low cost of unsanitary landfill, the costs of recycling/reduction/reuse plants are very high according to the unsanitary landfills.

Problems with management of waste oil

- Insufficient system for collection of waste oil from small and medium companies and households.
- Lack of organized places for storage of waste oil generated in sea accidents.

Problems with disposal of batteries

- Lack of information about batteries, their types and environmental effects.
- Insufficient countrywide system for collection of small batteries from households.

Problems with medical waste

- Lack of efficient systems for management of medical waste.
- Lack of a system for monitoring of the amount of medical waste generated.
- No countrywide system for collection of expired pills from households.
- Lack of awareness of the effects of medical waste.

Problems with explosive waste

- Lack of a program for explosive waste management.

Solutions for general problems mentioned above:

- Development of educational programs in environmental studies.
- Selective collection of waste.
- Development of recyclable products.



Mechanical equipment in a solid-waste treatment system

- Development of new waste management program for reducing, recycling and reusing of waste.
- Preparation of a source separation plan.
- Increasing the targets for not recyclable products.
- Finding of new foundations for sanitary landfills and decreasing the cost of landfilling.
- Closing unsanitary landfills.
- Elimination of illegal waste dumps.
- Building of reuse/recycle market.
- Charging the storage for mixed municipal waste.
- Decreasing the quantity of municipal waste that is subject to biodegradation.
- Development of a waste management plan for household hazardous materials, batteries, medical waste, explosive waste, and waste oil.
- Collection of data and planning a strategy to decrease the quantity of total stored waste in the coming years.
- Increasing the energy recovery from waste.
- Integration of the waste disposal regulations with the EU standards.

2. The recycling industry

The recycling industry is a large and diverse network of public sector institutions (e.g., local governments, state agencies, colleges and universities) and private companies. Recycling organizations are steel mills, iron and steel foundries, paper manufacturers, computer and electronics manufacturers, glass container manufacturers, rubber producers, pavement producers, plastic reclaimers and converters, private and government safe collection centres, materials recovery facilities, and recyclable materials wholesalers.

The economic impact of the recycling manufacturing sector far exceeds the recycling collection, processing and reuse sector.

Recyclables have high value. The recycling process allows materials that would become waste to be used as valuable resources. Recyclables that you put in your bin and take to a drop-off centre and up to the market as valuable commodities can contribute significantly to the economy. The increasing supply of recyclables fuels manufacturing industries, supporting their compatibility and sustainability.

In general, national recycling and reuse industries are favourable to other key industries such as automotive manufacturing and mining. The recycling industry far outpaces the waste management sector because recycling adds value to the material and increases the labour force. Reuse industry creates many jobs, ranging from the more traditional thrift shops and antique dealers to computer manufacturers and pallet rebuilders.

2.1 Waste recycling

There are potential environmental and economic benefits from a comprehensive approach to waste recycling. However, there are a number of practical obstacles to this process, and further research and consultations are necessary. Detailed information on each waste stream will be needed for cost-benefit analysis and determination of the contribution of each part in the global material cycle. In addition, the economics of the collection infrastructure should select the most cost-effective sources of materials subjected to recycling.

An important approach in this context is the producer's responsibility. It is demonstrated through a successful scheme of production of waste originating from end-of-life products. Waste originating from other materials could not be producer's responsibility, so it is important to sustain the practices applied in this field.

In accordance with these factors, a careful delimitation of collected fractions may contribute to the effectiveness of a recycling system. In addition, environmental and economic indicators

should be considered in collection of different waste streams. Thus, a clear-cut allocation of actual and financial responsibilities of the targets (industrial product and material groups) will be achieved.

The process of recycling requires purposeful actions prior its commencement. There are 3 steps involved in the pre-recycling waste collection that include:

1. Collection of waste from doorsteps, commercial places, etc.
2. Collection of waste from community dumps.
3. Collection/picking up of waste from final disposal sites.

2.2 Instruments for waste recycling promotion

PRO EUROPE wellness strategy implements the following initiatives aimed at fostering waste recycling and contributing to development of a sustainable waste management policy:

- Landfill taxes

They have to reflect the real current and future costs of managing a controlled landfill. These taxes will help to balance landfill costs with recovery options.

- Producer responsibility

Producer responsibility scheme has demonstrated environmentally and economically efficient solutions for packaging waste. Producer responsibility schemes for packaging have considerable experience in the efficient operation of recycling markets. These schemes have negative impact on competition. In general, service contracts are awarded on a competitive basis in accordance with the legal requirements.

- Pay-as-you-throw scheme

Pay-as-you-throw schemes have already been implemented in several member states with a positive impact on consumer awareness and selective collection results. The rise that this scheme can assume that:

- the pressure on the “refused fraction” can lead to an “illegal dumping” placing the “refused fraction” in containers intended for certain selectively collected waste. Additionally, consumers should not be charged twice for the same activity (producer responsibility plus waste management municipal taxes).
- Tradable certificates

Tradable certificates system already impedes a number of environmental markets, including trading certificates for CO₂ emissions, renewable energy, and packaging recovery. Besides a

few obstacles, the use of tradable certificates systems in the future could avoid potential risk of uncontrollable and high risk system evolution.

The minimum waste streams that should be considered are:

- Household / municipal waste
- Industrial and commercial waste
- Construction and demolition waste

Agricultural and hazardous waste streams, which are subjected to existing or would be included in the planned European legislation, are: batteries, clinical waste, electronic equipment, life vehicles, oils, ozone depleting substances, contaminated soils, and others.

2.3 Why incinerators are a waste of public money?

Incinerators, even if they produce energy by burning waste, are not good investment options for public money because they:

- squander precious materials that could be reused or recycled; thus, they necessitate import of increasingly expensive new raw materials from around the world at a huge cost to national economy;
- produce high CO₂ emissions and facilitate climate change;
- harm surrounding communities with toxic pollution and generate toxic ash;
- provoke public protests, leading to difficulties with construction permissions;
- block development of waste prevention and recycling, as incinerators require a constant input of large amount of mixed waste for decades to achieve predicted profit.

2.4 Why recycling is better for the environment and the economy?

- Every ton of waste that is reused / recycled avoids extraction, processing and import of new resources.
- Recycling saves several times more energy than incinerators can produce by burning waste.
- Recycling has lower investment and operational costs: a euro spent on recycling services will handle more waste than a euro spent on incineration.
- Recycling creates more jobs. The European Commission's waste strategy says: "recycling 10 000 ton of waste needs up to 250 jobs compared with 20 – 40 jobs needed if the waste is incinerated, and about 10 for landfill."

- While the environmental benefits of recycling are well known, what is less known is that recycling is an economic success story as well. By turning waste into valuable raw materials, recycling creates jobs, builds up more competitive manufacturing industries and significantly reduces environmental pollution.
- Municipal waste generated by country in selected years (kg per capita), presented in the table below (Eurostat, 2013) emphasises on the social significance of this process.

3. Impact assessment on the thematic strategy on waste prevention and recycling

Economic, environmental and social impacts of risk and waste prevention and recycling policy comprise strategic approaches, including the following reliable indicators for their measurement:

- The amount of waste (weight) is considered an appropriate indicator for environmental impact of waste generation and management. The developed policy is based on reduction the amounts of generated waste subjected to landfill or incineration processing.
- Alternatively, the amount of waste (weight) is not considered an appropriate indicator for the environmental impact of waste generation and management. The developed policy aims at reducing environmental impact based on life cycle of resources and products.

	1995	1999	2003	2007	2010	2013	change (%) 1995-2013
EU28	:	:	:	523	503	481	:
EU27	473	511	514	524	504	481	2%
Belgium	455	465	468	494	456	439	-4%
Bulgaria	694	598	603	553	554	432	-38%
Czech Republic	302	327	280	294	318	307	2%
Denmark	521	577	598	707	673	747	43%
Germany	623	638	601	582	602	617	-1%
Estonia	371	412	414	449	305	293	-21%
Ireland	512	577	730	772	624	586	14%
Greece	:	392	427	448	531	510	:
Spain	510	613	646	578	510	449	-12%
France	475	507	506	543	533	530	12%
Croatia	:	:	:	399	379	404	:
Italy	454	498	524	557	547	491	8%
Cyprus	595	620	670	704	696	624	5%
Latvia	264	256	304	391	324	312	18%
Lithuania	426	351	389	419	404	433	2%
Luxembourg	587	646	678	695	679	653	11%
Hungary	460	483	464	457	403	378	-18%
Malta	395	476	580	654	601	570	44%
Netherlands	539	582	586	606	571	526	-2%
Austria	437	563	607	597	562	578	32%
Poland	285	319	260	322	316	297	4%
Portugal	352	433	449	471	516	440	25%
Romania	342	314	353	391	324	272	-20%
Slovenia	596	550	418	525	490	414	-31%
Slovakia	295	261	281	294	319	304	3%
Finland	413	484	466	506	470	493	19%
Sweden	386	428	464	486	439	453	17%
United Kingdom	498	569	591	567	509	482	-3%
Iceland	426	454	484	558	306	345	-19%
Norway	624	594	402	491	469	496	-21%
Switzerland	600	635	667	720	708	702	17%
Montenegro	:	:	:	:	:	508	:
The former Yugoslav Republic of Macedonia	:	:	:	:	351	384	:
Serbia	:	:	:	280	363	336	:
Turkey	441	459	443	433	407	406	-8%
Bosnia and Herzegovina	:	:	:	:	332	311	:

Environmental impacts of waste generation and management are rationalized by taking into account the whole life cycle of resources and products.

The business risk linked to recycling / reuse process depends on the balanced environmental policy. It aims at reducing potentially negative effects of waste, while providing some benefits. From economic, environmental and social points of view, the optimal waste management strategy should include a balanced combination of waste prevention, material recycling, energy recovery, and disposal options.

Therefore, the European strategy supports policy, based on evaluation of the environmental impact of life cycle of resources and products.

This strategy addresses:

- a global approach mixing legal, voluntary and economic instruments that could reinforce the effects of implementing each of them;

- cost-benefit analysis; this method is fully aware of its methodological limitations; different research approaches are being worked out for development of an environmentally and financially balanced recycling policy.

This statement is connected with the fact that recycling is not always the most economically feasible option, since resources invested could become higher than the materials saved. In addition, the life-cycle approach, being continuously improved and applied by companies, can be a tool for minimization of waste products. However, this tool can be costly and time consuming for all companies and products, so it should not be mandatory.

Thus, in regards to the subsidiarity principle, it is necessary to assess whether a concrete measure will be more sufficient at community level or at national / local level.

Moreover, once decided the convenience of a national or a local measure, its impact on the free movements of goods within the European Union must be carefully analyzed.

Also, the development of market of secondary raw materials is a key issue that could determine the success or failure of a waste recycling strategy. Therefore, the assessment of demand-side measures to promote market for recycled materials should be analyzed within the context of the strategy. Moreover, this approach should be complemented with a communication policy to improve citizens' perception of products made of recycled materials.

Garbage that we are throwing away everyday can be reused in the environment again, and "Reuse of the garbage" principle reminds you to get the products without consuming the valuable sources in environment and by conserving natural resources, saving valuable landfill space reserved for garbage and solid waste. Moreover, it saves you money.

Everyone must try to use reusable and refillable products; repair broken or worn items; mend shoes, furniture and patch clothing. If you are not reusing anything, think that there will be someone who can use it. Try giving clothes, magazines, furniture, and others, away. You can find these possible recipients around you. Even if you think that you cannot use a material again, do not throw it away and try to put it into practice.

4. Most Popular Reused Materials:

Paper is the most famous material that is reused. These are old copies, old books, paper bags, newspapers, cardboard box, etc. Some ways to reduce our usage of paper are given below:

- Use unwritten paper and do not throw it away;
- Try to use brown paper bags;
- Reuse gift wrap for gifts again and again.

Glass wastes comprise bottles, plates, cups, bowls, etc. They can be reused very easily:

- You can use the jars to put cookies inside.
- The easiest way to carry soup or any liquid is by putting it into a jar.
- You can put spice to small jars.
- You can put screws or nails to the jars.

Plastics. The most popular plastics include containers, bottles, bags, sheets. They must be reused in the following ways:

- You can fill the plastic bottles with water and use them to drink water outside.
- You can use plastic containers to protect meals.
- You can clean and reuse plastic dishes, forks, spoons, and others.

Miscellaneous. Here, domestic waste like old cans, utensils, clothes, furniture, etc. is included.

Always remember the three R's: Reduce, Reuse, Recycle



Recycle process in a solid-waste treatment plant

Some ideas about what else we can do to reuse and where are given below:

- Do not throw away the stale bread, eat it toasted.
- You can use small boxes as drawers.
- Put a towel near paper towels.

- Instead of making paper copies, use originals.
- If you use rechargeable batteries, you do not have to throw away the batteries; use rechargeable batteries.
- You can use old toothbrushes to clean outreach and tiny places.
- Always use the two sides of paper sheet and make two sided copies.
- Try to use bath water or treated waste water for your garden.
- Buy concentrated form of food to save money and use less packaging.
- Do not buy things that you use very seldom, try to borrow them from someone else.
- Use items made from recycled materials.
- Try not to use disposables as they cannot be used again.

Waste recycling has some significant advantages. In general it leads to less utilization of raw materials; reduction of environmental impacts arising from waste treatment and disposal. Recycling makes the environment cleaner and healthier, saving landfill space. It literally saves money, since reduces the amount of energy required to manufacture new products. And finally, recycling can prevent the creation of waste at the source.

4.1 Recycling saves energy

Recycling saves energy as the energy for recycling is less than the energy for its generation from original materials.

- Recycling of aluminium products consumes only 5 per cent of the energy needed to make a can from aluminium.
- Papers or newspapers: the paper used can be recycled into new paper using only 55 per cent of the energy needed to make it from trees.
- Plastics can be recycled into other plastic products using roughly 33 per cent of the energy for producing the plastic from its original.
- Backyard composting saves energy by reducing the amount of garbage sent to landfills.

Recycling of aluminium products consumes only 5 per cent of the energy needed to make a can from aluminium.

4.2 Recycling saves natural resources

Throwing away everything and using disposables in our daily life is the worst habit in the world. Every day a new kind of disposable product is invented. There is no limit for disposable

products, as there are even disposable watches and mobile phones.

In reality, extending the lifetime of a product instead of using disposables is real protection of the environment. Recycling increases resource efficiency in production and consumption.

4.3 Recycling aluminium saves resources

Aluminium is used in many packaging applications, such as beverage cans, foils and laminates and represents 20 per cent of aluminium waste in Europe. Consumption of aluminium packaging has risen by more than 4 per cent per year since 1980.



Waste bins for separate collection

4.4 Recycling paper saves resources

Forests are destroyed to produce paper products. The world consumes five times more paper now than in the 1950s. The US offices' paper usage increased from 0.85 to 1.4 trillion sheets (about 4.2 to 7 million tons) between 1981 and 1984, as early desktop computers and laser printers were being introduced. Other countries underwent the same changes. From 1970 to 1990, paper production rose 4 per cent a year in Japan and 8 per cent in Southeast Asia, compared with 2.5 per cent in the US.

Source: [Natural Capitalism](#)

4.5 Recycling glass saves resources

Glass itself, as a material, is considered environmentally friendly since it is recyclable and can be reused. When recycled, it saves raw materials and energy. Each ton of cullet used to manufacture glass saves ca. 1.2 tons of virgin raw materials (sand, limestone, and soda ash). The substitution of each 10 per cent of virgin raw materials in the furnace saves about 2 per cent of the energy required for melting.

Source: [Fédération Européenne de Verre d'Emballage](#)

The US EPA estimates that recycling of one glass container saves enough energy to light a 100 Watt bulb for 4 hours.

Recycling also diverts materials from landfill and significantly reduces the amount of waste from mining that would otherwise be generated.

4.6 Recycling steel saves resources

Steel is the world's most recycled metal. About 435 million tons of steel are recycled worldwide every year thus saving 652.5 million tons of iron ore and 217.5 million tons of coal.

Source: [Wuppertal Papers, Material intensity of advanced composite materials](#)

4.7 Recycling plastics saves resources

The development of plastic materials has exploded in the second half of the 20th century. Production of plastic materials in the world rose from less than 5 million tons in the 1950s to some 80 million tons in 1997. Consumption of plastics in Western Europe was about 28 million tons in 1997 (35 per cent of the global production).

Plastic packaging waste represents about 60 per cent of the total plastic waste.

The distribution and industry sectors generate some 2.6 million tons out of the 9.8 million tons of post-user packaging waste produced in Western Europe. Household waste represents more than 70 per cent of the overall plastic packaging waste.

Source: [European Directive on packaging and packaging waste](#)

4.8 Recycling Reduces Pollution Risks

By saying “Recycling Reduces Pollution Risks”, we mean, “Recycling reduces land pollution.”, “Recycling reduces air pollution.”, “Recycling reduces water contamination.”, “Recycle and save money.”, “Recycle and have a better life.”, “Recycling secures the future of our children and grandchildren.”

Recycling reduces environmental damage caused by mining, logging, and manufacturing raw materials. Recycling reduces risks of air and water pollution from manufacturing processes. Recycling paper cuts air pollution by about 75 per cent. Substituting steel scrap for virgin ore reduces air emissions by 85 per cent and water pollution by 76 per cent. Recycling also reduces pollution risks by keeping materials out of disposal facilities. No matter how strong environmental standards may be, there is always some risk associated with waste disposal. Recycling and waste reduction are preferred and effective alternatives.

5. Business waste actions involving reduce, reuse and recycling

Planning environmentally friendly business is of crucial importance to ensure a safer and cleaner future for us all. Thus, if a company follows proper management of waste, it will save money and pollution risks. A good approach to reducing the amount of waste is to reuse the majority of available products and to recycle as much as possible. This attitude may result in considerable improvement of environmental pollution. In addition, managing waste will save business money.

5.1 What is the present situation?

Currently, landfill is the main disposal route for waste accumulation and processing. However, we are running out of space. Trying to find alternative solutions for handling the gradually increasing cost of waste disposal, as well as to control the pressure on environment and waste management services, legislative and administrative measures are implemented. Legislation is gradually changing and making waste separation mandatory for most businesses. Separation of waste in different source categories is essential to ensure maximum capability of recycling by producing clean waste streams.

5.2 Waste production environment and the active position of the business

Coordinating actions:

- Coordinate a review of waste production with the following main tasks: specification of waste streams; quantifying the produced waste (volumes); determination of areas where waste production/disposal is a problem.

New opportunities generation:

- Purchase durable, reusable and repairable equipment and consumables to attempt at preventing and/or recycling waste.

- Imply waste separation approach and identify materials for composting or recycling; optimize the separate collection bin system, pick up schedules and other details that are specific for the process.

Networking:

- Organize cluster activities with other businesses and local authorities involved in waste management.
- Promote waste reduction and recycling thinking at work place and encourage employees to behave in the same way at home.

5.3 Recycling and Reuse Business Risk Assessment

People that work in recycling business have to be careful with the toxic waste, such as glass, paper, plastic, iron and electronic garbage that may generate dust, germ and contaminated substances causing occupational diseases and accidents. The objective of recycling and reuse business risk assessment involves evaluation of the risk and solution of health problems of the workers. The recycling business deals with different substances, such as iron and aluminium, coconut peel, glass, plastic, paper, and others. The workers may cut themselves on metal and glass, may inhale dust, microorganisms and contaminated substances. The diseases that may occur are skin, respiratory, gastrointestinal diseases, cancer and heavy metal toxicity, along with eye injury and hearing loss. The inappropriate position when carrying heavy goods or standing for a long time may cause fatigue. The unsafe process may cause accidents, while lack of personal protective equipment may lead to occupational diseases. There are certain things that can be done to reduce risks, such as: personal protective equipment; ergonomics plan; evaluation of working conditions; physical examinations. Workers should wear protective equipment, including masks, gloves, safety shoes, clothes, eye-glasses, ear plugs, and safety helmets.

Risk assessment has usually been applied into two major areas:

- Adverse health and environmental effects of exposure to hazardous chemicals.
- Failure of complex technological systems.

The use of risk assessment in waste management facilities and especially in landfills has been increased since it was understood that all landfills, especially hazardous waste landfills, can harm both the environment and human health due to both constructional and operational problems.

The accumulated experience in landfill construction and work encourages improvement of risk assessment procedures and their application in almost all phases of a landfill life cycle. In landfill design, the understanding of the physicochemical and mechanical characteristics of the materials used is of major importance. Risk assessment is exercised not only in planning the overall design but also in considering the details of individual materials and their methods of installation.

For risk assessment in landfill design, construction and operation, the following issues must be considered:

- Framework for risk-based engineering in landfills.
- Use of risk-based approaches in evaluation of alternative design models.
- Use of risk-based techniques in evaluation of operational issues.
- Use of risk-based approaches for determination of waste acceptance criteria.

The following events often occur in waste management/recycling:

- Businesses that generate industrial waste may violate the law or get involved in inappropriate waste treatment.
- Illegal waste dump.
- The common cases and key proactive/counter measures are:
- Expiration/cancellation of a license for contracted business dealing with waste treatment/recycling.
- Lack of insurance and violation of the management guidelines for control on industrial waste.
- Waste outflow from contractors, affiliates and distribution channels, among others.
- Waste discharged from the department where a waste management/recycling practice is not regularly carried out.
- Waste products that are sold as usable materials.

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LO 10: ENVIRONMENTAL RISK ASSESSMENT IN WASTE MANAGEMENT

1. Environmental risk assessment in waste management

Environmental risk assessment requires understanding of the source of a hazard to or from the environment, the characteristics of an environmental receptor that may be at risk and the means or channels by which the receptor may be affected by that hazard.

Location, operation and decommissioning of waste management facilities are associated with certain risks that are assessed at various times during a facility's life: from design through construction and operation to decommissioning and licence surrendering.

Environmental risk assessment can be applied

- At strategic planning, pre-planning and planning stages (through environmental impact assessment and environmental statement, including risk assessment).
- During the process of waste management licensing (it may be carried out in parallel to the planning application).
- During the site supervision stage.
- Prior to modification of the licence or amendment of the working plan, resulting from changes to operation.
- Prior to site completion/closure and licence surrendering.

2. Solid Waste Programme

Once a community has a shared understanding of the problems caused by waste, it can take steps to solve them, starting with projects that fully meet the community's needs and abilities.

A complete community solid waste program would include all of these steps:

- Reduction of the amount of generated waste, especially toxic products and products that cannot be recycled.
- Separation of waste on-site for easier and safer handling.
- Composting food scraps and other organic waste.
- Reuse of materials whenever possible.
- Recycling materials and encouraging government and industry to develop community recycling programs.
- Safe collection, transport, and storage of waste; respect and fair wages to people who do the job.

- Safe disposal of waste that cannot be reused or recycled.

2.1 Reducing Waste

Waste that litters our streets, homes, and fields is often a by-product of industrial manufacturing that cannot be reused or recycled. One goal of a community waste program is to reduce waste in the long term by helping people use less of the materials that may become waste.

2.2 Separate Waste at Source

Keeping food waste from mixing with paper, glass and other waste makes it easier to reuse, recycle, and get rid of materials and helps prevent the health problems caused by mixed waste. Separating waste is the first step toward better waste management, though it only solves the problem if there is a good way to deal with waste after its separation. Waste separation is one phase of a system that includes reuse, composting, regular collection, recycling, and safe disposal.

3. Impact on businesses that discharge industrial waste in violation of the Waste Management Law

1. Penalties

Penalties including penal servitude or fines should be imposed for violation of the Waste Management Law. In case of penalty provision against employers and employees, the company is to be penalized. Thus, it is important for employees to strictly follow the law.

2. Impacts on business management

When a business that generated industrial waste appoints/subcontracts a company for waste treatment/recycling but the waste is not treated according to the legal requirements, the responsible companies will be subjected to measures that may be officially announced.

Such cases may not raise the costs but tarnish brand images.

3. Published cases

In case of large-scale illegal waste dumping, the name of the business discharging industrial waste should be publicly announced in the media.

3.1 Waste management/recycling as business management risk

- Companies that follow procedures of proper waste management/recycling must comply with the laws, including the Waste Management Law. A company should be aware

about various hidden risks that may arise in case of lack of appropriate agreement with a contractor or breaching contractor's waste treatment/recycling practices.

- In case of violation of the Waste Management Law, the name of the relevant company and details of law breach may be publicly announced.
- The following common violations, which businesses dealing with industrial waste tend to commit, are: contraction out to business with expired license, violation of the operational guidelines of the control manifest, among others.
- It is important to remember that some waste, such as leftovers after events and defective goods, are hard to be included in a waste management/recycling system on a regular basis.

3.2 Recycling Turns Waste into a Resource

Recycling takes products that are no longer useful and turns them into source material to make new, useful products. Recycling of certain materials (such as metal and rubber) must be done in factories. Recycling of other materials, such as paper and glass, require less equipment and space and can be done in small workshops or at people's homes.

Recycling is an important way to reduce waste but it requires support from government and industry, as well as commitment by communities and people. If there is no market for recycled products or if they are not safely recycled, recycling is not a solution. Recycling reduces waste by transforming it into new products and saves energy used in manufacturing. For instance, it takes two-thirds less energy to recycle paper than to make new paper, or to make steel from scrap metal rather than from raw ore. Making aluminium from scrap takes a tiny amount of the energy to make it from raw bauxite ore.

Recycling

- Reduces the amount of solid waste that pollutes our environment.
- Reduces the amount of solid waste in need of disposal, thus saving space and money.
- Reduces resource use by using the resources more than once.
- Helps the local and national economy because fewer raw materials need to be imported.
- Provides jobs.

Recycling is a tool for economic development as well as an environmental tool. Reuse, recycling and waste reduction offer direct development opportunities for communities. If collected with skills and care and upgraded with quality in mind, discarded materials are local

resource that can contribute to local revenues, job creation, business expansion, and local economy growth.

Recycling-based economic development is directly related to increasing the society's wealth. This strategy links reuse and recycling with community development and has documented the job creation and value added benefits of reuse and recycling.

On jobs per ton basis, sorting and processing recyclables alone sustain 10 times more jobs than landfill and incineration. However, making new products from old ones offers the largest economic pay-off in the recycling loop. New recycling-based manufacturing enterprises employ even more people and give higher wages than companies sorting recyclables. Some recycling-based paper mills and plastic product manufacturers employ (on a per ton basis) 60 times more workers than landfills.

Product reuse is even more job-intensive than recycling. It is a knowledge based industry focused on accurate sorting and pricing and good industry management.

Value is added to discarded materials as a result of cleaning, sorting and baling. Manufacturing using locally collected discards adds even more value per end product. For instance, old newspapers are sold for 30 euros per ton, but new newspapers are sold for 600 euros per ton. Each recycling step a community takes locally means more jobs, more business expenditures on supplies and services and more money circulating in the local economy through spending and tax payments.

Recycling has a major impact on job creation in local/national economies.

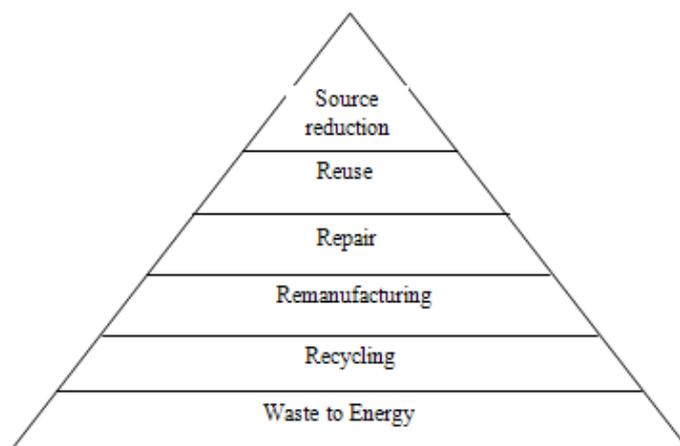
Recycling helps businesses, other organizations and communities to avoid disposal costs associated with landfills and incinerators. More and more local communities – large and small – demonstrate that recycling and reuse programs can be cost-competitive with disposal options. This is true in particular if communities consider the full cost of solid waste disposal and account for the environment and other negative impact of waste generation.

In addition, recycling stimulates the development of green technologies. Recycling encourages the development of more environmentally friendly products. The vast supply of low-cost materials from local collection programs has spurred many businesses to develop cutting-edge technologies and products. Waste tires are used in many applications including rubberized asphalt for paving roads.

3.3 Benefits of Reuse

- Environmental benefits

Many reuse programs have evolved from local waste reduction goals because reuse requires fewer resources, less energy, and less labour, compared to recycling, disposal, or manufacture of new products from virgin materials.



Reuse in waste reduction hierarchy

Reuse provides an excellent benefit, environmentally-preferred alternative to other waste management methods because it reduces air, water, and land pollution; limits the need for new natural resources, such as timber, oil, fibre, and other materials. The EU environmental policy has recently identified waste reduction as an important method of reducing greenhouse gas emissions that contribute to global warming.

- Community benefits

For many years, reuse has been used as a critical channel for getting needed materials to the many disadvantaged populations. Reuse continues to provide an excellent way for people to get the food, clothing, construction materials, business equipment, medical supplies and other items that they desperately need. There are other ways however, in which reuse may benefit the community. Many reuse centers are engaged in job training programs, programs for the handicapped or youth at risk.

- Economic benefits

Reusing materials instead of creating new products from new materials lessens the burden to the economy. Reuse is an economical way for people of all socio-economic statuses to acquire the items they need, such as business furniture and household items, cars and appliances. It is cheaper to buy used things than new ones.

3.4 What are the economic benefits on the recycling economy?

By converting raw materials into products, recycling (including recycling-reliant industries such as paper mills, and reuse and manufacturing) creates jobs, builds more competitive manufacturing industries and adds significant value to the national economy.

Direct impacts

- Building recycling business establishments.
- A number of recycling jobs.
- Millions annual payrolls.
- Billions receipts.
- Indirect impacts
- Recycling business provides important benefits by purchasing goods and services that support other businesses.
- Recycling business generates considerable state tax revenues.

4. Develop an Environmental Training Programme

There are a lot of Universities and Environmental Science Institutes offering Environmental Engineering and/or Environmental Science graduate programs. In addition, there are many environmental and social courses in other departments of Applied and Natural Sciences Institutes and Social Faculties such as Departments of Landscape Architecture, Urban and City Planning, Public and Administrative Sciences, Geography, Biology, Sociology, Psychology, Agriculture and Fisheries.

Thus, enough experts are working at state and private organizations, related with waste management. But everybody that attempts at building a successful waste management plan should answer the following questions.

- What is the solid waste management hierarchy?
- Is recycling worthwhile?
- If there is plenty of landfill space, why should I recycle?
- What costs more, recycling or throwing trash away?
- What is the relationship between global warming and waste recycling?
- How do the municipal solid waste generation and recycling rates compare between the countries?
- How does recycling save energy?
- What are the most common recycled materials?

- What products are taking up the most space in landfills?
- What kinds of materials in my trash are hazardous?
- How should I separate recyclable materials?
- How can I start a recycling program in my area?
- Where can I take these materials to be recycled?
- What happens after putting them outside?
- How can I find information materials to encourage participation?

A training strategy may be an instrument for raising environmental awareness of society and it should describe methodologies for environmental education, explain how it affects creative thinking and behaviour change, provide criteria for choosing materials, as well as links to background information on various environmental topics. Other instruments are teacher programs or student research. Kids and teachers should learn more about how to protect our environment and our planet and think about answers of the questions above. Kids and teachers programs should be accompanied by educational materials, such as books, videos, and other links.



Ashes automatically being carried by conveyors in a solid-waste treatment

Organic waste is produced wherever there is human habitation. The main forms of organic waste are household food waste, agricultural waste, human and animal waste. In industrialised countries, the amount of organic waste produced is increasing dramatically each year. Although many gardening enthusiasts compost some of their kitchen and garden waste, much of the household waste goes into landfill sites and is often the most hazardous waste. The organic waste component of landfill is broken down by microorganisms to form a liquid leachate, which contains bacteria, rotting matter and, perhaps, chemical contaminants from the landfill. This leachate can present a serious hazard if reach a watercourse or enter the water table.

Digesting organic matter in landfills also generates a large quantity of methane, which is a harmful greenhouse gas. Human organic waste is usually pumped to a treatment plant where it is treated, and then the effluent enters a watercourse or is deposited directly into the sea.

Companies and institutions in developing countries deal with organic waste in different ways. In fact, the word ‘waste’ is often an inappropriate term for organic matter that may be usefully employed. In most developing countries, materials and resources must be used in their full potential, and this need has propagated a culture of reuse, repair and recycling. Many developing countries have a whole sector of recyclers, scavengers and collectors that salvage ‘waste’ material and reclaim it for further use.

Places where large quantities of waste are created, usually major cities, have inadequate facilities for dealing with this waste; so much of it is either left to rot on the streets, or is collected and dumped on open sites near the city borders. These countries have few environmental controlling institutions that can prevent such practices.

There are various uses of organic waste. Organic waste is often employed in soil improvement, animal raising and as a source of energy.

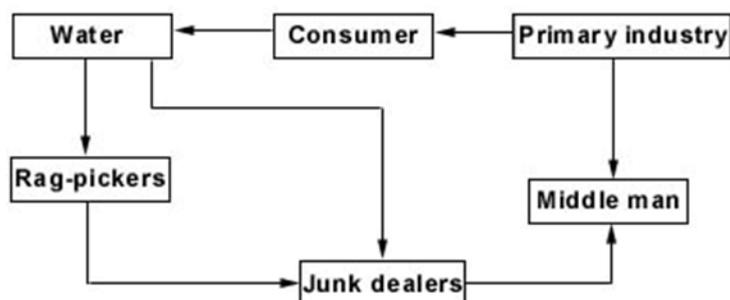
4.1. Organic Waste – Types, Sources, and Uses

There are types of organic waste that are commonly discarded. Below, we will look at types and sources of organic waste, along with examples of their common uses.

Domestic or Household Waste

This waste is usually made up of food scraps, either cooked or uncooked, and garden waste, such as grass cuttings or trimmings from bushes and hedges. Domestic kitchen waste is often mixed with non-organic materials, such as plastic packaging, that cannot be composted. It is beneficial if this waste can be separated at source because its recycling will be far easier. Domestic or household waste is usually produced in relatively small quantities. Developing countries generate a much higher organic content in domestic waste.

The principal recycling of domestic wastes is depicted in the schematic diagram below.



Domestic waste recycling process

Commercially Produced Organic Waste

This is waste generated by institutional buildings, such as schools, hotels, and restaurants. The quantities of waste generated there are much higher and the potential for its use in small-scale enterprises is good.

Animal and Human Waste

It is worth mentioning that there are serious health risks in handling sewage. Raw sewage contains bacteria and pathogens that cause serious illness and disease. One should stress that health and safety procedures should be followed in dealing with sewage. People dealing with its handling should have a clear understanding of the health risks involved. Raw sewage should never be applied to crops for consumption by humans or animals.

- Human faecal residue is generated in large quantities in urban areas and is dealt with in various ways. In the worst cases, little is done to remove or treat the waste, so it can present enormous health risks. This is often the case in the slum districts or poor areas of large cities. Sewage is often dealt with crudely and is pumped into the nearest water body with little or no treatment. There are methods for large-scale treatment and use of sewage as a fertiliser and source of energy. The most commonly used method is anaerobic digestion to produce biogas and liquid fertiliser. Composting toilets facilitate the conversion of human faecal waste into rich compost.
- Animal residue is rarely wasted. This fertile residue is commonly used as fertiliser, being applied directly to the land, or as source of energy, either through direct combustion (after drying), or through digestion to produce methane gas.
- Agricultural Residue. This waste remains after the processing of crops, e.g., maize stalks, rice husks, foliage, among others. There are a wide variety of applications for it, ranging from simple combustion on open fire to complex energy production processes that use it for fuel source.



Outer equipment of a solid-waste treatment plant that generates electricity

5. Supportive Policy Environment

The governments (and sometimes municipalities) play an important role in establishing a policy environment that supports good solid waste management (SWM) practices at local level for

- Enabling legislation (to protect public health and environment and ensure safe handling practices).
- Regulations and standards (permits, licenses, inspections for landfills, emissions from incinerators, and others).
- Law enforcement (financial and criminal penalties).
- Solid waste planning (recycling and waste reduction targets).
- Market incentives for recycling (beverage container deposits, minimum percentage recycled content).

6. Choosing Appropriate Technologies

All cities must consider a number of factors when choosing appropriate technologies for collection and disposal of solid waste.

Collection. Municipalities often spend as much as 70 per cent of their operating budgets for SWM on hauling costs alone due to rising transportation costs, outdated, poorly maintained

machinery, and inefficient existing collection routes. The city can lease this service to private companies. Experience has shown that private sector SWM costs between 20 and 40 per cent less than the same public services and that privatization of SWM and facilitating the entry of private providers contributes to the adaptation of best practices and appropriate technologies. However, SWM authorities must be aware that such a shift usually requires both decrease in employment in the waste sector and institutional shift of focus of public SWM authorities from service provision to oversight and regulation (both to ensure that companies meet the relevant standards and that they are not colluding).

Disposal and its alternatives. When planning the adoption of solid waste technologies, SWM authorities should consider the following issues:

- Planning, construction and implementation of new sanitary landfills are costly, so the alternative of small to medium-scale solid waste management practices should be considered.
- The tendency for municipalities to import expensive "end-of-pipe" technologies, such as collection vehicles and processing plants, often leads to additional unsustainable costs in training, repair and site maintenance.
- Dump upgrade, involving measures such as landfill liners, mandated landfill disposal standards, and low-cost remediation, along with improved waste minimization strategies may prove to be cost-effective alternatives to the expensive new SWM sites.

Health. Toxic runoff, pollution of water and soil, methane gas emission from unregulated landfills, and unsustainable areas subject to settling that often become informal settlements later, are just a few of the environmental and health challenges resulting from poor SWM. Uncontrolled dumping greatly endangers the immediate health of both informal sector waste workers and nearby inhabitants. Additionally, uncontrolled dumping has adverse effects on all urban residents, thus impacting the public health of the urban area, through water supply, air and soil contamination. Authorities must consider the public health impact of their current SWM strategies, as well as the health benefits and cost-effectiveness of alternative strategies for upgrading SWM, e.g., whether to emphasize landfill improvements, expansion of solid waste collection, or other measures as initial investment priority.

The recycling industry changes fast and involves a wide variety of service and product businesses, from companies that collect and process all sorts of materials to those that reuse materials or manufacture recyclable products. The industry also supports businesses in public education, consulting, transportation, brokerage, and retail of recycled products. Recycling-

based manufacture has the greatest economic, social, and environmental benefits within the industry. The manufacture with reused and recycled materials can be a profitable enterprise.

In the recycling industry, the small entrepreneur has almost unlimited chances. However, some businesses are easier to start than others. Since materials' added value is the key for business profitability, one method involves use of materials with very low or negative costs of making a new product of much higher market value. Due to their low values, green or mixed-coloured glass, mixed paper, plastics, scrap tires, and construction and demolition waste such as scrap wood, have great potential.

Another approach to manufacturing a product that is already on the market involves substituting virgin materials with recycled materials or producing a recycled product locally, using local materials. Only a very small percentage of products that are distributed on the market nowadays are truly new inventions.

Job creation from recycling activities far outweighs disposal on a per ton basis. Jobs and wages increase when recyclable materials are collected, processed and manufactured. Sorting and processing of recyclables provide ten times more jobs than would be available if the same materials were thrown away.

Manufacturers that use recyclable materials to make new products, employ even more people at higher wages than sorting and processing companies. For instance, some recycling-based paper mills and plastic product manufacturers employ between 25-60 times as many workers as landfills do on per ton basis.

7. What activities are performed by recycling businesses?

Examples:

- **Reuse:** Collection and sell of used construction materials, such as kitchen cabinets, windows and appliances. Everyone benefits as contractors save on disposal costs, construction company owners get tax deductions, and low-income customers purchase products at discount prices.
- **Remanufacturing:** A laser toner company collects and remanufactures computer printer toner cartridges, diverting tons of metals and plastic from disposal each year.
- **Collection:** A company provides collection services for municipalities and businesses that generate recyclable paper and cardboard, bottles and cans, and construction and demolition debris. It sorts materials and sells them to manufacturers that make recycled-content products.

- Processing: A company recycles scrap plastics by regrinding and selling them to manufacturing companies that use plastic in their products.
- Manufacturing: A company collects, processes, and manufactures recycled paper products. Such company can use recycled newspapers, magazines and office paper collected from cities and towns to make recycled-content book boards for notebooks, hardcovers and game boards.

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