Claiming compensation for natural resources damages. Economic analysis, liability regimes and consequences for public interest litigation.

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SCHOOL OF SCIENCE & TECHNOLOGY

A thesis submitted for the degree of

Master of Science (MSc) in Energy Systems

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THESSALONIKI – GREECE
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Abstract

This dissertation was written as a part of the MSc in Energy Systems at the International Hellenic University. Environmental damages are very common phenomenon and this is the reason why the law systems are being constantly improved. There is described the way, which evaluate the damages with different approaches, in different law systems and from the perspective of the economic analysis, like in the USA (on the example of Oil Pollution Act OPA and the Comprehensive Environmental Response and Compensation Liability Act) and in the EE (Directive 2004/35 of the European Parliament and of the Council on environmental liability) are analyzed.

There is an approach in the fact that the Environmental liability regimes in the Member States of the EU have not regulated environmental damage as such but mostly traditional types of damage, such as personal injury or property damage that are caused via the environment. EU Directive on Environmental Liability 2004/35 was introduced in order to fill this gap in the protection of ecologically valuable natural resources and that is the reason why there is a comparison between the USA system and the Directive 2004/35. Finally there are suggestions for the improvement of the law systems in order to be economically and legally efficient as a precise incentive to be avoided the environmental damages.

Keywords: evaluation techniques, use value, non use value, economic analysis, cost benefit analysis, OPA, CERCLA, environmental liability directive, citizen suit.
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1. Introduction

1.1. Scope and target of the study

According to Mc Kenna, (1995) to secure the financial coverage of the damages is of crucial importance. So, “where a polluter is insolvent or cannot be found there is in general no civil remedy available to a plaintiff”. So some of the basic and important point as mentioned until now is the existence of Environmental liability. Under this point of view it is necessary to mention that the amount, which will be paid, is estimated by means of the economic evaluation methods, so as it is understand these two points the liability regime and the evaluation of the resources are closely tied due to the fact that the one is the helping tool for the other. There is an analysis in the natural resource damages and in different ways to estimate them in order to give a value not only in the resources which have price in the markets but also to define the non market value. The value of the actual damage could be the one amount of compensation after the contamination; the other is the interim losses and the restoration of the damage. The civil law until now covers the situation like this but the consisting environmental accident set as priority to be existed specific liability systems in order to protect the natural resources. The USA system and the European are compared in order to find which parts of the one influence the other and finally to find the gaps which lead to inefficient law design also from the perspective of the economic point of view. The USA law has the CERCLA and the OPA, which are the first specific law for the natural resources damages and set the terminology of the compensation for different perspective (McKenna, 1995).

The absolute compensation target and the restoration compensation are the two different scopes irrespectively but finally lead to the same target. These laws use a variety of methods for the estimation of the damaging recourses value depending on the philosophy of each one. The European Directive 2004/35 comes later than the USA laws and is more strictly, a variety of characteristics from the OPA and CERCLA participate in this directive. The try to critical both systems and find the gap which is not covered by the existing law system based not only in legal factors but also in the economic efficiency criteria of each method and law. This wide analysis lead to the end in the suggestion in order to improve the way which protect the environment under an efficient economic and cost benefit analysis.
1.2. Methodology – The art and structure of presentation

In this point is worth mentioning that according to the previous literature review we use methods, which we use to complete this dissertation. The main methodology is the cost-benefit analysis and general the economic analysis like in the situation of the cost restoration and generally in the remediation measures.

This is understandable in the context of crucial relevant legal aspects. In this situation, we evaluate the different law framework like the combination of civil law and the introduction of liability in this in the form of the tort law.

There should be an effort to argue for the appropriate method to estimate the damage in the environment and, finally, to realize and specify the liability which could be an incentive for the polluter to prevent the damage or reduce its extent.

Finally, the approach to argue for legal means and proceedings by any private parties, which could claim compensation for, environmental damages and, more specifically, for the restoration cost is also a target.

In order to develop an argumentation for necessary statutory changes to domestic law by establishing collective judicial disputes to secure that compensation will be enforced in case that the state does not take advantage of the means of the public law liability regime properly, any advantages of collective action (basis-grounding for the acceptance of administrative decisions by the citizen as well as a certain contribution to the creation of a more thorough picture of the real data that form the basis of the administrative decision) shall be assessed in advance.
2. Definitions and preliminary clarifications

2.1. Environmental damages

It is widely known that environmental accidents can create a variety of damages, which occurred in production, in storage, in transportation or in different other stages. Moreover, we have to notice here that there are other Environmental pollution effects which occur not only from the previously stages but from splits or emissions etc. environmental damage is not only linked with the loss of human and animal lives but also with the destruction of property and with economic losses. For example, an environmental damage in sea or in an island has as a consequence that fishermen lost the advantage to fish. Additionally, hotels or restaurants suffer losses as tourists avoid visiting the area due to the pollution. The destruction of flora and plants lead to a loss of aesthetic value. So, based on all above, we have to notice here that the damage takes two distinctions, the first one is this which is related with the natural resources and the second one this which is related with the injury to health and to property. After that is necessary to quote the definition of damage (Allen, 2011).

2.2. Definition of damages and importance of the biodiversity balance.

"Damage" or "damages" means any economic loss, arising out of or directly resulting from an incident, including but not limited to: 1) removal costs; 2) injury to, or destruction of, real or personal property; 3) loss of use of real or personal property; 4) injury to or destruction of natural resources; 5) loss of use of natural resources; 6) loss of profits or impairment of earning capacity due to injury or destruction of real or personal property or natural resources, including loss of subsistence hunting, fishing, and gathering opportunities. [Code of Federal Regulation§ 29.1(e)]

The damages is not only in the natural resources and the losses from the economic point of view is not only by the injuring on it, there are is also contamination in the biodiversity and this has as a consequence the economic inefficient and the negative externalities which are analyzed in next topic. The term ‘biodiversity’ refers to “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part” (Convention of Biological Diversity, Article 2) and natural resources’ refer to “land, fish,
According to Pearce, Atkinson and Mourato (2006) “all life is embedded in various categories of ecosystems, where ecosystems are defined at life forms (“biota”) and their abiotic environments. Thus, a forest or a wetland is an ecosystem, as are coral reefs, deserts, estuaries and rivers. All ecosystems generate services, which are extensive and pervasive. Those services essentially maintain life on Earth so, in one sense, all ecosystem services are economic services – they have an economic value based on the benefits human beings receive from those ecosystems”. These kinds of benefits could be the purification service like the filter of the air from the forests. Also there is the ecological cycling from the step of the growing a plan where there is observing of carbon dioxide for their process of growing and after the death of the plants some of them could be carbon in soil form and after the burning of these soil there are emissions of green house gases. Moreover the Pearce Atkinson and Mourato (2006) support the providence of “Regulation services: natural systems have interacting species such that pests are controlled through natural processes, reducing the need for artificial controls. Ecosystems may regulate watershed and weather behavior, reducing risk of floods”. The habitat provision is also a service where the different organisms protect the environment in order to avoid the action of collapse in the whole ecosystem.

Generation and production, according to this the ecosystem for example provides biomass where there is the cover of needs like the electricity and general different energy forms. Information are the last kind of benefits and advantage of the ecosystem where there is a significant kind of knowledge for the scientific science and so with the help of it there is a higher level of knowledge for different disciplines. The significance of all these is the correlation of the damages with the liability system in Europe and in the USA also with the economic effect which has a bad policy in order to reduce the contamination areas as always to be an incentive for the polluter to be careful about the operation of a risky actions. The natural resources as also the biodiversity are related with the method of damage evaluation as the final compensation is existed after a carefully examine of the damaging value and after an intensive natural resources damage assessment. This is why this topic is focused in the terminology of the natural resources as also of the biodiversity.
2.3. **Strict vs. negligence liability**

Starting with the two types of the liability is necessary to mention the types of accidents because each type of liability has different importance depending in the accident form. So there are two basic types of accidents the first one is the unilateral and the second one is the bilateral accident. “In a unilateral accident situation the behavior of one person (the injurer) can influence the chance that an accident will happen, and the gravity of the accident. In a bilateral accident case, both the injurer as the person who is harmed (the victim) can influence the occurrence and gravity of the accident. The accident risk is not, however, influenced solely by the level of precaution taken by the parties in the accident but also by the level of activity, which are the times that the parties engage in the activity” (De Smendt, 2007).

The two basic liability regime types is the strict liability and the negligence. According to civil environmental liability systems all the persons who cause damage to others have to compensate for this damage. In this point of view we have to notice that strict liability, not depending on fault, which is for specific hazardous activities, is becoming part of public law. Regarding this normative choice to establish liability, as historical point is worth mentioned that Norway and Sweden are the first countries, which introduced this system of law. Also Denmark and German have chosen strict liability versions. On the other hand Finland and Sweden are imposed the liability regime for any activity which causes damage to the environment. The first and most important characteristic in public law liability systems is that the polluter is responsible for the damage; more specifically, in the EU liability regime of Directive 2004/35 as well as in most cases of domestic liability systems the land owner or the operator are the “liable persons”.

The definition of the two types of the liability is “under a strict liability rule, the injurer has to compensate the victim no matter what care he took in attempting to prevent the accident. He will always have to bear the costs of the accident. Under a negligence rule, on the other hand, the injurer will only be held liable if he did not take appropriate care. The law and/or the court usually determine the appropriate care level, this level is called reasonable care or due care. The due care standard specifies a level of care and defines parties who take less care to be at fault. The question, however, is how this 'due care' level can be determined” (De Smendt, 2007).
The law defines the level of precaution measures, where the final target is to minimize the social costs of an accident. Here the methods, which described before are used and more specific the cost benefit analysis, which is related with the social-economics part. The minimum cost generally is faced when the marginal cost is equals to the marginal benefit. In cases of accidents, which cause environmental damage a liability, regime is reasonable when the accidents that could be avoided by taking precautions of which the marginal cost is equal or lower than the marginal benefit. Of course there are available technics and measures to protect the environment but probably there is not the marginal cost lower than the marginal benefit, which means that it is economically inefficient. Finally we have to mentioned here that when the marginal cost is equals to the marginal benefit is the so called the optimal level. Past surveys (Learned-Hand formula in 1947) lead to the conclusion that cost is less than the expected damage. The three variables that determine the negligence are the probability of happening the accident, the result of the injury and the cost of precaution measures. According to the negligence liability rules a person is liable for the compensation when the cost of precaution is less then the harm times the seriousness of the injury.is worth mentioned at this point that the negligence and the strict liability have differences in the effects.

So in the situation of the negligence the liable person is that who did not take the appropriate measures to protect the environment, so this person takes less measures in order to have the optimal or the due care.so the person who is liable takes measures and that means a cost, but prefer paying for this kind of cost and not the cost of restoration in the impaired area. In the situation of the strict liability there is not a level of due care because the injurer pays the cost of accident and similarly the minimization of the cost for precautionary measures is again in the optimal level. Generally, by taking more precautionary measures than the optimal level the cost that is related with these precaution measures is increased and especially is higher than the benefit, which is derived from it. In the situation that is spent less than the optimal level then the risk for the accident is higher, and obviously the accident cost.

So in both situations the primary cost of an accident is reduced. The differences are clear in the secondary cost where in the negligence liability the liable person is not liable for the damages when there is in the due care level and on the other hand there is a full compensation for any kind of damages. Finally, in the administrative cost is also different in two types of liability, in the strict liability the cost before the court is higher since the injurer
is always liable for the damage so the administration and court costs is higher than in the situation of the negligence liability regimes. If the liable person in a situation of negligence is proved that did not take the precaution measures the polluter has to pay the clean up cost or the compensation. In the situation of the strict liability in environmental issues the operator has to pay for any compensation despite the measures it takes. The company has the full responsibility for the damage and obviously for the clean up cost. The main concept of the liability includes two targets. The fist one is the incentive to internalize the negative externalities, to reduce pollution and a trial to achieve the optimum social welfare or generally to operate the firms under an efficient economically speaking way. The second target is the compensation by any polluter for damages in the environment within the scope of the specific liability system. (De Smendt, 2007).

2.4. Primary restoration measures

So after the interim losses there is an analysis in the primary restoration and compensatory restoration, which are two, parts very important in the natural resources evaluation. The first one is the process to restore the damaged natural resources if it is possible to the baseline. In the Natural Resources Damage Assessment it includes four states, the setting of the restorations targets, the identification of the primary restoration option, the selection of the primary restoration option and the estimation of the interim losses. The important point in the primary restoration and more specific for the choose of the appropriate primary restoration measure is the consideration of cost of the carry out for this option, the length of restoration time, the effectiveness of this option, for example if the natural resource return to baseline, the likelihood of success and finally which option prevent future damages. The cost benefit analysis and the cost effectiveness analysis are the criteria if there are more than one restoration measures which covered the process which was analyzed in the primary restoration part (Elliot and Partners, 2001).

Restoration in this process is important as in the liability regime indicates that the restoration has to set the natural resources in the previous state. The problem here is to identify exactly the start level, as the use of data and historical sources are used to estimate this point. Is very common phenomenon the fact that interim losses do not covered by the liability regime and as a consequence are not indemnifiable. So is important the restoration
estimates and includes this value. In this point we have to notice that there is priority in the measures of restoration from the same category and after that the equivalent measures. The reason why it happens is because the cost of assessing the damage is reduced because the economic assessment is not needed for this occasion.

2.5. Interim losses

So in the process of assessing damages and especially in the cost assessment the interim losses play an important role which refers to the reduction in natural resources and the services they provide, relative to baseline, which occur from the onset of an incident until complete recovery of the injured resources”(Elliot and Partners, 2001). Interim losses can be compensated even in the situation that there is fully recovery in the baseline point. This happen because the recovery is not implemented immediately, there is lost time and services during this process and for that reason the compensation is necessary. Identification and qualification of any interim losses are crucial not only for the election of primary restoration but also for the compensatory restoration.

2.6. Compensatory restoration measures

Compensatory restoration has as a target to compensate the public for the interim losses of resources and services during the recovery period. In this step is necessary to set the objectives for compensatory restoration choices, to identify the monetary or/and the resources compensation, to identify the compensatory options and finally to select the appropriate compensatory option. Both types of the restoration measures will be analyzed below analytically in relation to the liability rules of the EU regime and the significance of each step in the compensation for the environmental damages (Blatch, 2004).

One also important part in the liability regime is the monetary value of losses remaining despite the restoration in order to cover the principle of “polluter pay”. Generally the monetary compensation is in used but there is a point where there is a doubt about that. The reason is that exist damages, which are non-restorable, these damages, which are, not in
kind are in common sense non-important because the compensatory restoration has as a focus the losses which remain after the primary restoration. In this situation probably takes measures for similar damages, which are in a specific kind, these measures based in economic, and in environmental methods. In this point is the doubt, is not sure that the measures are appropriate for this situation. Probably the time and the amount of money of the monetary compensation is not proportionate for this situation. It is consequently very important to assess the damage and determine the appropriate value of restoration measures.

2.7. Liability as a part of public (administrative) law system

For an improvement design of a liability regime the elements established liability have to be part of public law, moreover is necessary the definition of liability to be specific applicable and for a listed biotypes and species. As we mentioned before the liability regime and the Economic analysis are closely tied. From this point of view the method that is used to wage the Economic analysis is very crucial. When we know the market price of a good then is easy to calculate the compensation but in the situation where we do not exist the market price then this process is more difficult. Despite the variety of methods of doing the Economic Analysis for a non market good the problem is that the application of that methods are for irreversible and non-substitutable natural goods.

2.8. Liability versus regulation of safety as means of controlling accident risks using the economic method of analysis

So generally the most important activities in order to protect the environmental damages are the regulation by the government with the combination of the law and economic tools\(^1\) or by the pure legal tools like the liability regime tools. The liability system is also

\(^1\)Until now is analyzed the importance of the liability regime rules and the economic incentive to reduce the cost associated with the protection of the environment. The liability is provided as one of the most important way to protect the environment and to calculate the compensation with the evaluation techniques. Nevertheless there are also solutions, which contribute to the precaution of the damages like the marketable permit or the quantity instruments. In this situation is set a level of quality for the environment and the second step is to minimize the cost. A great example for this is the emissions allowances where there is a level of quality for the environment
known as ex post and the regulatory system as ex ante. The choose of better solution is always depending on different criteria.

The first one is the issue of the cost, the cost of liability is linked with the cost of controlling accident and the legal expenses, on the other hand in the regulatory the cost is related with the public expenses and the cost of compliance with standards. A very important issue is the person who bears the environmental damage, for example the regulatory agency set a due care level and so the firms are not face this kind of cost due to the reason that the cost is covered publicity. Is also known that in the liability the restoration is responsibility of the liable person like a firm. One important issue which contributes to the choose of the liability or the regulation is the information. If there is knowledge regarding the risk then the firm face the risk and the restoration of the damage, it is obvious due to the fact that a firm know better the risk and has the ability to known the ways to protect this situation. There is also the possibility to have lack of information and in this situation the cost is overestimated or underestimated and there is the need to implemented regulatory tools.

Liability regime, regulation tools or other tools, which used to protect the environment has as a consequences to change the behavior of the human. So in the survey generally there are two main issues, which take into consideration the recognition of crowded, put effect and fairness and justice consideration in the economic analysis of law. The first one supports that the human behavior is not affected only by monetary incentives but also from intrinsic incentives. The use of the laws and regulation want to achieve the target to protect the environment and to reduce the pollution, except of this policy the use of marketable permits or the charge for any unit of pollution has as a consequence to provide a price to the use of

and then announced the emissions allowances for each industry regarding a specific cap. So the industries in order to minimize the allowances use new technology and as a consequence there is an abandon in the emissions.

In order to understand better this process there is an explanation of the allocation methodology in the EU. The new allocation methodology is the Phase III of the EU ETS, post 2012 established by the Decision of the Commission 2011/278/EU on “Transitional community-wide and fully harmonized implementing measures pursuant to Article 10a(1) of the EU ETS Directive” (CIMs) and developing the National Implementation Measures (NIMs)

The second important issue is the pricing instruments like the emissions charges or the pollution taxes. The first step here is to determine the level of quality and then it is achieved by impose taxes and emission charges for example if there is a charge for any unit of pollution then the industries try to minimize the cost due to the high taxes which have to pay for the emissions and at the same time try to reduce the pollution. (European Commission)
environment and this is an efficient policy.

The so called crowded out effect illustrates that the individuals have the trade to behave eco friendly but the more costly their behavior the less moral concerns it is. In the situation that there is a too high cost in the behavior of individuals only a specific category will keep behaving in environmental friendly way. But there is not only the part of the individuals, there are also the firms where the green production has a very high cost, moreover the use of specific technology in order to produce with environmental friendly ways has as a consequences the high operations cost in the firm. For example when there is license in order to pollute then there is a correct way to operate the firm and under the rule of not polluting. In the situation that there are taxes for the pollution and especially for the majority of the companies in a sector then all the firms are obligated to pay this kind of taxes despite the fact that probably operate environmental friendly, so in this situation there is the existence of the crowding out effect. The second important part as we mentioned before is the Fairness and Justice Considerations in the Economic Analysis of Law. According to Kaplow and Shavell there is the importance to incorporate the fairness into the economic analysis of law. As we mentioned before the economic analysis based in the welfare economics and the social benefits. In any situation that there is not the optimal level and the benefits are lost by an inefficient policy then there is the worse off situation of the society.

2.9. Literature overview

A fist approach from the law perspective is the Study of “Civil Liability Systems for Remedying” by Cameron McKenna (1995), which is based, in the civil liability, a liability regime rule under the public law and the criminal law. So as a consequence the first difference with the other surveys is the differentiation of strict and common liability regime, which we meet in the Kokott (2003) and the civil liability, which combines the characteristics of public and criminal law. Comparison in different legal systems and the precaution measures for the environment are analyzed in order to enlarge upon liability regime systems and the divergences between them. This evaluation of the systems of liability is a synopsis of the existing liability regime rules in different countries with different law building but the same final target, to protect the environment by contamination accidents. Topics and parts of the points are included analyzed in other literature; not only the legal framework described
but also the general operational rules of this. So a more specific analysis from this point of view could be deemed more interesting for our purpose. It is worth noticing that the strong points of McKenna’s study (1995) are the developed details generally; at the same time this is probably a weak point because these details could create a confusion regarding the evaluation of the information.

A very common issue in this dissertation is the assessment of the damage and the cost of restoration the study “Harm to The Environment” by Wetterstein, Schoenbaum and Brighton (1996), is a significant resource for this issue as it has two basic topics. The first one is the cleanup cost of the pollution from the environmental damage against the liability limits and the second one is the limits application only for specific damages. There is an extension analysis regarding the third party and the liability regime for this part. There are gaps like the fact the third parties with no intense or direct connection with the damage and try to give a solution to this problem but one of the strong point of this survey is the specification of damages in categories in order to clarify the responsibility of each part in the general liability regime framework. Like in previous papers it is also here focused on cost analysis like the remediation or the restoration cost and the economic loss damage. This is from this specific dissertation an important approach as it combines economic analysis and the legal elements of the survey.

In “Environmental Liability in International Law: Towards a Coherent Conception” by Rüdiger Wolfrum/Christine Langenfeld/Petra Minnerop (1999) is analyzed the strict liability regime, also problems like the proving of connection between the operation of the installation and the damage. “Contaminated sites “and “Ecological damages” are the rest problems witch authors prefer to explain in their survey. The main differences with the Kokott (2003) are the specific reference in the German Law and not in the international liability general and especially to the appropriate design of this. Finally both of surveys based on the problem of this topic, the combination of the law systems, economic analysis for the prevention of the environment in different design forms and implementing methods. Taking these surveys into consideration has as a consequence to lead in an improvement solution in order to fill the gap in the existence legislation.

There is a literature regarding this dissertation, at this time is provided this one, which is related to the law and economic analysis in the protection of the environment, By “Liability Policy and Toxic Pollution Releases”(Heyes, 2001) there is an approach, which combines the
economic analysis and the law. Additionally is worth mentioning Juliane Kokott/ Axel Klaphake “Ecological Damage and its Assessment under International, European and National Liability Regimes – A Legal and Economic Analysis” (2003) (an extended summary is published under the title “Key Elements of a Liability Regime Taking into Account Ecological Damage” in Journal for European Environmental & Planning Law 2 (2005), pp. 277-286). In their method, the authors approach the liability regime framework first of all from the perspective of “polluter pay” principle. Is analyzed the steps of design the liability regime framework and identify the problems which are important in each step.

Kokott/Klaphake compare different legal systems in different countries, which covers the liability regime spectrum. For example, in the United Kingdom the problem is the statute law from one side and the common law from the other side. As in the majority of situation the liability regime is largely restricted for specific kind of damages and the main assessment is the restoration solution and measures for the damages. The main problem of liability, which is only for the restoration cost and not for the irreparable ecological damages and interim losses and so there is the conclusion that is, not exist a full liability regime. So definitions like primary restoration and compensatory restoration are used to specify the legal framework and its gaps in the liability regime rule. Finally Kokott/Klaphake analyze which characteristics should be included in the remediation option in order to be more effective this legal rule.

One more advantage is the phase of first assessment of the damage. Other parts of papers try to analyze directly the environment damage; there is nowadays an effort to introduce the so call pre-assessment phase. Is worth mentioning the fact that this pre-assessment phase the “Harm to The Environment” follows the same survey way as in the situation of Kokott (2003), but introduce the criteria to set restoration measures which make the difference. The literature covers also different perspectives of this topic. According to Michael Faure, “Environmental liability”, there is a problem of choosing the appropriate liability type. For example to choose the strict liability or the negligence is common but having specific characteristics in environment issues. The question how law can provide appropriate incentives to the protection of pollution and how an ex post compensation is provided at the lowest cost regarding to other methods is analyzed in this survey. Moreover is provided an example of which liability form is worth implemented in different situations and in different combination of law structure.
If is necessary to find a weak point in the literature, this could be that there is mostly insufficient mention to the environmental groups which can claim for environmental damages before courts in the procedural form of citizen suits. The important point in this paper is the decision to choose between the most proper liability forms. There is a confused situation, either because the damages in the majority of the situation have not a clear responsible individual or the legal framework in different countries has priorities and rules not similar. The situation for example of the third party access and the responsibility of it in the environmental damage is a different and is depended in the legal form.
3. Environmental liability regimes

3.1. National and international environmental liability regimes

The major in this process is the identification of basic problems in the international liability regime and according with the economic analysis tries to find a better design system. After a survey in different countries try to set the basic characteristics for each system. In the Belgium system for example is provided the rules for the environmental damages and there is a provision for the compensations which be occurred. The main problem in this according to Kokott is the not exist of restoration for the irreparable damages. In Italy for example there is provision for the environmental and ecological damages but there is also a problem in the assessment of damages, which is “in the responsibility of judge and in the lack of commitment of national government agencies to use the compensation” (Kokott, 2003).

In the Netherlands the liability regime is also for the certain case and in the Sweden probably exist a legal framework for compensation according to the court but there is lack of “special statutory provision for ecological damages”. In the Switzerland this legal frame is existed and there is compensation for the natural goods and moreover there is the statutory protection as there is in the system of the United Kingdom. The only system according to the Kokott, which is completed, is this of the U.S.A where there is a liability system which covers the majority of the environmental accidents, additionally the existence of the lobby enforcement provide a more tool to the full cover of the damages in the natural resources.

The liability regime is strictly mentioned to the restoration cost, the problem in this is that there is not liability for the irreparable ecological damages. An effort for the international liability has been made but there is an important restriction about the restoration measures. For example International Convention and the Fund for Compensation of 1969 and 1971 consider that the liability exist only when there are the appropriate restoration measures to eliminate the environmental damage. In the situation that there are not these kinds of measures then there is not compensation.
3.2. Liability regimes as the scope of the present study

The last two decades there have been legislative efforts, initiated mainly by the Commission, to establish a liability system within the EU by harmonizing the MS-liability regimes. The corresponding directive is the 2004/35 concentrating on the prevention and the restoration of contaminates sites and on loss of biodiversity”. To be regarded as the way to prevent and remedy environmental damage with financial responsibilities for the operators or the managers of activities with high risk (De Smendt, 2007). The purpose of it is to minimize the risk of the environmental damage. The principles, which are illustrated in this legal statute, is the polluter pays and the prevention.

3.3. US environmental liability regime

The first operation of this kind of the liability is in the USA where according to this there is obligatory the compensation for the environmental damages in the natural resources. All the land, water and the wildlife are held from the state in the name of the society. As is analyzed below it is necessary in order to have an economic efficient system. This part is described below in the economic analysis topic. So the liability regime in the us has to compensate the public for the loss of the resources itself or for losses in use, in the amenity from this resources or for any services which are provided by this resources.”(Minika Hintegger 2008) .By this way is get of the barriers in the legal process to find the owner of the resources. The law describes “a body of rights, obligations and remedies that is applied to provide relief for persons who have suffered harm from the wrongful acts of others. Under tort law, if someone suffers a physical, legal or economic harm he may be entitled to bring suit .If the suit is deemed valid, damages may be awarded to the victim to compensate for his troubles” (August, 2010). After the problem of the ownership of the resources in the tort law the second important problem is the assessment of the damages, which again is faced by the US, legislation in the liability rule and the methods will be explained in a specific topic.

Until now the US law system largely covers the damages in the environment and there is a try to identify the cost of this injury. Both in state and in federal level there is the strict liability as a basic part to protect the environment due to the fact that there is not
environmental liability like in the situation of the European Union. At this time a small amount of statues regulate liability regime rules for specific hazardous or for specific areas. The two basic laws for these are the Comprehensive Environmental Response and Compensation Liability Act (CERCLA) and the Oil Pollution Act (OPA). The first one was regulated in 1980 after detecting 80000 tones of toxic water in 1978 under school and neighborhood in Love Canal of New York. OPA was necessary after the Exxon Valdez were eleven million gallons of oil was spilled into Prince William Sound of Coast Alaska. The restriction of this law is the implementation only for impacts of oil spills and oil dumping in American Waters. “CERLA has much wider ambit, covering emissions caused by hazardous substances not only in the water but also in land imposing liability for remediation costs and environmental damage on land were hazardous waste is suspected, (Wolfrum, Langenfeld, Minnerop, 2004)”.

3.4. EU law

Until now is logical that the damages and the estimation of the value is a very important factor in order to protect the environment and to compensate the injurer the victim. According to this concern there is directive from the EU and internationally in order to precaution the environmental contamination. Before proceed to the directive analytically is necessary to mention the basic principles of the law making process in the European Union. The first one is the high level of protection; the second is the Polluter Pays where according to this “the costs of the measure to deal with the pollution should be borne by those casing the pollution through the imposition of environmental charges, environmental standards or environmental liability” (Directive, 2004/35).

3.4.1. European environmental liability regime: Directive 2004/35

Damage

So the European directive as damage considers three different types according to the Article 2§1:
The damages to protected species and natural habitats. “Damage that has significant adverse effect on reaching or maintaining the favorable, conservation status of such habitats or species; only species and habitats that are mentioned in the Wild Birds Directive and the Habitats Directive are covered. The conservation status of natural habitats consists of the sum of the influence that may affects its long term natural distributions, structure and function including the long term survival of each typical species. With respect to species the conservation status consists of the sum of influences that may affect the long-term distribution and abundance of its populations. It exists when the natural area and the range, which is covered, are stable or increasing, when the specific structure for the long term of maintains exists and could be exist in the future and finally when the long term survival are guaranteed. The significance of an adverse effect is to be assessed with references to the baseline condition and the criteria set out in the Annex I to the directive, which refers to various measurable data concerning the status of the species or habitat, such as number, role or capacity of regeneration. Baseline condition is the condition the natural resources or service would have been in at the time of the damage, had the damage not occurred. Damage that has a proven effect on human health must be classified according to the annex I to the directive as significant damage. Negative variations that are smaller than normal natural fluctuation or negative variations that have natural causes need not be classified as significant damage. Water damage is qualified in relation to the EC water Framework Directive 2000/60/EC as any significant adverse on water according to the water quality categories. Finally, land damage is any land contamination that creates significant risk to human health as a result of soil and subsoil contamination by substances, preparations, organisms or micro-organisms”. Is worth mentioned here that the damage on the person or the property or economic losses in not included in the directive because these areas are covered but the civil liability regulation of the EU-MS and, more specifically, by tort law. So the directive distinguished in activities listed in the Annex III, for other activities it is only applied to protected species and natural habitats and not to water and land.

3.4.2. Prevention measures

In article 5 §1 is clearly mentioned that any operator of installations listed in Annex II of the relevant Directive has to take prevention measures. If, after taking the appropriate
actions, the risk of the contamination still remains then the operator has to inform the component authority as soon as possible (Article 5, §2). After of the informed the operator has take prevention measures to avoid the damage (Article 5, §3), if failed to do or is not legally or cannot be identified so the is required to bear the cost remediation (Article 5, §4).

The directive except for the restricted definition of the damage and the measures in order to protect the environment ta resources from the damages set the measures in order to remediate the environment from any contamination situation. This is logical because as mentioned before the scope of this directive is not only the incentive to prevent the environment but also to set the process for the restoration and the compensation. In this situation the operator has to inform authorities about all aspects of the situation, to take all steps to control the situation, to take remedial measures, to restore rehabilitate or replace damaged natural resources and finally to provide any equivalent alternative to these resources and services (Article 2§1.).

The liability regime rules based on four main characteristics, the first one the type of the liability between the strict and the negligence liability, the second is how the causation be determined for negligence, the third is the decision of the appropriate basis or standard in order to decide when the damage of the environment is important and the finally who is going to implement the liability rules. So there are activities, which are under the strict liability, these are activities, which are dangerous, and on the other hand there are activities which are not dangerous and they are under the negligence liability. One very important factor is the period where operators or managers are liable. In the liability in order to be liable a person for the compensation and for the restoration cost there is necessary the existence of linking between the damage and the activity (EU Directive 2004/35).

### 3.4.3. Choice of the appropriate remediation actions

The operator in order to choose the appropriate remediation action has to take into consideration some criteria as the are described in the Article 1.3.1 of Annex II of ELD. The effect on public health and safety, the cost and the likelihood of success, the length of time and extent of restoration and the extent of benefit to compensate of the natural resources or service in the situation there has been already remediation measures is not necessary for more
measures. The three types of the remediation are the primary, complementary and the compensatory.  

3.4.4. Remediation measures for the water, species and habitats

When the contamination is focused in water or in species and habitats, then the primary restoration return the natural resources damage to the baseline condition or to the start level. When the primary restoration measures are not efficient to set the natural resources to the start level then is necessary the complementary remediation in order “to provide an equivalent level of natural resources or services as that available had the damaged site been returned to its baseline condition. The compensatory remediation is existed when there is the need to cover the interim losses of natural resources Moreover MS-liability rules before have considered only damages in natural resources and without calculating the losses, which occurred until the time, which the resources came to the starting level. So there are monetary evaluation methods, which described in specific part, like the travel cost method, the avoidance cost approach and the hedonic price approach (Annex I, §1.2.3). Remediation for land damage has to account according to the directive the remediation in this situation is to ensure that contaminants are removes, controlled, contained or diminished so that the contaminated land no longer poses a significant risk to human health. The risk in necessary to

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2 The reasonable remedial options should be evaluated, using best available technologies, based on the following criteria:
— The effect of each option on public health and safety,
— The cost of implementing the option,
— The likelihood of success of each option,
— The extent to which each option will prevent future damage, and avoid collateral damage as a result of implementing the option,
— The extent to which each option benefits to each component of the natural resource and/or service,
— The extent to which each option takes account of relevant social, economic and cultural concerns and other relevant factors specific to the locality,
— The length of time it will take for the restoration of the environmental damage to be effective,
— The extent to which each option achieves the restoration of site of the environmental damage,
— The geographical linkage to the damaged site.

3 1.2.3. If it is not possible to use the first choice resource-to-resource or service-to-service equivalence approaches, then alternative valuation techniques shall be used. The competent authority may prescribe the method, for example monetary valuation, to determine the extent of the necessary complementary and compensatory remedial measures. If valuation of the lost resources and/or services is practicable, but valuation of the replacement natural resources and/or services cannot be performed within a reasonable time-frame or at a reasonable cost, then the competent authority may choose remedial measures whose cost is equivalent to the estimated monetary value of the lost natural resources and/or services.
be assessment according to the current use, according to the nature of the area and its expected development.

3.4.5. The methods of service-to-service, value to cost and resource-to-resource methods.

One more way to evaluate the damages in the environment is the so-called service-to-service method. This is used when the restoration measures for the compensating area could be in relevant level from the prospective of the quality, and unit value with the damaged resources or the services, the characteristic is the existence of the perfect substitutability for these resources or services. If for example there is damage in natural resources then the restoration measures in order to be implemented, is necessary to have present value equal to the present value of the contaminating part. The problems in this method is the equivalent level of the restoration measures regarding the damaging part, the equal present value of the substitute measures and the contaminating service or resources and finally if a measure could perfect substituting.

In the value to cost the present value of the restoration costs have to equal to the present value of losses. Jones and Pease (1997) “To apply this procedure, the trustees must judge that the valuation of the lost services is practicable, but valuation of the replacement natural resources and/or services cannot be performed within a reasonable time frame or at a reasonable cost.” So, the ‘resource-to-resource’ equivalence approach basically means replacing the lost resources with resources of the same type and quality. Where resources of the same type and quality cannot be identified, then the next step is to identify the services provided by the lost resource and to see whether services of a comparable type and quality can be provided instead by an alternative resource: the ‘service-to-service’ equivalence approach (Blatch, 2004). According to 1.2.3 of Annex II. “It basically means that the monetary value of the interim losses is estimated and the equivalent money is spent on compensatory remedial actions irrespective of what the money buys. In other words, the value of the damages is set equal to the cost of the environmental resources delivered by the remedial actions. The actual value of these environmental resources may be more or less than the cost of providing them” (Blatch, 2004).
3.4.6. Liable persons

The first criterion in order to set a person liable is the identity as operator of an environmentally relevant installation (Directive, 2004/35). The directive “applies to actual environmental damage or the imminent threat of such damage caused by the occupational activities (article3) such activities is any economic activity, business or undertaking, irrespective of its private, public, profit or non profit character. The responsible party is the operator of the activity and any other persons are not consider to be responsible for the damage except of the situation that they are operators.

As already mentioned, the operators of activities listed in the Annex III to the Directive, are liable for the damages and have the responsibility for the operation of the installations with regard to air, water or ground water. Moreover, for the operation of waste management process including the operation of the landfill sites and incineration plans, for the manufacture, use, storage, processing, filling, release into the environment plant protection products or biocide products. Additionally the operators of these kinds of activities are also responsible for the transport of goods, which are dangerous during the transportation via road, rail, waterways, sea or air, and for the use of the genetically modified microorganisms. Finally the release to the environment or the transport of modified organism and the shipment of waste within into or out of the European Union.

3.4.7. Allocation of cost

The Directive demonstrates the activities, which are dangerous, and the obligations of the operator these specific activities. The assessment of damage in which areas and which measures to take in order to protect the natural resources, except for the preventive measures analyzed the remedial action to set the baseline condition and finally the remediation types regarding consequence. The identification of the liable person as well as the scrutiny, under which conditions the person can be held liable for the damage, are the last steps in the scheme of the liability Directive. One more factor, which participates in the approach of the liability rule, is the allocation of the cost. Generally, the operator is obligated to pay for the cost to compensate the damage (Article 8), which is probably to be covered by the authority in case
the operator is not identified or could not be considered liable under following circumstances: The damage which caused by a third party or according to the Article 8 §3 “the damage resulted in case of compliance with a compulsory order or instruction from a public authority other than an order or instruction consequent upon an emission or incident caused by the operator’s own activities. From the perspective of the member state it could allow to an operator to avoid liability if he proves that there is not in fault of their organization and management and second if he proves that there is not environmental damage based on scientific and technological knowledge (Directive, 2004/35).

3.5. Gaps in the EU environmental liability regulation regarding the scope of restoration also in comparison to the U.S. liability regime

A lot of time there is the need to be a relationship between the measures of restoration and the damage of natural resources. In the reality there is no metrics to set in balance this kind of relationship, so in this situation in the liability regime and especially in the Annex II is used a calculation to set a momentary value in order to determine the scope of compensatory restoration. In liability regime system the ecological methods are appropriate to set the right restoration measures and the economic assessment method are adequate for evaluation method. This kind of liability regime is used in the U.S.A and is recognized in various national and international liability regime types.

The differences and exactly the definition of these two liability types are analyzed below. As mentioned before the US legislation could be the first approach in order to have later the directive in the EU. Despite this fact there are differences between the two legal rules, according to the Hinteregger (2008) the directive covers a wide spectrum of dangerous activities in addition to the installations, substances and waste sites and the directive “includes the transport of polluting goods and the environment risk of genetically organisms”. The second significant difference is the definition of the damage, according to the directive it is more restrictive and are concentrate in specific types of damages, “damages to protected species and habitats, water damage and land damage. The also worth mentioning point is that the oil pollution from the tanker is not covered. Finally the directive is implemented only for
circumstances, which happen after 30 April 2007, which is the date for the member states to embody the directive in their legislation system.

So this problem could create a great disadvantages with economic and social effects due to the fact that European liability regimes does not cover damages which is not in the strict frame of this law. The complete US system is participates to the improvement of the law design in the European union but there is a lot of time in order to achieve this. At the next topic there is analyzed the economic analysis of different methods and general in the policies in order to protect the environment. The basic criterion of the cost benefit analysis also the welfare economics are the basis where is chosen the best strategy in order to avoid the environmental accidents also to set an incentive to the polluter or more specific to the operator to make an attendance in the risky operation process (OPA, Part 990).
4. Natural Resources Damage Assessment and economic analysis of environmental liability

4.1. Economic aspects by establishing an environmental liability regime

The minimum cost generally is faced when the marginal cost is equals to the marginal benefit. In the situation of the accidents the liability regime is reasonable when the accidents that could be avoided by taking precautions of which the marginal cost is equal or lower than the marginal benefit. Of course there are available techniques and measures to protect the environment but probably there is not the marginal cost lower than the marginal benefit, which means that it is economically inefficient. Finally we have to mentioned here that when the marginal cost is equals to the marginal benefit is the so called the optimal level.

Past surveys (Learned-Hand formula in 1947) lead to the conclusion that cost is less than the expected damage. The three variables that determine the negligence are the probability of happening the accident, the result of the injury and the cost of precaution measures. According to the negligence liability rules a person is liable for the compensation when the cost of precaution is less then the harm times the seriousness of the injury. Is worth mentioned at this point that the negligence and the strict liability have differences in the effects.

So in the situation of the negligence the liable person is that who did not take the appropriate measures to protect the environment, so this person takes less measures in order to have the optimal or the due care. So the person who is liable takes measures and that means a cost, but prefers paying for this kind of cost and not the cost of restoration in the injuring area. In the situation of the strict liability there is not a level of due care because the injurer pays the cost of accident and similarly the minimization of the cost for the precaution is again in the optimal level. Generally taking more precaution measures than the optimal level the cost that is related with these precaution measures is increased and especially is higher than the benefit, which is derived from it. In the situation that is spent less than the optimal level then the risk for the accident is higher, and obviously the accident cost.
So in both situations the primary cost of an accident is reduced. The differences are clearly different in the secondary cost where in the negligence liability the liable person is not liable for the damages when there is in the due care level and on the other hand there is a full compensation for any kind of damages. Finally in the administrative cost is also different in two types of liability, in the strict liability the cost before the court is higher since the injurer is always liable for the damage so the administration and court costs are higher than in the situation of the negligence liability regimes. There is an example with this kind of liability from the Polinky and Shavell (De Smendt, 2007), if is considered that there is a firm where the process of production is risky to lead to environmental damage. The social welfare in this situation is the utility from the consumption of produced goods, so there is focused searching to demonstrate which of both prevent from the environmental damage. Is necessary to remind that liability regime in the environmental situations are similarly with any other situation in the legal system. So, if the liable person in the negligence situation is proved that did not take the precaution measures the polluter has to pay the clean up cost or the compensation. In the situation of the strict liability in environmental issues the liable person or the firm in our example is necessary to pay for any compensation despite the measures it takes. The company has the full responsibility for the damage and obviously for the clean up cost. The main concept of the liability is included two targets. The fist one is the incentive to internalize the negative externalities, to reduce pollution and a trial to achieve the optimum social welfare or generally to operate the firms under an efficient economically speaking way. The second target is the compensation of polluter for any damages in the environment.

4.1.1. Risk, liability and Economics

Generally as was mentioned before there is try to create a liking between the liability regime rules and the economic affect which each of the liability form has as a consequences. As seen before there is the distinction between negligence and strict liability and obviously there are differences in the three types of costs mentioned before. Polluter and victim probably take both of them measures to protect the environment; the important in this situation is the final economic impacts. For example when the injurer pays for the protection then this kind of cost in the majority of situations is passed to the consumer or the injurer prefers to pay the prevention for example measure instead to pay the compensation.
The model, which creates the relationship between liability law and the economics, is necessary to take into consideration the types of accidents because the final target of it is to minimize the primary cost or the cost of accident. So the types of the accidents are the unilateral the bilateral and the multilateral. In the bilateral both victim and the injurer probably contribute to the accident so the economic analysis have examine the efficiency of care of both parties. In the unilateral the polluter has the responsibility of the accident and so the economic analysis is focused in the risk management. The main issue is the appropriate point where there is the minimization of the cost of the accident. Factors like the given activity level, the no administrative cost, the primary cost help us to define this level and identify the liability form. A study of an example, which provides the relation between the cost of prevention and the cost of accident, enables understanding of the linking both of them and with the type of liability.

4.1.2. Economic analysis

The economic analysis is based on neo-classical micro-economics and more specific to welfare economics. The core of it is the target of individuals to maximize their own welfare.

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4 The table below indicates the difference liability types and the cost of prevention-Accident cost actually there is a comparison for the two types of cost regarding the type of prevention and more specific the type of the liability form.

For example in the first situation there is the so call no liability where the cost of prevention is zero, if there is a probability of accident approximately 20% then the accident cost is 20 and the total cost is equals to 20. In the medium level prevention measures there is a cost in 3 points and the accident cost in 10 with the total cost 13. In the high prevention measures there are the stringent negligence Liability type where the cost for the prevention measures is approximately 6 and the expected accident cost is 8, so the total cost is 14. Finally in the absolute liability, which is the last one, the prevention cost is too high (14) so the probability for an accident is too low but in this situation the accident cost is 6 and the final cost is 20. Is important at this time to mention that the court has the responsibility to take into consideration the appropriate data in order to set the correct level of care in the negligence liability. This fact is a little bit dangerous and inefficient because the information could not be efficient in order to be set the correct level of prevention measures. The strict liability has similarities as in the situation of the polluter pay principle the main core for the environmental pollution issues. So the best method is the strict liability where with the prevention measures from both sides then the total cost is 13 and there existed the precaution activities from both sides. (De Smendt, 2007).
or general the individual utility. Economics support the main idea that individuals can maximize their utility and as a consequence there is that maximization of social welfare.

So in the situation that there is an environmental damage there is also the non-perfect operation of the market and there is a situation where the maximization of the social welfare is not exists. So the scope of the liability rules is to support the operation of the markets under legal and economic efficiency frame. Through the combination of the economic analysis and law there is a try to examine the response of the individuals to the changes in the law. In the first surveys regarding this relationship between the tort law and the change in the behavior of individuals there is the conclusion that the tort law leads to the reduction of the primary, secondary and tertiary costs. Primary costs are the costs of accident, which are the costs of taking precautions, and, the damage if an accident does happen. The secondary cost is existed for example in the insurances fees, actually is the cost to avoid an accident. The tertiary cost is the cost in the administration of the legal system. The sum of these three types of costs is the social accident cost, so this cost is reduced when there is the appropriate tort law.

According to economic theory effective environmental law creates incentives for producer or general for polluters to take measures to protect the environment and pay in order to take an advantage instead of paying for restoration measures. Generally speaking, tort law is a good incentive to reduce the negative effect in the environment or is a way to internalize the negative externality, which caused by the environmental damage. Modern liability statutes are based on the principle of “polluter pays” (De Smendt, 2007). It is valid that liability rules aim on the one hand at saving the principle of high level of environmental protection through the harmonization of the EU Member States liability regimes in order to protect the society from the negative externalities but this is from the economic point of view, there is also the legal part where is necessary the minimum level of protection in order to protect the citizens, so there is the trial to combine this two parts in one rule. To understand better this process is necessary to provide an example, if there is an oil split then the negative consequences in the victims and the non optimum level of the social welfare not only for the people who live there but generally.5

5 The whole process of the liability could also analyzed by the term race to bottom, which is according to De Smend “relaxation of state regulatory standards, caused by interstate competition to attract industry. This relaxation of regulatory standards would result in a reduction of social welfare below the social welfare level that would exist in absence of this race. If there is a risk that such destructive
4.1.3. Economic analysis approach in the cost benefit and the externalities

As already mentioned, the cost benefit analysis as a criterion in the final choice of a measure taken in order to restore environmental damage. This very common method is the basic line regarding the problem of value of loss in natural resources; this method actually is a process to understand the polluter the profits against the damage done and of course in monetary term (David Pearce, Giles Atkinson, Susana Mourato, 2006). Advantages/disadvantages and a generally criticism on this are through this survey which is very important as it demonstrates the policy, strategy and compensation regarding the damages on the environment. To be considered a disadvantage is the focus only on this method and not generally on the ways we can improve and cover a wide spectrum of assessment in the natural distortion.

4.1.4. Cost benefit analysis

“The essential theoretical foundations of CBA are: benefits are defined as increases in human wellbeing (utility) and costs are defined as reductions in human wellbeing. For a competition would arise, centralized standard setting might be advanced as a remedy to prevent states from engaging in this welfare-reducing race-to-the-bottom.” in the same survey there is a combination of games theory with the famous Prisoner’s Dilemma which refers to “a situation in which individual welfare maximizing behavior might lead to an outcome that is socially suboptimal, whereas with co-operation all parties would have been better off. A well-known illustration of the Prisoner's Dilemma is the example whereby two prisoners, who committed a crime, each face the same two choices. They can co-operate with each other and both deny any commitment in that crime or they can confess the crime. If both deny, they will get a light sentence. If both confess, they will get a sentence of medium severity, but if one prisoner confesses and the other did not, the one who confessed will be released, whereas the other prisoner will get a severe sentence. The prisoners will have to make their choice without knowing the other's choice. The result is that, although both would have been better off if they would have denied the crime, following individual self-interest, both will confess and get a medium sentence instead of a light one” (De Smendt, 2007).
project or policy to qualify on cost-benefit grounds, its social benefits must exceed its social costs. The geographical boundary for CBA is usually the nation but can readily be extended to wider limits. There are two basic aggregation rules. First, aggregating benefits across different social groups or nations involves summing willingness to pay for benefits, or willingness to accept compensation for losses (WTP, WTA respectively), regardless of the circumstances of the beneficiaries or losers. A second aggregation rule requires that higher weights be given to benefits and costs accruing to disadvantaged or low income groups” (Pearce, Atkinson, Mourato, 2006). In the cost benefit analysis it is necessary the inflation because the benefits and the costs could be higher than real is. Moreover, there is the discounting factor, which is mentioned, in previous paragraphs (4.3), in order to estimate the future benefit for example in the present time condition. Also the willingness to pay for environmental protection and the willingness to accept for the compensation for damages are also used commonly in this specific theory.

Generally, the economic theory deals with the costs and the benefits and are represented the fist category by the demand curve and the second by the supply curve. In the cost benefit analysis the demand curve is linked with the marginal benefit and the supply with the marginal cost. The combination of the two curves implies the market equilibrium, which shows the price and quantity traded. The environmental effects of this production have environmental impacts or with economic term the economic externalities. The externalities are analyzed below in order to understand not only the cost benefit analysis but also the economics of welfare, as the policy strategies, which implement measures, like the environmental taxes.

The net sum of WTP and the WTA for a project is the total economic value (TEV) and any change in this has as a consequence a change in the well being in the society. The TEV is separated in two main categories the use value which individuals give a price for the actual use of the good or to visit a specific area at the present time or at the future. Willingness to pay in order to maintain the goods aiming at having the ability to use in the future is the second category known as non-use value. This category is separated in three sub categories the existence value where the individuals express the WTP for a specific environmental good and his or her has no actual or planned use of this good neither to the present nor to the future, the altruistic value is the value for a good which is available for the current generation and the bequest value which is available for the future generation to use it.
The graph below illustrates the economic value and its categories.

![Total economic value diagram](image)

**Figure 1: Total economic value**

The use and the non use value there are methods to estimate this value, these are analytically below and for each category separately.

The first step, which follows in this process, is necessary to define the project or the policy which want to evaluate, what alternatives options are available and final the discounting of the benefits and the cost with final target the benefits to exceed to cost. Moreover the time choose is important because the individuals want to know when to have the benefit or when to suffer so as the time preferences is significant the discountiong process is necessary. Finally the risk known with the probabilities and the uncertainty with the form of the non-known probabilities has participate in the cost benefit analysis. There are various decision rules when comparing the cost benefit results, the primary and very common is the net present value. The accepted rule is the positive NPV and the rational behave is to rank the projects according to the NPV and if there are constraints then is used the benefit cost ratio.

The next step is the definition by the CBA the optimal scale of each option. According to this the marginal social benefit of the project must be equals to the marginal cost of the project. The meaning of the marginal is the little change when there is change in an other factor. For example in the cost benefit analysis the marginal benefit is the little change to the benefit of the society when there is a little change in the project, which is examined. This process is probably followed in the situation where a government wants to build a road of three or two lines, in order to define the changes in the environmental quality run the cost benefit analysis for finding the optimal scale of each option. This is the important point, the
examinations of different options and final to compare the options in order to find the optimal. There are also situations that the options could have the same costs, then there is the analysis of the net benefit and this is the criterion for the choose of the appropriate option, the higher the net benefit of an option the best choice it is.

The question in the whole process is which costs and benefits should be included in the analysis, in the majority of the situation there are included these of the national,, on any other situation these could included only in the situation where the project or the policy contain an international context where it is treaty of an important issue like the air quality. The other conditions where there is an ethical reason to include the internationals costs and benefits in the analysis a process, which is known as “standing”.\(^6\) At this point is worth to

\(^6\) From the mathematically perspective the level of the policy or of the project is given by the \(Q\) the \(Q\) could be the level of biochemical oxygen demand, the amount of the air pollution and any other parameter which is wanted to maximize in order to find the optimal solution. According to previous theory and taken into consideration the benefits and the costs based on the standing assuming .So the scope is to maximize the net benefits

\[
\max B(Q) - C(Q)
\]

\[
\frac{\partial B}{\partial Q} - \frac{\partial C}{\partial Q} = 0 \quad \text{or} \quad \frac{\partial B}{\partial Q} = \frac{\partial C}{\partial Q}
\]

The condition for this, is the marginal benefits equals to marginal cost usually is preferred to have the summary costs and benefits in the CBA in the present value and in order to do this it is necessary to discount the values with a constant discounting rate the formula is below:

\[
NPV = \frac{B_1 - C_1}{(1+s)} + \frac{B_2 - C_2}{(1+s)^2} + \ldots + \frac{B_r - C_r}{(1+s)^r}
\]

Alternatively could the benefits and the costs could be presented in the form of annuities. The annuity is a simply constant annual value which if summed after the discounting process then is produced the Net Present Value (NPV). the formula for the annuity is given below :

\[
NPV = A \left[ \frac{1 - \left( \frac{1}{1+s} \right)^T}{(1+s)} \right]
\]

in order to understand better the formulas take an example from the (AtkinsonMourato, Pearce,2006). According to this if there is an NPV=5% , \(T=30\) years and the sum of the present value is 120 constant annual sum is :

\[
A = \frac{(0.05)(120)}{1 - (1.05)^{-30}} = \frac{6}{0.7} = 7.8
\]

It is important to remember that tables give the calculation from annuity to NPV and the reverse process. Based on all the above the accepted criteria if the PV (B)>PV(C) or NPV>0.Previously is mentioned the benefit cost ratio. If someone wants to decide if a project is worth to be implemented according to this decision rule if the PV(B)/PV(C)>1 then the project is accepted or there is a good policy if choose this one with the highest benefit cost ration after the ranking of the results from different policies . One more usual way of decision is the internal rate of return (IRR), which helps us to decide which discounting rate to choose. This is one of the basic problems in the process of discounting, so a solution is to calculate the present values of the benefits and the costs and after this calculation to estimate the discounting rate, which gives us an NPV, equals to zero. This criterion helps the researcher to decide if the predetermined rate is appropriate and if there is wide distortion.
mention that the factor “human health” plays a vital role in the cost benefit analysis, as they are tight related. Is obvious that the environmental policies and projects affect the human health. So the cost benefit analysis are important in order to prove that with results like the marginal benefits to exceed the marginal costs. These kinds of policies reduce the risk for the human lives and as a consequence the humanity lives more. Moreover there is improvement in the lives of individual who suffer from diseases and finally these policies participate vitally to the reduction of the daily stress and so this has improvement in the mentality life. The environmental economists concentrate in the first and second field. The impressing is that in the majority of the situation where the cost benefit analysis has as core the human life the results are the exceed benefits from the cost, (relatively surveys like the Holland and Krewitt, 1996; AEA Technology, 1998a, 1998b; 1998c, 1999; Krewitt et al., 1999; IVM, NLUA and IIASA, 1997; Olsthoorn et al., 1999 and US EPA, 1997; 1999.)

So finally the cost benefit analysis is a process very important for the whole techniques of the evaluation of the value in natural resources. This could be used as a separate method to evaluate different policies and projects either if worth to undertake the project or to reject due to the fact that the existed disadvantage is too high. The major way to take the decision is the relationship between the benefit and the cost of a project or policy. If the benefits are exceed the cost then the policy is considered accepted and when the cost is higher than the benefit then it is rejected. An alternative way of chooses is the net benefits or the benefit cost ration and the ranking according to the NPV. Moreover the discounting rate in order to calculate the present value of the benefits and the costs is very important in order to compere them in the actual time. This economic way of thinking plays an important role in the decision due to the fact that is based in the welfare economics and the benefits of the society according to the policy, which is chosen.

4.1.5. Theory of externalities (assessment of environmental activities)

Externalities are said to exist if any activity of an economic agent impose positive or negative effect on the welfare of any other agent or groups of agent and when economic agents neither receive nor pay compensation equal to the cost inflicted or the benefits conferred upon them. The presence of an externality introduces distortion in economic decision and its correction requires government intervention either through taxation or through regulation” (Subhes C. Bhattacharayya, 2011). The real cost is mostly not included in
the schedule of a firm, these kind of costs create a distortion in the picture of reality; in order to improve this picture an internalization of these externalities which are the not included in prices cost is necessary. For example, air pollution has as a consequence health problems or the damage of the environment. According to the theories of the externality the cost of the society due to the pollution has to impose in the price where the product is sell or in the tax which producer has to pay due to the polluter pay principle.

The introduction of liability regime set as target to prevent environmental pollution and to avoid to estimate the value of the damaged resources but in the situation that this accident is existed then is necessary to have a value in order to influence the compensation. In the situation where the value of a resources is not specific then the analysis it is consider to be equal to zero because it does not affect the decision of the consumer regarding a product related to this pollution. So that is a reason to develop techniques in order to estimate the values of use and non-use goods to create an efficient economic policy. The graph below illustrates that the curve of the supply is the S and the demand curve is the D, the two curves determine the market equilibrium e with price P1 and Quantity Q1. If there is an activity or a production process where has as a consequence environmental externalities, in order to have an efficient economic policy the cost of the externalities has to be internalized in the price. If this happens the supply curve S’ is higher than in previous situation which illustrates higher costs due to the consuming of the product which is related to the negative externalities. In the S curve private costs like labor, capital and raw material, in the S’ curve private costs and external costs are included.

The market equilibrium e in the first situation is created by the demand and supply curve, in the second situation due to the fact that the supply curve rises because the external cost the equilibrium point are changed which illustrates that social optimum as external cost is included in the price. In other words, if a consumer buys a car he or she pays higher price in the second situation due to the fact that pays the pollution in the environment.
4.2. **Assessing Natural Resource Damages**

Due to the importance of the necessity to assess damages and the economic analysis which is related with the environmental resources there is “Natural Resources Damage”, which is used in the litigation experience in the USA in order to estimate the damages and the collapse of biodiversity balance. So in this methodology there are three main steps the first one is the Damage Assessment and Significance, the second one is the Primary restoration options and the third one is the Compensatory restoration options (Blatch, 2004).

4.2.1. **Estimating the value of damage**

The main problem is the choice of methods in order to estimate the value of the damaged environment as non-good market good, the goods that do not have price in the markets and so in the situation of the damages is difficult to estimate the lost value. In the release of survey in 1998 from the “Environmental department, the World Bank” there is an approach in the value of environmental damages to analyze the total economic value from the use and non use value promises a great success because there is a wide spectrum of survey regarding the value of damages. More analytically, these are in the main body of this
dissertation, which will be presented below the methods to estimate the value either of market or the non-market natural resources, which are related with the estimating, lost value.

So in the first step there is the definition of the status of the resources before the damage, the assessment of the scale of damage, the impact of assessment and finally determining if the damage is significant. When there is the baseline condition it is in terms of quantity or in the start type, which be the resources, but a very important point are the services, provided by these resources. Is worthy mentioning that “service” in linked with the use made by the resources, the ecological function and economic analysis, which is to be analyzed in next topic. A person is liable when it is financially and legally responsible for something so the liability system is necessary to follow up three main criteria the first is the allocation and the scope of the liability, the second is the kind of restoration and the third is the goals of the remediation. If someone asks to determine exactly the term of services is quite difficult to give a clear and very specific definition due to the fact that natural resources are not exactly identified if there is not mention to the benefits, which are enjoyed by the population. In this meaning are included the tourist traffic or issues with non-value price like the view of this specific geographical area.

The Assessment of scale of damage is the identification and the quantification of the damage from the perspective of the Geographical scale of the damage, in the species-habits and in time being this damage. The impact assessment on the other side is the identification and the quantification of impact from the damages, more specific is the affect of the environmental damages to the species or there is an assessment if this damage is temporary or permanent. This process is very important because helps to the restoration options and in economic analysis. Also a very important part is the characteristic of “significance” for an environmental damage and this is according to the significance threshold, which is set by the EU Directive, as more important is the damage, then is more important to choose an efficient method to restore the environment to the status quo level. When is needed to choose a restoration measure and there are more than one option, is chosen this one with the least cost because the final target is to find a method to reduce or decrease the contamination at least cost based on the cost benefit analysis (Kokkot, 2003).
4.2.2. Ways to estimate the environmental damages

In this sector will be analyzed the valuation techniques of environmental damages. The Natural Resources Damage Assessment is the core of the environmental analysis. There are steps which have to be followed in order to evaluate the damage and finally to choose the best restoration measures. But these steps are implemented in different techniques, which are existed. Nevertheless there are techniques for the Environmental Assessment in the Economic Analysis field due to the fact that contributes to the monetary compensation. According to Ulibarri and Wellman (1997) the evaluation techniques for the environmental damages are separated in five basic categories. The Market based techniques which are related to historical data and generally in the market price of a good, the Non market techniques which use the indirect method of estimating the value of resources, the Non market techniques which is used the direct value estimating, the cross cutting valuation techniques were are used characteristics of different methods and finally the ecological valuation techniques from the perspective of Ecological economics. A critical supervision on these techniques lead to the conclusion that non-market valuation techniques are preferred only in the situation that there are not possible to be implemented the market evaluation technique.

The market valuation techniques are easy to be implemented due to the fact that is known the market price, so the compensation is being calculated with a practical way. For example if there is an acre with rice which is contaminated by oil split then the amount of rice which are affected by this accident is approximately the price which the liable person have to compensate. But in the situation where there is not a price for the rice then the willingness of people to pay for the estimating value based in a wide category of methods, which estimate it.

4.2.3. Evaluation Techniques

In this category the market price approach the appraisal method and the resources replacement cost are analyzed. The main characteristic for these methods is the demand curve with the condition that other factors like the income and preferences of individual and the related good price are unchanged. So this curve provides us the price for the good.
4.2.3.1. Market based techniques

4.2.3.1.1. Market price approach

Firstly in the market price approach let’s assume that there is a land area which demand is illustrated in the figure 3. According to this if a buyer want to buy 20000 acres then is needed to pay 1500$. So the total monetary amount for this area is 30.0$ which is the area A. Area B is the consumer surplus, which is the area which expresses the satisfaction of the consumer when buy a product. Is obvious that this part is low when there is an increasing price and high when the prices are in low level.

So areas A and B are the willingness to pay for this good or the value of the resources in term of WTP. If subtracted from this total area the A then the satisfaction received by the consumers is given. The pollution for example could creates a distortion in the market as it decreases the production of a good, the consequence is the increasing prices for this specific good and finally the decreasing of the benefits with this method can be calculated the price of
a market good, the willingness to pay for this good and the satisfaction of consumer in each actual price (Ulibarri, Wellman, 1997/De Smendt, 2007)

4.2.3.1.2. Appraisal method

According to the Appraisal Method the appraiser defines a fair price for an environmental good either in condition of injury or not injury form. The fair price is the price, which is paid by the buyer in order to obtain a good from the seller. The deputation who estimates the fair price takes into consideration data like transactions in the past for a specific period. For example, there is different fair price for a land for individual use or for commercial and agriculture uses.

4.2.3.1.3. Resource replacement cost

Resources replacement cost is the cost, which results from restoring, rehabilitating or replacing natural resources. The resources without price could be estimated except of the Contingent evaluation by the replacement cost to restore the damage. Moreover this value is used in the continue as a compensation for the environmental accident. Additionally the replacement cost is only estimated and not implemented in order to set the resources to the baseline.

The previous methods are based on the idea of the damaged cost avoided and estimate the value according to the lost services and the cost or replacing or subsidies natural resources. The meaning of the avoiding damaged cost is the willingness of the individual to pay in order to avoid the cost of the remediation a natural resource after a significant contamination. So probably this could be an insurance, which the society pays per month in order to, protect a specific area. There is not intense the characteristic of Willingness to Pay from the individuals, instead is assumed that the cost of replacing is the cost to set the environmental resources to the initial status or the cost to set the provided environmental services to the start point. This evaluation procedure could be about the measures to improve the water quality with controlling projects, the value of protection actions for the forests. The value of the storm protection actions by measure the cost that arises form the building protected projects.
For example if the authorities want to protect the society from the flooding then the cost based methods are used in order to calculate the benefits from the improving of the natural defense in a city. The first step is to calculate the cost of establish the protection measures and the cost for the full restoration of the damage. The second step is the calculation of the replacement cost or the avoidance cost in the next two situations the first one when there are not prevention measures by the individuals for the flooding and the second if they had taken this kind of measures before the flooding. Moreover at this step is necessary to set the appropriate cost method in order to set the benefits from its implementation. The advantages of these methods are the ability to estimate the cost in order to have benefit comparing with the cost of the restoration, replacement or rehabilitation.

4.2.3.2. Indirect Non-market valuation methods

There are situations where there is not the ability to collect this kind of data and give finally a price or generally a value to natural resources. One main category of non market evaluation methods is the indirect evaluation techniques which based in the personal opinion of individuals regarding how they estimate the value of a natural resource. The methods are related on this category are the travel cost method, the random utility method, the hedonic pricing method and the factor income method.

4.2.3.2.1. Travel Cost Method

The travel cost method is used to estimate the economic use value associated with ecosystems or sites; more specifically, it is used to estimate the monetary benefits and the cost under consideration of the changes in the access cost of the recreational site, the elimination of an existing recreational site, the addition of a new recreational site and the changes in environmental quality at recreational sites (contingent evaluation methods). As main application field can be considered ecological parks or fishing places. Generally when an individual is willing to pay to visit a specific site (which can be estimated based on the number of trips that they make at different travel costs), then this amount is the value for the specific characteristics of the site used, for instance, for recreation. This is analogous to estimating peoples’ willingness to pay for a marketed good based on the quantity demanded.
at different prices. For example the total cost of travelling to a park (like tolls, fuels etc.) is the money people are willing to pay in order to visit this area, so the time and the travel cost expenses represent the price of access to the site.

The main advantages of this method are quickness and easiness by collecting data. The disadvantage is the difficulty when there is no observable behavior and the consequence is the lack of data collection. For example local authorities use the travel cost method in case of an area where living special species and with high ecological value in which, so due to the development of a new industry in a nearby area, the protected species have high possibility to be contaminated in order to attain knowledge about the value of the recreational site area and to give advise regarding the protected measures. This kind of technique is used because the site is primary valuable to people as recreational site and the second reason is the low cost of the project to protect this site and so the inexpensive method of the travel cost is the appropriate in this situation. At this point is necessary to mention that a variety of other methods could also used in order to estimate the value and specific with high precise estimate for specific characteristics and with estimation of the non-use value but this method is not expensive and not complicated.

4.2.3.2.2. Zonal travel cost approach

Under this method of application the cost is low and moreover this method is very simple as estimate the value for the recreational services. The simple idea of this method is to collect data from different distance taking into consideration the factors of the distance ant the time and so the cost, which is depended on the previous factors. The researcher in order to make the demand function for the site and estimate the consumer surplus uses these data. In other words the consumer surplus is the “satisfaction” which the individual receive when use or consume a product. So the first step is to set zones surrounding the area, it take place with separate the geographical areas surrounding the recreational area and is implements by circles around the site or categories the metropolitan areas or countries around the site. The second step is to collect data from visitors of each area and the number of visits from the last year, the third step is to create a rate per 1000 population in each zone and this is estimated if the visits in this area is divided by the population of the zone. The fourth step is the estimation of the travel cost per trip, for this this calculation is necessary the average cost per mile and per
hour for the travel and finally there are results like the calculating cost of .15$/minute. The fifth step is the calculation of the regression analysis, is the equation which combine the visits per capita with the travel cost and more variables which are important in our models. These kinds of variables could be the age, the income or the education level. The sixth step is the estimation of the demand function for visits to the site taking into consideration the results from the regression analysis there are two basic calculations in this step the first one is the visitors in specific travel cost and the second is the visitors with different entry fees in the site. The last step is the estimation of the economic benefit with the calculation of the consumer surplus, with the calculation of the area under the demand curve. The results are used by the authorities in order to decide if have to take measures to protect the area or to find other solution in order to make it worthwhile. This decision is based on the relation between the cost of the protection project and the economic benefit from the site. If the cost is less than the benefit then is worth to take this precaution measure but in the situation where the cost is more than the consumer surplus then the authorities have to find solution in order to increase the value of the area before taking any protecting measure.

4.2.3.2.3. Individual travel approach

The main difference from the previous approach is the use of data based on individuals and not to zone areas. Is so logical that in this technique the process is more complicated and need more advance statistical tools in order to have a precise result. The possible questions for this survey are the location of the visitors home and how far the visitors travel in order to visit this area, how many times they visit the area, the length of the trip, the time to spend for this trip, the expenditures regarding this travel, the income of the visitors, other substitute sites which individuals visit. Except for these questions there are other like the amount of fishes caught, the reasons of the trip, any other location which the individual visit during the trip for the site and other socioeconomic characteristics. The process after these questions is similarly to the zone approach. The researcher use data collected from individuals and proceeds to the regression analysis in order to find the relation between the visits, travel cost and other variables.
4.2.3.2.4. Random utility

When there are a variety of options like to restore an area or to create a new one with the same level of quality and quantity the random utility model is a useful tool. As method is more complicated than other approaches. but is also the best solution when there is the need to find the benefits for the creation or not of a substitute area. In the example, which is mentioned before, we use this approach in order to find the economic losses when there is decreasing in the population of the fishes in the recreational area. So the researcher in this process ask questions if the individual go for fishing, how many times they go, the fishes which caught and the rate of them. If via the questions the researcher is understand that the visit of the area is related with the quality, then is estimated the economic benefit as mentioned. For example questions like the expecting traveling rate in a substitute lake lead the researcher to decide which is more worthy, the recreation or the substitute solution.

4.2.3.2.5. Hedonic assessment amenity

The Hedonic Pricing Model is used to estimate economic values for ecosystems and environmental services, which directly affect the market prices, again as in previous methods it, can calculate the economic benefits or the cost which is associated with the environmental quality and the amenity. For example in the sale of a house the nice view or the clear quality of air have different price and this is added to the final amount, which has to pay the buyer. On the other hand the injury of these specific impacts has as a consequence higher compensation. So there is not only the restoration cost also the lack of amenity, which a polluter has to pay, of course, that hedonic price is available only in the situation that there are data from real estate or municipal sectors.

Until now the Hedonic Assessment price is related with the amenity, there is also a linking with the economic issues which can meet in the rise of health or safety risk problems, the so called Hedonic price of life. In other words is the secret value from an injury like the health damage from the leakage of oil in the sea. There is no only the restoration cost or the cost to replace the area and the species but is also the cost for the health problems and different disabilities in the residents in the injured area. The hedonic price is distinguished in
the insurance value and in the deterrence value. The insurance level is the amount of money that an individual is willingness to pay in order to be protected from a specific risk. The deterrence value is the amount, which is paid in the situation of pollution; always this price is higher than the price of insurance due to the fact that it includes the consequences of the risk.

The first step of this method is the collection of data related to the price of residential goods like the price, which is, sell the houses. The specific characteristics like the number of the rooms and the size of the house, characteristics, which demonstrate the price of the goods, like the quality of the school in the area, the criminal indicator and different types of taxes. Finally the environmental quality and the distance to work or to the shopping centers the so called accessibility characteristics could also be collected in order to start design this process. These kinds of data are available from municipal offices, multiple listing services, and other sources or kind of lists. The second step is according to the statistical tool to create a function with relation between the property value and the different characteristics and the result is a function, which estimates the portion of property price, which is affected by different factors. There is an amount of change of the one variable regarding the change of the other or in an example there is the change of the house prices regarding the change of the air quality or the building of an industry.

So the prices will reflect the price of each characteristic, this is a way to calculate the economic value and the benefit from a natural resource. The most precise use of the method is the comparison between the prices of houses which has same characteristics like the room of bathrooms, bedroom etc and finally if there are all the factors except of the environment at the same level of price, the difference in the prices could reflect the value of the environment. This is the reason why markets goods are participate in the estimation of the value of non-market goods and more specific to the estimation of the natural resources value.

The concentration of this method to the relation between the environment and the house prices is a disadvantage, moreover the individuals have to take into consideration to give a price to the houses according to the environment differences between the areas and not take into consideration other criteria because this thinking is caused a price distortion and so the result is not precise to the evaluation method. Final there are factors like taxes, interest rates etc which affect the house prices, so the condition which is written above that all factors is necessary to stay unchanged could not be existed .The data and the accessibility is important to efficient as the design model for the correlation of the factor, in any other
situation it has as a consequence a result which not illustrates the real value of the environment.

4.2.3.2.6. The factor income method

One more non-market method is the factor income. In this the main idea is that the resources are used in order to produce other services or goods: water, forests, enjoyment in nature (for example in area for fishing). The reason is that these factors could be used as inputs to assess processes of industrial production like on the agriculture. For example if a producer uses water to produce a good, he has the obligation to clean the water, which is contaminated. If an accident occurs during this process and the water is getting dirtier, then the cost of treatment is increased. So this amount of water income factor is lost from the production process, in order to estimate the value of it the treatment cost per unit is the indicator, which provides us an icon of this value.

4.2.3.3. Direct non-market evaluation methods (Contingent Valuation)

Despite the use of the previous methods there are also the direct non-market evaluation methods, the so-called contingent valuation methods and usually are used to estimate the monetary value of the resources for all kind of ecosystems and Eco services. The central concept on this method is the willingness to pay of people regarding the resources or the amount that they want to pay for the protection of the resources or generally for the protection of the benefits received from the environment. Except for the amount of money that they are willing to pay for a natural resource there are also questions about the amount of money that individuals want as compensation in the situation of damage, so there is not the price from the markets but the intention to pay for the resources. The main difference between direct and indirect methods is the fact the in the second one there is the observing behavior related to natural resources. So the CV method based on the intention of individuals to pay according to a questionnaire and provide a value almost for any kind of resource via phone, email or face to face interview. Is actually the opposite process from observing the actual behavior of the individuals. By applying these methods questions are asked as the amount of money, which have to pay, by individuals for the resources in different form like
entry fees or taxes. The “how much” or “make a ranking of alternatives” are very common questions which are in this kind of questionnaire. The importance of this method is based on the fact that could provide an economic value to the non-market goods as well as to market goods. The significance lies in the participation in the evaluation process of the non-use value. For example, if there is an area for protected species and wildlife and authorities have to issue an operation license for mining at this site, the contingent evaluation process and especially the individuals asked the questionnaire have to weight the two choices and give the price to the non-use good of this area. There are other non-market techniques but at this specific example the significance level is higher and other techniques could underestimate the value. Answering such questions is not easy because the license to the mining supports the offset of the unemployment and if the value of the protected species is higher then probably the authorities cancel the license.

So the first step in the direct non-market evaluation method is to define the valuation problem, this is meaning that have to specify which services are evaluated and which population have to participate to the survey. For example in the situation that there is a public area the population, which could participate, is all the citizen of the country. The second step is the decision regarding the question which be asked, the way of the survey like emails, personal interview or phone. The answer to all of these depending on the important of the situation and how complexity it is. For example the personal interview questions is more effective than other methods because it is easy to explain the questions and help the individuals who participate in this method to answer a valid answer, additionally the photographs and more materials could be a helpful fact to the whole process. The disadvantage of the personal contact is the increasing cost of this method, the telephone and the emails is not so costly but the explanation of the question is difficult and so there is high probability to have an invalid value to the survey. The third step is the survey design, which it is a long-term process, which takes six months or more to be completed, starting with interviews about general issues like the opinion about the problem and personal elements the groups that take place in this survey. For the problem which mentioned before is asked to answer questions about the area, the knowledge of the mining and general questions in order to understand the researcher if the target group have the appropriate knowledge and if there is not to help them to have access to more information. In later the group is asked question more specific for the problem and with more details, at this point the researcher provide information which help the group and not to create distortion in the thoughts which have
regarding the problem. For example these information could be the distance of the area, the characteristics of the site and the important of the species and also the characteristics of the mining and the negative-positive of the operation of it. The number of groups is necessary to have variation in order to satisfy the discriminatory.

After these questions the researcher know where to provide more information and what kind. So this is the time of the valuation question and at the start the asked to answer in the email form in order to understand the differences of the way, which answer the individuals regarding the personal interview. The group sets the answers to the researcher in order to have the value of the service. The four step is to select the sample of the survey is the statistical tools and the same process is in the situation of the telephone and mail methods. The fifth step is the analysis and the report of the results again with the help of the statistics, if during the survey the value of the site is $10 per capita and the population is 260 then the total value is $2600 with the given amount of the individuals.

4.2.3.3.1. Cross cutting resource

Aaccording to the so called cross cutting methods, there is an estimation of the value of resources based on the market data and pre-exist value of resources either from direct or from non indirect methods. The most known are the benefit transfer and the unit day value.

4.2.3.3.2. Benefit transfer

During the estimation of the non-existed value there are difference criteria, which have to take into consideration in order to have a reliable result. These are:
The purpose of original value estimates
The user group(s) considered
The nature of substitutes in the initial study area
The geographic area
The demographic and socio-economic characteristics
The baseline conditions
The specific or unique problem that may be influenced by
The magnitude of the estimates
The general attitudes, perceptions, or levels of knowledge
And the omitted variables described above

4.2.3.3. Unit day value

A similar method is the unit day value method, which has very common characteristics with the benefit transfer method. The difference is that in this process the value based on multiple different values from existing surveys has to be estimated. For example if there are a lot of surveys which estimate the value for a specific resource then the researcher which uses the unit day method combines these estimated values in order to have a final variable value for the resource.

4.2.3.4. Ecological value

Except of the methods, which was described before and based on the monetary value of resources, there are also methods in order to provide an ecological value of resources. All previously mentioned methods mainly argue with the ecological function of the resources, anyway. There are two basic information to taking into consideration the opinion of individuals what about consider as eco-good and what has its intrinsic value to the ecosystem. So, it is crucial that the ecological function is related to the total value of the goods and services

Figure 4: Selection of valuation techniques and total economic value

Taken from: The World Bank, Environment Department, Economic Analysis and Environmental Assessment, in Environmental Assessment, Sourcebook, Update 23 (1998), p. 3
4.3. Which option is to be chosen

It has been already pointed out that there is a variety of solutions to assess ecological damage for restoring it. When it is to select among them, this would be based on two criteria. The first one is the size of the damage as also the importance of the damage and the second is the Cost Effectiveness Analysis, which is actually a comparison of a present value of choices. When, for example, there is an important environmental injury obviously there is a specific way to evaluate the damage and there are not all the methods appropriate. Present value “is the value on a given date of a payment or series of payments made at other times’’. So if these payments are in the future they are discounted to a specific point of time with the appropriate discounting rate. Generally is the tool to compare the casflows from different times in a specific time. Discounting means “the process of determining of the present value from different time cash flows”, discounting rate is the interest rate used in discounted cash flow analysis to determine the present value of future cash flows. The discount rate takes into account the time value of money (the idea that money available now is worth more than the same amount of money available in the future because it could be earning interest) and the risk or uncertainty of the anticipated future cash flows (which might be less than expected).

The formula of the present value is given below (Smart, 2008):

\[ PV = \frac{C_1}{(1+r)^n} \]

\( C_1 \) - Cash flow at period 1
\( r \) - discounting rate
\( n \) - number of periods

In order to choose which cost is feasible or where is the benchmark to accept or not a cost for a specific restoration measure it is important to demonstrate a benefit limit which is equal to the benchmark. The more good quality or the more efficient the service provided by the resources the more is the benefit from the restoration measures. There are more methods developed to calculate the economic value of environmental damages, resource-to-resource, service-to-service, value-to-value, and value-to-cost are the main that are used to support this
survey. This is a non-conventional and common method. For example, SIMAP program (Spill Impact Model Application Package) is used to estimate the injuries of spill oil in the fish in water. Similarly the REA analyses are applied to determine the quantities restoration for bird injuries. Moreover methods to estimate the injury in species are common in use throughout this survey. These are methods difficult to apply due to the huge amount of information. On the other hand methods like the “cost-benefit analysis” and the “contingent valuation” are widely in use but there are some disadvantages, which will be analyzed below. All these methods due to the fact that are related with the remediation measures in the European Liability 2004/35 are analyzed in the §3.4.5.

4.4. The way to use the appropriate method

In order to understand better the methods which were analyzed before there is the figure 5, which clarifies the way in order to use correctly the each method depending on the situation. The first and the main step is to decide if there is a change in the production or in the environmental quality from the damage, in the first situation is necessary to find if there are the market prices. If there are data for this, then is used the method of change in productivity output, if there are not data then is used method like the surrogate method approach. When there is not a change in the production output and there is only change in the environmental quality then is necessary to categorize this changing for example in the habitat, in the air quality and in aesthetic or biodiversity.

The changes in the production can be estimated with methods like the opportunity cost, replacement cost approach, land value approach and finally with the contingent valuation. The changes in the air quality are estimated with the cost effectiveness prevention, with the preventive expenditures and with the replacement or with the restoration cost approach. In this point is worth mentioned that the change in the air quality probably lead to health effects where is necessary to use the loss of earnings and the medical cost when there is sickness and are used the prevention measures and the human capital when there is death. When there is situation which is necessary to implemented restoration measures then are used the travel cost method and the contingent evaluation and finally when there is distortion in the
aesthetic part or in the biodiversity then is used the contingent evaluation method (Ulibarri, Wellman, 1997)

In the previous process find as a solution to calculate the value except from the main and basic methods like the contingent evaluation or like the travel cost, more techniques like the opportunity cost. There is in some cases the need to protect a specific resources, the opportunity cost is the lost of economic opportunities due to the cost for the protection of this kind of resource. It is a way to calculate the cost of the environmental protection in the perspective of the development and benefits

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Figure 5: Choice of Valuation Technique
5. Normative decisions regarding evaluation techniques in the liability regimes of the USA and EU

5.1. The USA system on the example of OPA and CERCLA

By the decision of the State Of Ohio v. Department of interior (880F.2d 432,DC 1989) restoration measures have been primarily recognised as basis for the assessment of any environmental damage. At the same time contingent evaluation methods have been held admissible (Kopp & Pease, 1997). According to the methods of the evaluation the next step is to set the profile of each of the liability and environmental law either in the USA or in European Union. The concept of OPA is focused in the damages to real or in the personal property with different forms in the Ecological losses or in the health injury. OPA measures the natural resource damages under the section 2702 (b) 2 A: “The cost of restoring, rehabilitating, replacing or acquiring the equivalent of the damages natural resources, the diminution of value of those restoring resources and the reasonable cost of assessing the damage, the main idea in the compensation is based on payments in order to restore the natural resources as also other cost relating to this resources”. So all the previous mentioned methods are used in the OPA only in the compensation, which are related to the damage of resources.

The measure has the priority to restore the environment in the baseline also to decrease the interim losses from the time of the accident to the full recovery. The USA system uses the government trustee to recover or to set different alternatives options for the restoring of the environment but all the options has two dimensions the first one is the primary restoration which is the physical restoration of the resources and the second one is the compensatory restoration for interim losses. The main characteristic is the reducing emphasis in the measuring process of the monetary value of the resources; on contrary there is increasing interest in the

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7 “If the resource was not traded in a market, the proposed rule directed the trustees to use the appraisal method. If the trustees could do neither, they could use nonmarket methodologies such as travel costs, hedonic pricing, unit value, factor income, and CV. Interior recognized CV as a method to survey direct use values but restricted its application in other areas by stating that CV can only be used “to estimate option and existence values ... if the authorized official determines that no other valuation technique will foe feasible”.
cost of restoring (Brans, 2001). So, the OPA is based on non-market methods to estimate the lost value and taking into consideration the compensatory restoration measures.

The CERCLA is the second important law that introduces a specific liability regime for the environment, so according to the Resource Damage Assessment the process of value evaluation has as target to determine the use and the non-use value of the resources with emphasis in the monetary idea. There is not priority in the restoration but in the compensation for the damage. Probably in the end if there is any obligation for compensation to the polluter it is regarding the restoration in the contaminating area, so the final result could be the same as in the OPA which set as priority the restoration measures. The focus is in measuring capability of the impaired resource concerned to regenerate and in the intensity of impairment. (Section 11.61 CERCLA). The CERCLA sets firstly the evaluation methods of CV, travel cost, hedonic price, Market price without setting any kind of priority to these methods. More specifically, it defines economic assessment methods for monetary compensation (in the Damage Determination Phase) to estimate the use and non-use natural resources value which is the compensable value (section 11.13 (e) (3), 11.80 CERCLA-NRDA)\(^8\)

According to this law “The purpose of the Damage Determination phase is to establish the amount of money to be sought in compensation for injuries to natural resources resulting from a discharge of oil or release of a hazardous substance. The measure of damages is the cost of (i) restoration or rehabilitation of the injured natural resources to a condition where they can provide the level of services available at baseline, or (ii) the replacement and/or acquisition of equivalent natural resources capable of providing such services. Damages may also include, at the discretion of the authorized official, the compensable value of all or a portion of the services lost to the public for the time period from the discharge or release until

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\(^8\) (e) Type B assessments. Subpart E of this part covers the assessments provided for in section 301(c)(2)(B) of CERCLA. The process for implementing type B assessments has been divided into the following three phases.

(3) Damage Determination phase. The purpose of this phase is to establish the appropriate compensation expressed as a dollar amount for the injuries established in the Injury Determination phase and measured in the Quantification phase. The sections of subpart E of this part comprising the Damage Determination phase include guidance on acceptable cost estimating and valuation methodologies for determining compensation based on the costs of restoration, rehabilitation, replacement, and/or acquisition of equivalent resources, plus, at the discretion of the authorized official, compensable value, as defined in § 11.83(c) of this part.
the attainment of the restoration, rehabilitation, replacement, and/or acquisition of equivalent of baseline” (section 11.80 (a), (b)).

5.2. Differences in the interim losses

Except for differences regarding the methods in the evaluation, in the restoration and in compensation priority respectively OPA and CERCLA there is also a different approach in the interim losses. According CERCLA a monetary assessment for the compensable value is provided as well as a utilization of restoration measures. There are not standards to implement and to choose the methods but a priority in the monetary assessment, the cost efficiency analysis of these methods. Additionally, Contingent Valuation is used for measuring non-use values if there is no impairment of use values (section 11.83)\(^9\). So the recovery of the interim losses is in terms of estimating value and imposing compensation for the damage by the public trustee. In the OPA concept the compensation restoration has a non-monetary terming, the liable person has to restore the damage in the environment and through this to offset the interim losses (Penn, 2001).

The next comparing topic is in the economic analysis. CERCLA does not reduce the cost of restoration; moreover the fact that in some situation there is dispute about the implementation of the assessment methods leads to inefficiencies in system. This gap is covered by OPA because there is a compensatory measure to restore the damage and this is accepted which can lead to avoidance of disputes, in other words, to efficiency of the whole damage valuation system. The problem in the CERCLA is based on the fact that the monetary

\(^9\) 2.(i) The authorized official shall select among the cost estimating and valuation methodologies set forth in this section, or methodologies that meet the acceptance criterion of either paragraph (b)(3) or (c)(3) of this section.(ii) The authorized official shall define the objectives to be achieved by the application of the methodologies.(iii) The authorized official shall follow the guidance provided in this section for choosing among the methodologies that will be used in the Damage Determination phase.(iv) The authorized official shall describe his selection of methodologies and objectives in the Restoration and Compensation Determination Plan.

3 Cost estimating methodologies. The authorized official may choose among the cost estimating methodologies listed in this section or may choose other methodologies that meet the acceptance criterion in paragraph (b)(3) of this section. Nothing in this section precludes the use of a combination of cost estimating methodologies so long as the authorized official does not double count or uses techniques that allow any double counting to be estimated and eliminated in the final damage calculation.
compensation estimated, is different compared with the actual monetary value of the restoration process, so that these two different categories lead usually to dispute between the pollutant and the private part which claim the compensation (Carson, 1999). The fact that the OPA does primarily cover the use value of the resources can be considered economically inefficient because the valuation procedure can be more easily accepted (Flores, 2000).

5.3. European Liability regime

In the directive 2004/35 there are methods of monetary assessment for determining the value of impaired resources mentioned merely in order to determine compensatory restoration measures. The preconditions are defined in Annex II 1.2.3 “If it is not possible to use the first choice resource-to-resource or service-to-service equivalence approaches, then alternative valuation techniques shall be used. The competent authority may prescribe the method, for example monetary valuation, to determine the extent of the necessary complementary and compensatory remedial measures. If valuation of the lost resources and/or services is practicable, but valuation of the replacement natural resources and/or services cannot be performed within a reasonable time-frame or at a reasonable cost, then the competent authority may choose remedial measures whose cost is equivalent to the estimated monetary value of the lost natural resources and/or services”.

An economic approach is also recognisable Article 2,Nr 16 which states that “costs means costs which are justified by the need to ensure the proper and effective implementation of this Directive including the costs of assessing environmental damage, an imminent threat of such damage, alternatives for action as well as the administrative, legal, and enforcement costs, the costs of data collection and other general costs, monitoring and supervision costs” (Directive, 2004/35). Directive 2004/35 has similarities with the OPA, which is more evident in case of irreversibly damaged environmental resources, where there is no direct restitution of a damage (indemnification) provided for but restitution of equivalent environments. A monetary valuation of damaged (lost) resources is possible if assessment on losses and functions is feasible but an assessment of the surrogate(s) of the resource does not seem proportionate. The European Directive states in Annex II 1.1.2 “when the damaged natural resources and/or services do not return to their baseline condition, then complementary remediation will be undertaken. The purpose of complementary remediation
is to provide a similar level of natural resources and/or services, including, as appropriate, at an alternative site, as would have been provided if the damaged site had been returned to its baseline condition. Where possible and appropriate the alternative site should be geographically linked to the damaged site, taking into account the interests of the affected population.” On the other hand “Compensatory remediation shall be undertaken to compensate for the interim loss of natural resources and services pending recovery. This compensation consists of additional improvements to protected natural habitats and species or water at either the damaged site or at an alternative site. It does not consist of financial compensation to members of the public” (Annex II 1.1.3).

5.4. A general comparison between the USA and EU system

Directive 2004/35 has differences with the USA system. In the perspective of the Directive the remediation standards are different between water, species or natural habitats and land damages, because in case of land damage there must be reference to significant risk affecting the human health. These differences are not in the US system, where all three types of natural resources are treated in the same way.

In Annex II, section 1 ‘remedying of environmental damage, in relation to water or protected species or natural habitats, is achieved through the restoration of the environment to its baseline condition by way of primary, complementary and compensatory remediation’. The definition of the primary remediation measures according to the section 1(a) is “any remedial measure, which returns the damaged natural resources and/or impaired services to, or towards, baseline condition”. This situation creates the differences because in order to have the whole picture of the baseline condition is necessary the sufficient information data. OPA sets as priority the existence of significant information data collection or set a process to obtain them at least cost; if these are not satisfied then the restoration measure is not implemented. Section 1(b) identifies the complementary measures as “any remedial measure taken in relation to natural resources and/or services to compensate for the fact that primary remediation does not result in fully restoring the damaged natural resources and/or services”. The directive sets this terminology as a separate category of remedial action, while the OPA is not introduces this kind of differentiation. Finally, section Section 1(c) defines compensatory remediation as, “any action taken to compensate for interim losses of natural resources and/or services that occur
from the date of damage occurring until primary remediation has achieved its full effect”. Interim losses could exist after the primary and complementary remediation measures. This has as a great advantage to cover almost completely the damage in the environment but a precondition is that existence of experts in order to define the best compensatory remediation measures at least cost and with the appropriate knowledge in order to assess exactly the interim losses has to be ensured. A lack of this has as a consequence inefficiencies in liability.

As was mentioned before, there are values not only for natural resources which has price in the market but also in situations where there is pollution in the air or damages effect satisfaction of any individuals (for example there is a decreasing satisfaction to walk in a contaminated park). The USA system based on the economic evaluation techniques to estimate the value of the resources without market prices as according to concepts of contingent evaluation methods.
6. **Possibilities to develop the provided ecological damage valuation methods of Directive 2004/35 by resource to the USA liability regime.**

So the US system regime is focused in the economic valuation techniques in order to calculate the monetary damages in the cases of the interim losses and in the case of the non-use value of the resources. Actually the US authorities do not collect the monetary damages but focus on facilitating the restoration activities in the environmental damages, in other words the polluter has to face the full restoration. So the last one is the main differences in the other liability system.

So the first important difference between the US system and the other liabilities regime rules is the lack of the equivalent component in the international regimes except on this of the US. The second is the fact that the US liability regime system covers the compensations for the losses of use and non-use value of the natural resources in the restoration period, but in the international liability regimes this does not happen. Finally the US law design in the situations where there re significant damages in the environment and this is not repaired, then is provided by the US liability system a nearby area for creation. On contrary the international system if the damages area is not possible restored then the is neither compensation for the damage nor any kind of remedy. So according to all previously mentioned facts, the international system has to impose the equivalent components when there is not way to set the injuring area in the starting level or differently to make the polluter to pay for all the losses and the administrative cost which occurred from this environmental damage.

As seen before the main specific environmental laws by the US are the OPA and the CERCLA. Under the OPA the natural resource damage recoverable by the trustees of the US, this type of law is very important because is existed after a significant environmental damage, like the pollution of Allaska from the Exxon Valdez accident. So OPA covers pollution in the land, in fishes, in the biota and wildlife, water ground or water for drinking. The measure of the damage based on the cost of the restoration, replacement or rehabilitation. After the need to exist an improvement of the first OPA there is the OPA 90, which imposes the liability on
the responsible party, the costs of removal and specific damages. The damages could be in natural resources, in a private property, loss from the no use of natural resources, lost revenues resulting from injuring property or natural resource and finally the existence of extra public services in order to remedy the damage in the environment (oil spill). “The compensation for this kind of damage come out after the cost of restoring, rehabilitating, replacing, or acquiring the equivalent of the damaged natural resources and the reasonable cost of assessing damages” (Allen, 2011).

In the civil law if the damage from one person has as a consequence the injury of other person then this damage has to be compensated. CERCLA is the point where are meet civil, criminal and administrative liability. So under this law the Environmental Protection Agency has the responsibility to clean up and take care the recovery process. The liability in this situation is existed when there is damage in natural resource hazardous substances. In the CERCLA the government actions and the cleaning up activities are complicated. According to the McKenna (1995) “firstly interested parties may participate in the EPA’s procedure for selecting an appropriate remedy by submitting at public hearings either oral or written comments on the EPA’s proposed clean-up action and the studies on which such action is based. “Secondly interested parties can challenge the EPA’s selected remedy in one of two ways. Responsible parties who are being sued by the federal government for the recovery of its costs in performing the clean-up, or facing an injunctive action compelling the performance of a clean-up, may challenge the EPA’s remedy at that Time”

Comparing the European liability and the US there is a gap as mentioned before in the restricted implemented nature of the first one. So, as a suggestion for this one is the existence of the trustee for the environmental resources and the recognition of these damages to the environment per se. In the OPA is used the full monetization of the damage but this process is time consuming. On the other hand the CERCLA there is emphasis in the restoration measures and in the assessment of the damage. So the European liability, which is later than the CERCLA and OPA, introduces the characteristic to restore the contaminated area to the statues quo by remediation measures at this point is introduced the definition of the compensatory restoration which is more wide comparing with the USA system which focus in restoring the contaminating part in the previous baseline condition. The intensive existence of the monetary methods play a minor role and are provided in order to determine a reasonable restoration cost value. Finally to the disadvantages, which mentioned before like the implementation in specific
situation there is one more, the no limitation or any responsibility for the polluter of emissions, which according to the knowledge are not harmful for the environment

After mention in the US system and in the Environmental liability there is the economic analysis effect due to the gap, which probably is created by this. If for example there is an injuring area which is polluted and this area is not covered by the European liability due to the fact that is not pollution in water, species or land and also there is not a damage from one person to other the negative externalities are passes to the society. In the part of economic analysis was analyzed the negative externalities, the negative effect to the society due to the pollution. According to the existed law system is not a remediation measure, as this accident is not covered by the liability. The problem is more significant if there is evidence, which prove that the accident creates damages irreversible to the environment and so there is not any action to set the statues quo level. So according to the cost benefit analysis this situation set clearly a no benefit occasion as there is no any plan for restoring the polluting area. Secondly there is no social optimum from welfare economics. The reason as written before is the negative externalities. If this area is not under remediation measures probably after years will be the need to replace the damage and of course these activities have rising cost. The cost in the majority of the situation will pass to the society through taxes. so the social optimum is decreasing. Finally the negative effect of the pollution will be consequences in the human life which means a decreasing social satisfaction from this kind of the externality. so the civil law does not cover the law 2004/35 of the European Union because the polluter does not pay if there is not satisfied the restrictions of the Liability regime rule. As mentioned before there are consequences from the economic point of view like the non optimum and sustainable use of the natural resources and the minimum social welfare.

So according to the US system, which largely covers different disciplines of the pollution areas the European Law, could use specific characteristics like the compensation form the government trustees. Finally the suggestion of the lobby solution could be one of the most important solutions to cover the gap, which is existed in the Law design. Previously was mentioned the significance of the lobby in the enforcement to the court for examine situations out of the restricted spectrum of the liable system. The significance of them is increasing constantly from the situation where there is not a court solution in contamination problems which are not covered by the existing European Liability System. in the next part is analyzed this kind of suggestion as this could participates in the improvement of a law system in order to have a fair organization society but also an economic efficient law system.
7. Environmental Citizen Suit for claiming compensation for environmental damage parallel to EU liability regime

In the Article 12 of the Directive 2004/35 there is the existence of “1. Natural or legal persons: (a) affected or likely to be affected by environmental damage or (b) having a sufficient interest in environmental decision making relating to the damage or, alternatively, (c) alleging the impairment of a right, where administrative procedural law of a Member State requires this as a precondition,” additionally the article 13 mentions that “1. The persons referred to in Article 12(1) shall have access to a court or other independent and impartial public body competent to review the procedural and substantive legality of the decisions, acts or failure to act of the competent authority under this Directive”. So under this articles the directive has open an area to lobbies in order to help the process of the environment protection. As seen before the European liability regimes do not cover all the sectors like the general spectrum of implementation of the US liability. For that reasons it consists a disadvantage of the European law design system.

So under this restriction could be a gap in the legislation and in the damages, which not included in the law. A suggestion to this disadvantage could be the group enforcement in order the court to prevent the damages by using single and specific regulation of the environmental liability. The citizen suit model is group model, which try to create a relationship between the environmental policy and the enforcement environmental law. According to Burrows (2009) “Typically, citizen-suit provisions confer broad authority to “any person” to bring suit on his own behalf against a private or government entity alleged to have violated the substantive provisions of the underlying statute, and may also authorize suits against a government agency charged with the implementation of the statute. Citizen-suit provisions also authorize the reviewing court to award attorneys’ fees to citizen plaintiffs, in some cases where they prevail or substantially prevail and in other cases whenever the court deems it appropriate.”

The definition of the citizen suit is also provide by Roberts (2006) “Since 1790, United States citizens have been able in limited cases to sue to vindicate certain public rights
those granted by statute to the population as a whole. These citizen suits have been used to enforce federal regulations in diverse areas ranging from antitrust to consumer protection. Citizen suit provisions are said to create private attorneys general, for they confer upon the individual the right to enforce public laws against other citizens” (Platter, 1995).

The are three main categories of this the first is this which a private citizen can suit a other citizen, corporation or government body for an illegal action against the environment. The second category is when “a private citizen bring a lawsuit against a government body for failing to perform a non discretionatory duty “and the third “is analogous to the common law tort of public nuisance. In general, the law entitles plaintiffs who bring successful citizen suits to recover reasonable attorney fees and other litigation costs” (Platter, 1995).

In order to a citizen suit set a problem in the court has as priority to fulfil the next three preconditions:“Citizens may only bring citizen suits in federal court if they have standing to sue. To establish standing, the courts have required proof of three elements. First, the plaintiff must have suffered an “injury in fact. Second, there must be a causal connection between the injury and the conduct complained of—the injury has to be “fairly ... trace[able] to the challenged action of the defendant, and not ... th[e] result [of] the independent action of some third party not before the court.” Third, it must be “likely”, as opposed to merely “speculative”, that the injury will be “redressed by a favorable decision

7.1. Advantages of citizen suit

So the citizen suit has advantages in three main categories in the constitutional principles, in administrator decision rules and finally in the social rights.in the fist category the main advantages are the Implementation of the constitutional requirement for environmental protection and the Strengthening participatory democracy. As mentioned before the administration decisions rules could be improved by the suit of this specific group. Firstly there is a foundation base to accept the decisions of the Administration of the citizen and secondly there is a contribution to a more complete picture of the facts forming the basis of the administrative decision. Last there are the social rights, which have advantages from the citizen suit, first of all is the incentive for citizens to enforce the law, as always the Establish
participation of non-governmental environmental organizations before international organizations as agents of intervention rights and finally the recognition of civil society as a determinant of public policy and political level processes in international environmental fora.

Despite the fact that there are replacing simple economic tools such as, in particular, the environmental tax from an environmental liability with the introduction of Directive 2004/35, the obligation to compensate for ecological damage results at higher cost, has a threatening character, which can be function more effectively in preventing injurious behaviours. Given that the law of torts has serious difficulties to create effective incentives to limit damage to the environment, mainly due to lack of protection of property rights and especially the indifference of victims to take protective measures because of the low head loss assistance insurance coverage and the indifference of the social insurance institutions to make claims against the tortfeasors.

Additionally there are problems in the valuation of damage as well as in proof of causality between acts of business and loss (usually health) victims. The failure to appeal the damage has resulted in lower than the socially optimal level of measures to prevent or reduce damage to the environment. And yet, it is not certain that the public law system based on accountability would be able to contribute to reducing the substantial deficit implementation of EU environmental legislation by Member States.

7.2. Reasons for establishing a citizen suit for claiming restoration of impaired environmental resources directly against the polluter

One of the most important reason is that the civil law covers losses in traditional assets such as property, health, personality rights, the sharing, but the environmental damage can not be restored because the environment itself is not a legal right, protected by private law. Additionally there is not ensure the principle of rehabilitation, thus not presented a real alternative in the environmental protection of public law applicable, since Greek law does not include integrated ecological damage on objective hypostases rules require a restorative compensation. The fact that the public law does not covers largely the environmental law issues, since the law itself does not cover all cases of environmental damage, leads to the conclusion that the protection of civil basis and collective application is ancillary.
The importance of the existence one special arrangement for the citizen suit in order to cover the gaps in the environmental liability could also need in order to have a fuller set of tort and compensation. The citizen suit has as target to enforce not only the court to take a decision for a contamination situation which is not covered by the law systems but also the enforcement to the polluter to operate carefully and under restriction of the civil law. The compensation, which claims the lobby from the court, could be in order to restore the damage and not to receive the citizen suit the compensation for itself. During the court there is also common the phenomenon to be an agreement between the two parts and the polluter gives an amount to the citizen suit for the rehabilitation of the polluting area.

So the law design system could have advantages form an improvement agreement in order to cover the gaps which are inefficient to prevent the damages. The citizen suit system could enforce the rehabilitation or, where appropriate, to compensate the right to request an action and teams based on a statute designed to protect the environment if they have previously put forward a request to the competent public authority to inform the occurrence of the event. The same applies if the competent authority while issuing the act, but strictly within a specific time period of the adoption of the Act to determine the amount of compensation due.

Also the citizen suit could insert in the situations where the consequences of ecological damage from the third act relating to property, warranting principle is the owner of the property. Lobbying can have acceptable action against the injurer if the owner consents expressly for this purpose. The same applies if the owner does not exercise its right against the injurer within a period from the time it becomes aware and responsible person, after notice and a relevant group, which has as final target to enforce for compensation or for the restoration of the damage. This is important because as mentioned in the economic analysis the interim losses could creates great negative impacts in the social welfare dye to the distortion of the normal economic activities in the injuring area.

So the danger to some environmental areas to be unprotected by the law design system of each country could be protected by solution like the citizen suit which the operation of lobbies has as final target the prevention from the possible damages. Of course is necessary to be well organised and especially in the situation that the lobby is consisted by a big amount of members is needed the existence of good managers in order to achieve and prevent the well organization and synthesis of it because in any different situation the final target is not
achieved. Citizens can use their attendance to find areas, which need more regulation than the existence of the law system. The individuals who can notice oil spill in a river or to find emissions from a factory for example and compensate the compliance for this little or not damage. This is a good way to cover the imperfection of the existence legal system and also a good incentive for the polluter not to injure the environment because the existence of these kind of lobbies make them to pay according to the polluter pay principle.
8. Conclusions

8.1. Environmental liability regimes in the Member States of the EU have not regulated environmental damage as such but mostly traditional types of damage, such as personal injury or property damage that are caused via the environment. EU Directive on Environmental Liability 2004/35 was introduced in order to fill this gap in the protection of ecologically valuable natural resources.

8.2. The approach of Directive 2004/35 is similar to the regulations in the US environmental liability law, namely the provisions for natural resource damage assessment (NRDA) based on the Oil Pollution Act (OPA) as it relies basically on a resource based compensation and a balancing between the benefits obtained from restoration and the losses due to the injury.

8.3. OPA supports the non-market methods, as the most important target is the restoration of the impaired environment. Contrary to CERCLA, the measure of damage is under OPA the cost of compensatory restoration actions providing full compensation to make the public whole for interim losses, no longer the monetary value of the natural resources lost. In addition, the assessment approach of OPA minimizes the risk of disputes. CERCLA focuses its interest on the monetary valuation of the damaging resources with equivalent methods, which this law suggests. It is valid, that each damage evaluation process has to be carried out under consideration of cost benefit test analysis so that efficiency standards can be achieved in order to avoid negative externalities in the society.

8.4. Generally the European Liability Directive 2004/35 is affected by OPA; however, in comparison of EU and the USA systems there are gaps in the Directive, which possibly lead inefficiencies. The development of any positive impacts of economic assessment concepts of CERCLA and OPA on the specific economic motivated provisions in Annex of the Directive will depend on the willingness in the EU member states to apply economic valuation methods within the transposing acts.

8.5. Enabling environmental groups to claim for restoration of impaired environmental resources directly against the polluter by introducing necessary statutory changes in form of specific citizen suits similar to the models in the U.S.A. within the application field of Directive 2004/35, in relevant transposing acts, could support the European liability regime.
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