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POLLUTER PAYS PRINCIPLE IN INTERNATIONAL TRANSPORTATION

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## TABLE OF CONTENTS

ABSTRACT

ACKNOWLEDGEMENTS

TERMS AND ABBREVIATIONS

1. INTRODUCTION .....	7
2. METHODS AND MATERIALS .....	9
3. POLLUTER PAYS PRINCIPLE .....	11
3.1. Legal principles in law science.....	11
3.2. Concept of “polluters”.....	13
3.3. Current definitions of PPP .....	14
3.4. Current implementation practices .....	17
4. SCHOOLS OF THOUGHT.....	25
4.1. Opposing views.....	25
4.2. Scientist opinions.....	33
5. DEFINING “POLLUTER PAYS” PRINCIPLE.....	37
5.1. Optimal definition of PPP .....	37
5.2. Universal implementation mechanism for transportation sector.....	39
6. RESULT ANALYSIS AND CONCLUSIONS .....	41
REFERENCES .....	42

## ABSTRACT

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Polluter pays principle has been a controversial topic in many pollution related industries for almost a hundred years. First mentions of such legal principle can be found in economic literature from the beginning of the 20<sup>th</sup> century. Though during this period of time society's legal consciousness and pollution statistics have gone up, there is still no full consensus on whether such principle must be implemented in international law and how it should be done. The main goal of conducting the study was to take a neutral look upon the issue of the implementation of PPP since, during the pre-research, lack of neutrality in PPP research was observed. The aim was to research the problem from different perspectives and develop a clear and universally applicable definition and implementation framework of the PPP.

The thesis was a truly academic study based on scientific literature and personal analysis supported by years of studies and experience in fields of legislation, transportation logistics and management. Tips and advice were received from many logistics and environmental field professionals during the research.

The main goal was reached but certain adjustments to the initial objectives were made due to lack of available statistics and knowledge in fields of economics, finance and physics. A comprehensive definition was developed, however, only a theoretical framework of the implementation mechanism was

created. Further, more detailed research should be carried out, though it would require large amounts of statistics and pricing information.

## ABSTRAKTI

Aiheuttajaperiaate on ollut monella teollisuudenalalla kiistelty puheenaihe jo lähes sadan vuoden ajan. Ensimmäiset maininnat tällaisen periaatteen käytöstä löytyvät jo 1900-luvun alusta. Viimeisen sadan vuoden aikana yhteiskunnan oikeudellinen tietoisuus ja päästömäärät ovat kasvaneet, eikä ole päästy yksimielisyyteen siitä, pitäisikö aiheuttajaperiaate –malli sisällyttää kansainväliseen lakiin, ja jos pitäisi, niin kuinka se käytännössä tehtäisiin.

Tämän tutkimuksen tavoitteena oli tarkastella puolueettomasti aiheuttajaperiaatteen käyttöönottoa teollisuudessa. Koska tutkimuksen aikana havaittiin olevan vain vähän puolueettomia lähteitä, tavoitteena oli tarkastella ongelmaa eri näkökulmista ja lopuksi ehdottaa selkeä ja kansainvälisesti sovellettavissa oleva määritelmä ja täytäntöönpanopuitteet aiheuttajaperiaatteen käyttöönotolle.

Tämä opinnäytetyö on akateeminen tutkimus joka pohjautuu tieteelliseen kirjallisuuteen ja henkilökohtaiseen analysointiin, jota tukee vuosien koulutus ja kokemus lainsäädännöstä, logistiikasta ja hallinnosta. Tutkimuksen aikana palautetta saatiin monilta logistiikka- ja ympäristöasiantuntijoilta.

Päätavoite saavutettiin, mutta joitakin yksityiskohtia tehtävänannossa jouduttiin muuttamaan. Kattava määritelmä laadittiin, mutta vain teoreettinen täytäntöönpanomekanismi saatiin valmiiksi. Tarkempaa tutkimusta olisi vaadittu, mutta se olisi vaatinut paljon statistiikkaa ja hinnoittelutietoja.

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Last but not least, I would like to thank family and girlfriend Aija for their unconditional, concrete support and enthusiastic encouragement at tough times throughout my studies abroad and before that. As an English writer and poet John Haywood said: „*Many hands make light work*”.

## TERMS AND ABBREVIATIONS

PPP – Polluter pays principle;

OECD – Organization of Economical Co-Operation and Development;

EC – European Community;

EU – European Union;

SECA – Sulphur Emission Control Area (North Sea, Baltic Sea, and within 24 miles of California coast according to MARPOL ANNEX VI);

MGO – Maritime Gas Oil;

HFO – Heavy Fuel Oil;

OPA – The US Oil Pollution Act of 1990;

IMO – International Maritime Organization;

MARPOL convection - International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978;

DWT – Deadweight ton;

MBIs – Market – based instruments;

GHG – Green house gases;

VPP – Victim pays principle;

MDC – Marginal damage costs;

MRC – Marginal remediation costs.

## 1. INTRODUCTION

The principle that pollution related cost, such as clean-up costs and damage to the nature, must be allocated according to the source of its' origin is a well known paradigm that begun in late 1920's<sup>1</sup> and has carried onwards since. Many economists and lawyers have discussed this issue from different points of view, though, the first legal document that brought PPP to international stage and recognized it as a serious future reality for polluters was Draft Declaration of Principles on Air Pollution Control issued by Committee of Ministers of the Council of Europe in 1968. It stated that *“Legislation should provide that whoever causes or adds to air pollution must [...] keep such pollution to a minimum and ensure that impurities emitted are properly dispersed”*.

Such clause which recognizes that party who causes pollution is to be kept liable for causing it is followed by financial clause which states that costs incurred in preventing or minimizing pollution should be borne by whoever caused the pollution.<sup>2</sup>

Though many world-widely recognized legal documents and studies have been drawn since then, there is still no common implementation mechanism of PPP or common consensus whether such pollution related costs should be borne by the polluter. Many countries have implemented financial mechanisms that in some way shift the costs of pollution effects from public authorities to private companies which are usually the main polluters. The most common mechanisms are the liability clauses or even specific legislation. For example, in 1990 the U.S. Congress passes the Oil Pollution Act of 1990 which stated that: *“Responsible parties [...] are liable for removal costs and damages [...] that result from such incident [discharge of oil – auth.]”*.<sup>3</sup>

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<sup>1</sup> History and Development of the Polluter Pays Principle: An Overview. Munir M., Department of Law, International Islamic University, Pakistan, 13.09.13.

<sup>2</sup> Resolution (68) 4 approving the „Declaration of Principles” on air pollution control. European Council, Committy of Ministres, 1968.

<sup>3</sup> United States Code, 2010 Edition, Title 33 - NAVIGATION AND NAVIGABLE WATERS, CHAPTER 40 - OIL POLLUTION



Though, such and similar mechanisms shift costs to the polluter, it is only a small particle of the whole PPP. If OECD is acknowledged as one of the world most influential cross-nation organizations, it is necessary to recognize their definition<sup>4</sup> of PPP as the one to follow by. So analyzing the mentioned definition verbatim et literatim one can see that no broad definition of such terms as “polluter” nor “extent to the damage done to society” have been given. Even though for legal purposes legislation usually defines these terms as well, it still leaves possibilities for interpretation.

In modern days simple, non-commercial vehicles account for 33% of air pollution. If taken into account that it is only non-commercial road transport and only the air pollution, it is obvious that transportation sector as a whole is accountable for larger amount of pollution than any other business fields. Though transportation is inalienable necessity for the whole society so is the right for clean surrounding. This means that PPP actually is a matter of the whole worldwide society. There should be no or little possibilities for interpretation and PPP should be clearly defined as a principle including the implementation mechanism.

The objective of this thesis was to create a universally applicable definition and implementation of PPP. This was done by defining pros/cons, analyzing the current practices and legislations, determining the obstacles and gathering opinions for different paradigms.

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<sup>4</sup> „The polluter-pays principle is the principle according to which the polluter should bear the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level (standard) of pollution.” Glocery of Statistical Terms, OECD. <http://stats.oecd.org/glossary/detail.asp?ID=2074> (viewed on 21.01.2014)

## 2. METHODS AND MATERIALS

The objectives described in previous sections have been achieved by using research and analysis method. Meaning, pre-study on topic related previously researches, findings, scholar thoughts and legislation had been done followed by personally done analytics. The reliability of such analytics is based on personal studies of 3,5 years in cargo transportation field, 2,5 years in legal field, approx. one year of practical training in transportation field and approx. three years of working in legal field.

The process of objective accomplishment in this study can be divided into four periods:

- 1) Clarification of the thesis topic and the selection of objectives, goals and tasks. During this period some preliminary materials were studied which allowed to proceed with previously mentioned tasks of the period;
- 2) Pre-study of subject's background which included data gathering, studying and analyzing. Pre-study period took time of approximately two weeks during which sources like libraries, internet, e-libraries etc. were scanned for potentially useful reference materials;
- 3) Deep research and analysis on the thesis topic. During this period full research and analytics work was carried out. The outcome of this period is the main body text of this thesis upon which the final period of conclusion making and objective fulfillment could be carried out;
- 4) Objective fulfillment. At the beginning, the objectives of PPP definition and implementation mechanism creation had been set. During this period the research was being concluded in means of objective fulfillment.

As research materials, scholar statements, legislation, articles and personal knowledge from previous studies were used. During the Baltic Breeze seminar of 2014 at Kymenlaakso University of Applied Sciences, interviews with professionals from transportation and environmental study fields were carried out.

### 3. POLLUTER PAYS PRINCIPLE

Different kinds of legal systems have been known to the mankind since the beginning of the civilization. They all have been created upon moral principles and the understanding of right. So before inspecting some particular judicial practices, it is important to get the solid look at the basics. In this chapter legal principle as such will be examined to determine their role in the judicial systems. Also the core concept of the polluter pays principle will be inspected as from the current scientific and legal point of view.

#### 3.1. Legal principles in law science

Legal principles or general principles of law are unwritten form of legislation that in most cases do not count as legislation in its' full force. In short, legal principles can be defined as the manifestation of law that is recognized by civilized society. Though it sounds appropriate to use principles created by legal consciousness approved by civilized society and international community to settle juridical disputes, such practices are not common due to three main reasons:

- 1) Even though many international courts and tribunals have recognized legal principles as a primary source, judges have remained reluctant in their use and reference;
- 2) General legal principles by themselves have limited power to enforce obligations. If looked at, legal principles are mostly expressed in few words (or even a single one) or it is an expression. For instance, legal principles like "Pacta sunt servanta" ("Contracts must be fulfilled" - *Latin*) or "Innocent until proven guilty", are, in a sense, self-explanatory. However at the same time they do not express enough to enforce obligations upon someone. Only the interpretable, philosophical spirit of such principles can express something that can be enforced. But the possibility for interpretation in most cases restricts to rule a case based on a legal principle;
- 3) Legal scholars have thrown lots of criticism towards legal principles calling them equivocal which also infers from the possibility of interpretation mentioned above.

Therefore, due to major uncertainty lying over general legal principles, courts avoid the use of bare legal principles. Despite, a common thought between legal scientists is that without legal principles it would be almost impossible to create a fully functioning and fair legal system, especially if talking about international legal system. With no general legal principles, courts would be limited to only rule based on “the acts of the powerful”. Therefore internationally recognized legal principles are something outside national legislations.

There is a paradigm which argues that in fact there are two ways how legal principles are created:

- 1) By inducing from municipal level, meaning – if the majority of civilized inhabitants of a physical territory accept such principle;
- 2) By deducing from international legal logic directly.

It is said that legal principles are, so to call, “unfinished products” due to their flexible nature, interpretation possibilities and possibilities to be change according to, so to say, civilized society’s comprehension. However, still these principles fulfill their functions. In general, the main function of legal principles is to “fill the gap” between custom and treaty. Another important function is discretion to lawmakers and judges. Meaning: 1) cases can/could be ruled based on legal principles if there is no written legislation or clause applicable; 3) lawmakers can/could make legislation according to these principles accepted by civilized society.

Lastly, general legal principles allow interpreting laws according to the current world order and society’s state of mind.<sup>5</sup>

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<sup>5</sup> The Role of General Principles in International Law and their Relationship to Treaty Law. AF CHRISTINA VOIGT, DR.JURIS. UNIVERSITY OF OSLO, DEPARTMENT OF PUBLIC AND INTERNATIONAL LAW, Pg 4-24. 2008.

### 3.2. Concept of “polluters”

Polluter pays principle in the context of this research is an international law general principle. Thus, taking into consideration the complexity and interpretation possibility caused by distinctive attitudes and paradigm, term “environment”, which can be seen as the single most important aspect of this topic, in the context of this research is defined as “the surrounding of anything”. Meaning – environment is both the features and the products of the natural world as well as of human civilization. Some other definitions tend to not count world inhabitants as part of the environment, referring to them separately.<sup>6</sup> However, such approach leaves a gap for lawmaker human errors. Even though the wide definition does not express specific things, it allows viewing environment in a broad perspective.

Defining “polluter” on the other hand is more complicated considering the different viewpoint how environment can be seen. Some of the reliable definition examples state that “polluter” is:

- 1) A person, organization, country etc, who causes pollution of the environment<sup>7</sup>;
- 2) A person or organization that puts harmful substances or waste into the water, air, etc., causing damage to the environment<sup>8</sup>;
- 3) A person or organization that causes pollution of the environment<sup>9</sup>;
- 4) Someone who directly or indirectly damages the environment or those who create conditions leading to such damage<sup>10</sup>.

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<sup>6</sup> Principles of International Environmental Law. Third Edition. Sands Ph., Peel J., Cambridge University press. Cambridge.Pg. 13. 2012.

<sup>7</sup> Collins English dictionary. <http://www.collinsdictionary.com/dictionary/english/polluter> (viewed on 26.02.2014)

<sup>8</sup> Cambridge Business English Dictionary. Cambridge University Press. 2011

<sup>9</sup> WordNet Search. Princeton Online Dictionary. <http://wordnetweb.princeton.edu/> (viewed on 26.02.2014)

<sup>10</sup> The Liability and Compensation Mechanism under International Marine Environmental Law. Chen J., Law of the Sea Institute, UC Berkeley–Korea Institute of Ocean Science and Technology Conference. Seoul, Korea, May 2012

From the examples above, some key characteristics of “a polluter” can be deducted and identified:

1) Polluter can be either a human being or an organizational establishment (company, firm, non-governmental organization, country etc). So in legal terms, either physical or legal entities can be kept accountable for polluting. If pollution is managed under civil liability, the case is relatively simple for both entities. Yet, in some legal systems, especially on national levels, some particular level or way of an act of pollution is criminalized. Meaning – an act of pollution is a criminally punishable behavior. In such cases, it becomes difficult to allocate liability in legal entities. It is worth noting that even whole countries can be recognized as polluters;

2) Polluter is someone who causes damage and has harmful impact on the environment. Some definitions even specify harmfully impact-able areas according to authors’ comprehension on the term “environment”. For instance, in one of the given example definitions as harmfully impact-able areas are mentioned water and air;

3) Polluter is someone who operates with waste or harmful substances;

4) Polluter can be someone acting on purpose, unintentionally or just impacting an action. In most legal systems, consequences and liability for these different kinds of behaviors differ as well. Though, if intentional and unintentional pollution is a clear and self-explanatory case, questions might arise about the impacting of an action. Such situation might accrue, for instance, in previously mentioned setting where someone in a legal entity must be held accountable for pollution.

### 3.3. Current definitions of PPP

The history of polluter pays principle can be written stating from whenever the first concerns about environment begun. Thus many have tried to define and concretize the characteristics of the principle. However, in the context of this research, only official definitions recognized by international civilized community will be looked at despite the fact that also many high-class environmental, economics and law scholars have given their definitions as well.

As mentioned before, Organization for Economic Co-operation and Development (OECD) is the most influential global communities' representative in economics and development fields that has recognized polluter pays principle. OECD was also the first global cross-national organization that defined polluter pays principle and included it in one of its recommendations. So to say, the legal history of polluter pays principle started in 1971 when the principle was deeply discussed in a seminar held by OECD. Never before, a legal principle of polluters actually paying for their harm to the environment had been discussed on such high level.<sup>11</sup>

Mentioned discussions resulted in OECDs' *Recommendation of the Council on Guiding Principles concerning International Economic Aspects of Environmental Policies* of May 26, 1972. As mentioned before, OECD defines polluter pays principle as follows: *The polluter-pays principle is the principle according to which the polluter should bear the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level (standard) of pollution.*<sup>12</sup>

However, the previously mentioned recommendation gives a bit wider and deeper explanation. Section A, clause 4 of the Annex of the recommendation states that polluter pays principle is the principle which must be used to allocate the costs of pollution prevention and control "to encourage rational use of scarce environmental resources and to avoid distortions in international trade and investment". The following statement explains that the adoption of such principle means that someone who is declared "polluter" (in document – "polluter") should bear the costs of previously mentioned measures – prevention and control – according to public authority's views. The clause even suggests that all costs of these measures should be incorporated in the

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<sup>11</sup> History and Development of the Polluter Pays Principle: An Overview. Munir M., Department of Law, International Islamic University, Pakistan, 13.09.13.

<sup>12</sup> Glossary of Environment Statistics, Studies in Methods, Series F, No. 67, United Nations, New York, 1997.

cost of goods and services that cause pollution in production and/or consumption.<sup>13</sup>

European Community (now – European Union) was the next world leading cross-national organization that adopted the polluter pays principle. Although most of EC countries were also members of OECD, it was not enough and PPP was also implemented in EC legislation. However, it was still only the recommendation level. In EC's First Environmental Action plan polluter pays principle was defined as follows: *The cost of preventing and eliminating nuisances must in principle be borne by the polluter. However, there may be certain exceptions and special arrangements, in particular for transitional periods, provided that they cause no significant distortion to international trade and investment.*

The initial proposal for polluter pays principle definition by EC was the following: *This principle (the PPP) states that person causing nuisances to the environment should be called upon to pay for the above-mentioned measures (preventive action) which are decided by the authorities for the conservation of an acceptable environmental standard. In other words, the costs of such measures should be shifted onto the price of the goods and services which, as a result of the production process and / or the use made of them, are the cause of damage to the environment. Such measures should not be supported by subsidies since that would lead to significant distortions in international trade and investment.*<sup>14</sup>

Despite the fact that the EC/EU's definition of polluter pays principle has all the main characteristics of the definition adopted by OECD, it uses the word "nuisance" instead of "pollution" which in its broader meaning also includes such pollution forms as noise, odor etc.<sup>15</sup>

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<sup>13</sup> Recommendation of the Council on Guiding Principles concerning International Economic Aspects of Environmental Policies. OECD. 26 May 1972 - C(72)128

<sup>14</sup> History and Development of the Polluter Pays Principle: An Overview. Munir M., Department of Law, International Islamic University, Pakistan, 13.09.13.

<sup>15</sup> „Nuisance”. Concise Encyclopedia. <http://www.merriam-webster.com/dictionary/nuisance> (viewed on 27.02.2014)



### 3.4. Current implementation practices

In this subchapter a few of already existing implementation practices will be analyzed. As it was mentioned in subchapters before, polluter pays principle is a well recognized legal principle also in EU legislation. Nevertheless, there is no single, completely defined implementation mechanism. Therefore, implementation cannot be done in the same manner in all business fields. This work focused on EU's transportation sector. Therefore the subchapter will analyze polluter pays principle's implementation practice exactly in this field.

Ultimately polluter pays principle is implemented through two different regulatory approaches: command-and-control and market-based. The former is accomplished by creating a legal framework for performance and technology. The later includes such measures as taxes, tradable pollution permits and product labeling. Even though there is no single agreements upon which of these approaches give a greater effect, many economists believe that market-based instruments are more efficient since *“the total abatement cost of achieving a specified level of pollution reduction will generally be lower under a pollution tax than for a command-and-control approach that achieves the same reduction in pollution”*.<sup>16</sup>

#### Command-and-control

As the term suggests, command-and-control type of polluter pays principle implementation instruments are such that oblige something via a legal act. It also fully identifies a well known legal dogma that legislation either commands to do something or the opposite – forbids and restrains from doing something.

One of the most controversial topics in Europe's (mostly Northern and Eastern Europe's) maritime transportation sector which could be recognized as polluter pays principle implementation instrument in EU legislation is the new EU sulphur directive(EU Sulphur Directive 2012/33/EU). It performs the legislations' task of setting restriction in order to prevent something from happening. In the particular situation, sulphur directive sets restrictions on the

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<sup>16</sup> Polluter pays principle. Environmental Justice Organisations, Liabilities and Trade. Mapping Environmental Justice. <http://www.ejolt.org/2013/05/polluter-pays-principle/> (viewed on 27.02.2014)

amount of sulphur content in maritime fuels in specifically restrained shipping areas – SECA. The mentioned directive states that maritime fuel must not contain more than 1% of sulphur as of July 1st, 2010 and 0,10 % as of January 1st, 2015. As well as in sea areas outside SECAs - 3,50 % as of January 1st, 2012 and, in principle, 0,50 % as of January 1st, 2020.<sup>17</sup> Such numbers in the most cost-efficient way can be achieved either by installing a scrubber or by rebuilding ship engines to work on MGO instead of HFO. A scrubber works as a emission filter However, its massive structure makes it difficult or even almost impossible to fix on a ship to contain its stability and cargo space. Nevertheless, scrubber technology requires large capital investments.<sup>18</sup>

The same situation is with engine rebuilding. Apart from capital investments of the actual rebuilding process, HFO are considerably more inexpensive compared to MGO.<sup>19</sup> The price difference waves around \$300 per metric ton depending on the market situation.<sup>20</sup>

The controversy concerning the EU Sulphur directive is obvious. However, at the same time, signs and characteristics of polluter pays principle are noticeable as well. Sulphur is a well-known environmental contaminant which is highly generated in use of transportation. In the given example, maritime vessels are the contaminators who generate pollution by transporting goods. So the mentioned directive does what polluter pays principle stands for – allocates costs of pollution prevention to the current or potential polluters. Figure below shows the projected additional costs which ship-owners and

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<sup>17</sup> Directive 2012/33/EU of the European Parliament and of the Council of 21 November 2012 amending Council Directive 1999/32/EC as regards the sulphur content of marine fuels. European Parliament. 21/11/2012

<sup>18</sup> Realising the competitive potential of sulphur ECA compliance. Mirja-Maija Santala, Wärtsilä Corporation, Wärtsilä article, August, 2012. <http://www.wartsila.com/en/realising-the-competitive-potential-of-sulphur-ECA-compliance> (viewed on 28.02.2014)

<sup>19</sup> Sulphur content in ships bunker fuel in 2015 A study on the impacts of the new IMO regulations on transportation costs. Ministry of Transport and Communication of Finland. Helsinki, 2009.

<sup>20</sup> Bunkerworld.com, <http://www.bunkerworld.com/prices/> (viewed on 01.03.2014)

other associated parties with need to obtain in order to fulfill the set sulphur framework.

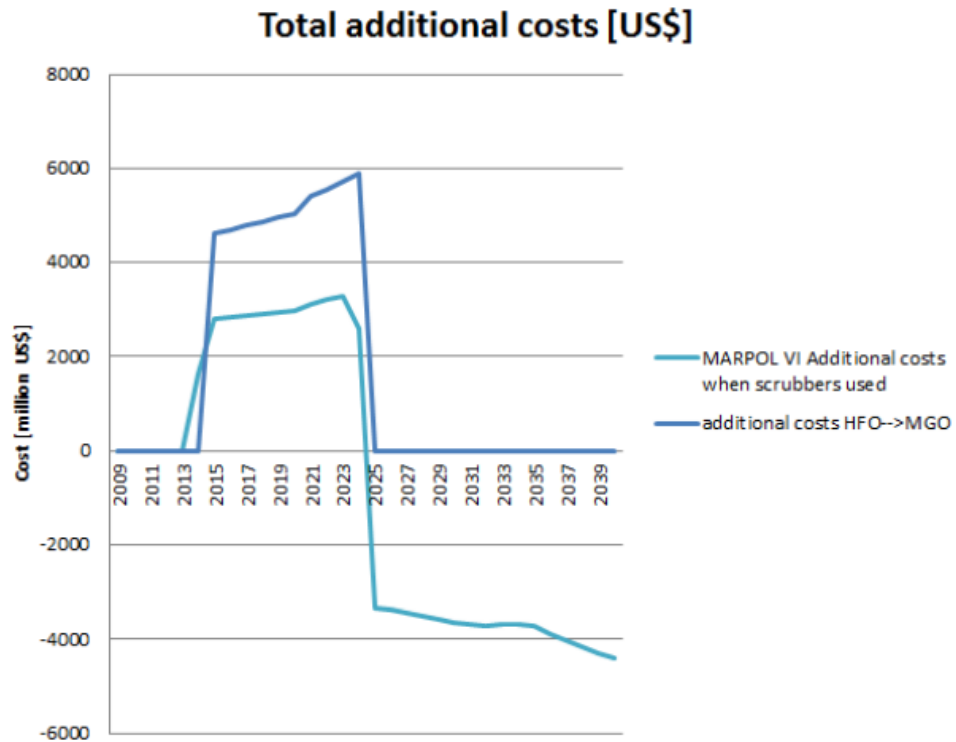


Figure 1. Total additional costs<sup>21</sup>

Another example of command-and-control implementation tool of polluter pays principle is the aftermath legislation of 1989 Exxon Valdez oil spill on the coast of Alaska, USA. The company paid record amounts of settlements and compensations though there was no strict legal background of necessity to do so. Not the US, nor international legislation stated that polluter in such case must act to remove the oil spill or prevent it from expanding. However in August, 1990 the United States Congress passed the 1990 Oil Pollution Act which apart from other legal conditions settled these divisive issues.<sup>22</sup>

Another new technological restriction was set after the Exxon Valdez accident. The new double hull requirements for oil tankers introduced in the OPA was later also proposed to IMO for incorporation in MARPOL convention Annex 1.

<sup>21</sup> The price of sulphur reductions in the Baltic Sea and North Sea shipping. Jalkanen J.P., Kalli J., Stipa T. BSRInnoShip.

<sup>22</sup> Oil Pollution Act Overview. United States Environmental Protection Agency. <http://www.epa.gov/oem/content/lawsregs/opaover.htm> (viewed on 01.03.2014)

In 1992 MARPOL was amended to make it mandatory for tankers of 5,000 DWT and more ordered after July 6<sup>th</sup>, 1993 to be fitted with double-hulls, or an alternative design approved by IMO.<sup>23</sup>

The second example of command-and-control implementation mechanism of polluter pays principle clearly shows how singular elements of polluter pays principle can be implemented into the international and/or national legislation to shift costs and allocate liability for environmental pollution. The characteristics of polluter pays principle in this case are:

- 1) Allocation of costs of pollution clean-up and other cost to the polluter;
- 2) Enforcing the potential polluter to undertake the costs of pollution prevention (double –hull).

### Market-based

Another environmental pollution control mechanism is carried out through the, so called, market-based instruments. Many scholars have given their definitions of MBIs but the core essence of this term is that economic variables such as tradable permits, pollution charges and taxation are used to encourage environmentally friendly behavior. Such measures are often used instead of explicit legal regulations regarding pollution control levels or methods. The main advantages of MBIs often mentioned are the allowance of implementation flexibility by companies and freedom of choice in technology use which then promotes innovations. However, implementation of MBIs also requires some sort of regulatory legal background.<sup>24</sup>

Many MBIs are used especially in transportation field. One of the most common instruments is the fuel tax or excise duty on fuel that is paid by every motor-vehicle user. A study carried out by European Environment Agency in 2002 shows a comprehensive picture of fuel tax influence on the overall fuel price. The Agency's statement about fuel taxes' environmental context is as

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<sup>23</sup> Oil Pollution. Background. IMO.  
<http://www.imo.org/OurWork/Environment/PollutionPrevention/OilPollution/Pages/Background.aspx>

<sup>24</sup> Experience with Market-Based Environmental Policy Instruments. Stavins N.R., Resources for the Future. Rff.org. November 2001.

follows: [...] Fuel taxes, originally instruments of fiscal policy, are also seen as instruments to reduce emissions from transport, in particular CO<sub>2</sub>. First, fuel taxes stimulate reductions of fuel consumption, e.g. by stimulating fuel efficiency within all modes. Secondly, they can stimulate a shift towards cleaner fuels, for example from leaded towards unleaded petrol, or to low-sulphur fuels [...].<sup>25</sup>

Figure 2 shows the rates of fuel excise duty among EU countries. However, fuel price that every motor-vehicle user pays consists mainly of three components: 1) market cost of fuel; 2) excise duty; 3) VAT. Figure 3, even though does not reflect accurate current situation, displays the ratios of all three components.

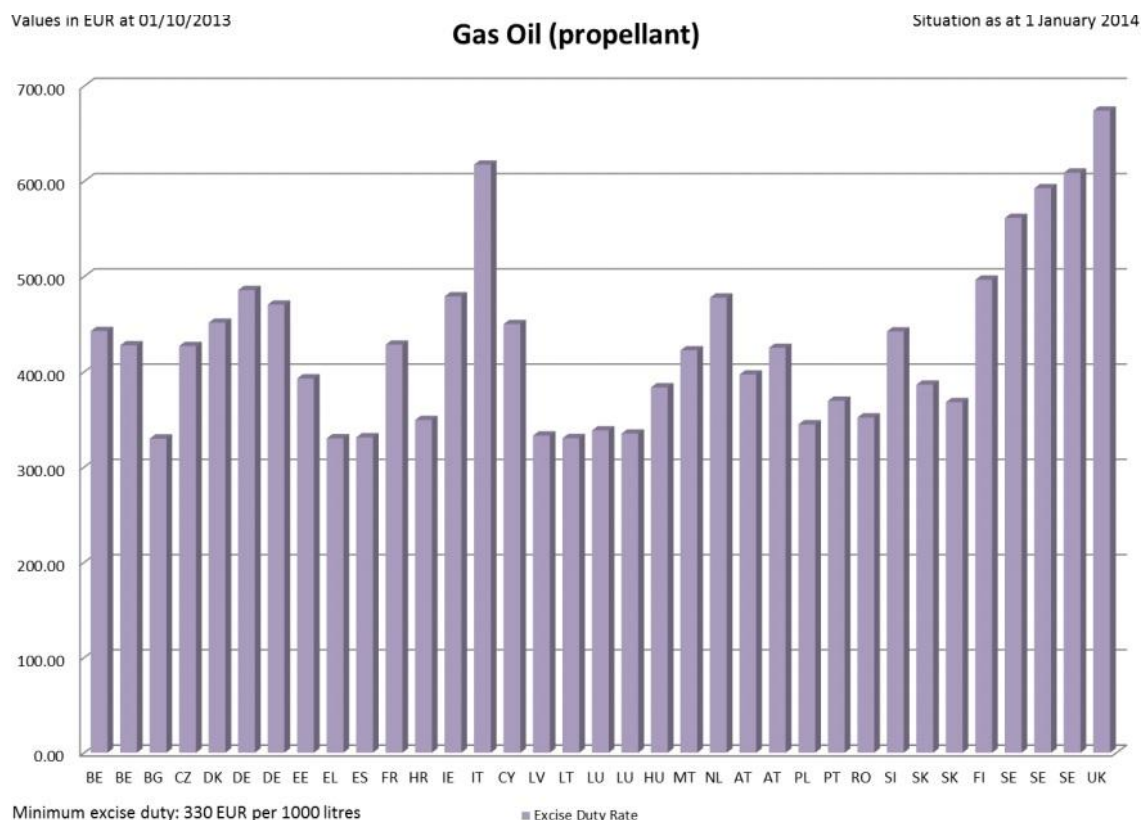


Figure 2. Excise duty rate per 1000 liters of gas oil in EU countries<sup>26</sup>

<sup>25</sup> TERM 2002 21 EU 0 Fuel prices and taxes. Indicator fat sheet. European Environment Agency.

<sup>26</sup> Excise Duty Tables. Part II – Energy products and Electricity. European Commission, 2014. Pg. 25. [http://ec.europa.eu/taxation\\_customs/index\\_en.htm](http://ec.europa.eu/taxation_customs/index_en.htm)

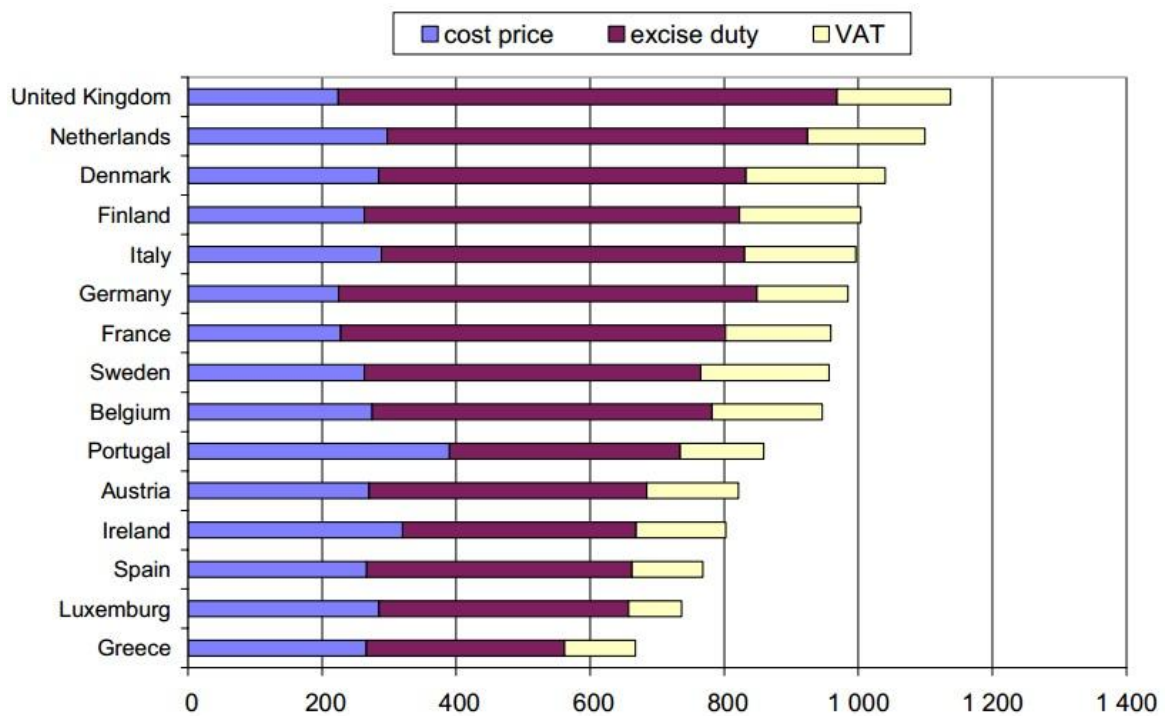


Figure 3. Unleaded petrol price in EU countries per 1000 liters in **2002** (25)

Obvious polluter pays principle elements and characteristics are incorporated in this MBI: polluter – a motor-vehicle user – is in demand for the polluting substance – gasoline to use his/her vehicle. In order to shift the costs of environmental damage to the polluter (in this case – to the motor-vehicle user), the price of the polluting substance is imposed with a fiscal instrument – a tax or a duty.

Another example of an MBI that can be named as in use of polluter pays principle implementation is a local traffic management plan which determines e.g. a city entrance fee for motor-vehicles. Such systems have been implemented in Singapore, Seoul, Milan, Oslo and many other high density cities around the world to reduce traffic together with CO<sub>2</sub> emissions. (24)

London was one of the first major cities in the world introducing the congestion charge which varies from £9 to £12 depending on the permit purchasing time. The latest amendments in the system provide a single 100% discount for electric vehicles and ultra low emission cars and vans. The city has introduced also differentiated discounts for different vehicle and people groups. However, still vehicle users are responsible for covering the environment damaging cost

caused by their vehicles so such MBI can also be named as such that implements polluter pays principle.<sup>27</sup> Still, at least in case of London, such instrument works only for lowering the emissions and reducing the amount of vehicle in the city center. Recent survey has shown that traffic jams have not gotten better meaning that travel time has not decreased and traveling costs have gone up drastically for the visitors of London city center.<sup>28</sup>

So far the international community has recognized and implemented 110 different MBIs for environment protection. Figure 4 shows that the vast majority of instruments have been identified and implemented in EU. Eighty-five out of 110 instruments were price-based, e.g. taxes or subsidies on products, processes or resources. In the EU the great majority of instruments are also price-based. Only some countries use quantity or rights based instruments, such as tradable permits.

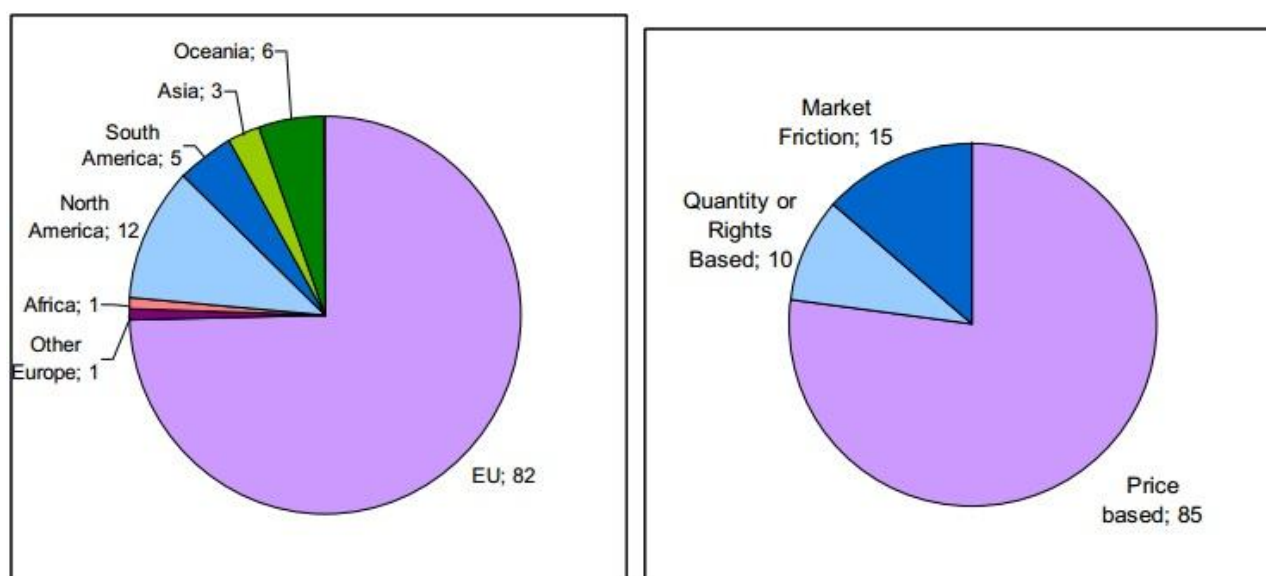


Figure 4. Identified MBIs by continents of origin (left-hand side) and type (right-hand side)<sup>29</sup>

<sup>27</sup> London congestion charge. Automobile Association Developments Limited. January 5th, 2014. [https://www.theaa.com/motoring\\_advice/congestion\\_charging/](https://www.theaa.com/motoring_advice/congestion_charging/) (viewed on 01.03.2014)

<sup>28</sup> Has London's congestion charge worked? Timms C., BBC News, London. February 15th, 2013. <http://www.bbc.com/news/uk-england-london-21451245> (viewed on 01.03.2014)

<sup>29</sup> The Role of Market-Based Instruments in Achieving a Resource Efficient Economy. Rademaekers K., van der Laan J., Smith M., van Breugel C., Pollitt H. ECORYS. Rotterdam. October, 2011.

So far it can be concluded that polluter pays principle is being implemented as, so to say, spirit of environmental regulations (Command-and-control and MBIs). None of the observed environment protection mechanisms actually constitutes and comprises all of the PPP's characteristics. Implementation mechanisms differ outstandingly as well so it cannot be said that there is a comprehensive and widely suitable mechanism for specific and clear implementation of polluter pays principle in its broadest definition.

#### 4. SCHOOLS OF THOUGHT

As indicated and analyzed before there are no common grounds among the supporters and the protesters of the polluters pay principle whether such principle should or should not be part of the legal framework of such high profit and society need-meeting business fields as transportation. There are two basic paradigms led by obvious interest groups. The environmentalists believe that it is a duty and a compulsory obligation of the polluter to absorb the damage caused by its actions via some kind of financial overlay. On the other hand, transportation sector has kept its lobby strong by claiming that the whole society (meaning – public authorities as society's delegate) must cover the costs since transportation services are an obvious need of today's society. This section takes a closer look into both paradigms and analyses the observations.

##### 4.1. Opposing views

###### Opponents

1) Emissions caused by the consumption of fuel are the most common pollution of environment induced by the transportation sector. Although there are many uncertainties surrounding the possible implementation of the PPP in the legal framework of air pollution control. One of such is the uncertainty and lack of scientific proof on how do each of the emitting particles affect human health in a longer period of time. It is clear that the overall air pollution might be the cause of many respiratory system illnesses but there is no scientific evaluation on which particular emission chemicals and/or toxins are to be blamed and thus – prohibited. It is believed that it would be reasonable to



modify fuels consumed by replacing some particular chemicals instead of paying extra to remedy the consequences.<sup>30</sup>

2) It is believed that in case PPP cannot be clearly defined and an absolute implementation mechanism is not adopted for all polluters equally then it becomes unreasonably unfair to some business fields. For instance, the previously mentioned expansion of the SEC area which is planned to cover the English Channel, North Sea and Baltic Sea by 2015 and require low sulphur fuel consumption for vessels traveling these waterways. It has been acknowledged that such measure will significantly increase the costs of sea transportation and thus contribute to the loss of cargo transportation market share since no similar emission restrictions are set for other modes of transport.<sup>31</sup> Even more – sea transportation already provides the smallest input of air pollution between all modes of cargo transport (see Figure 5 GHG Emission per mode of transportation).

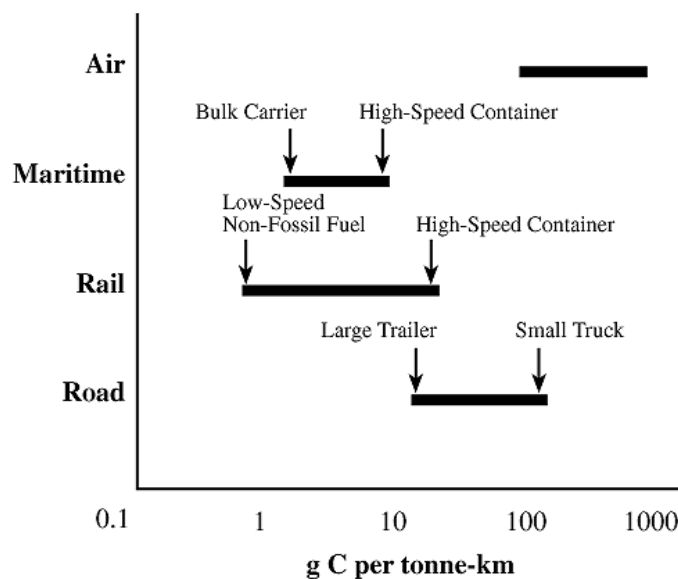


Figure 5. GHG Emission per mode of transportation<sup>32</sup>

<sup>30</sup> Commission staff working paper. Annex to: The Communication on Thematic Strategy of Air Pollution and The Directive on „Ambient Air Quality and Cleaner Air for Europe”. Impact Assessment. Commission of The European Communities. Pg 59. Brussels, September 21st, 2005. [http://ec.europa.eu/environment/archives/cafe/pdf/ia\\_report\\_en050921\\_final.pdf](http://ec.europa.eu/environment/archives/cafe/pdf/ia_report_en050921_final.pdf) (viewed on 02.03.2014)

<sup>31</sup> Loss of market share due to SECA 2015. Haram K.H., shiptonorway.no. March 20th, 2013. <http://www.shiptonorway.no/SitePages/NewsDetail.aspx?nid=95&t=%E2%80%8BLoss+of+market+share+due+to+SECA+2015> (viewed on 02.03.2014)

<sup>32</sup> Aviation and the Global Atmosphere. Intergovernmental Panel of Climate Change. <https://www.ipcc.ch/ipccreports/sres/aviation/126.htm> (viewed on 02.03.2014)

3) A simple calculation of upper mentioned SECA expansion case illustrates the dramatic increase of costs of container shipping via sea transportation in SECA 2015:

a) Route: Port of Rotterdam (The Netherlands) – Port of Oslo Fjord (Norway) - Port of Rotterdam (The Netherlands); (31)

b) Fuel costs: \$656 (475.57 EUR)/ton for HFO (heavy oil with current sulphur limits), \$868 (629.26 EUR)/ton for MGO with sulphur content below 0,1%;



Figure 6: MGO price (left-hand side) and HFO prices (right-hand side) in Rotterdam bunker market between March 17 – 21, 2014<sup>33</sup>

c) Price difference: \$212 (153.69 EUR);

d) An average capacity of a short sea shipping vessel: 800 TEU (or 400 FEU);

e) Assumed load rate: 75%;

f) Fuel consumption: 1,4 tons/hr; round trip – 93 tons;

g) Amount of additional costs: ~24 000 EUR; (31)

**h) Approximate cost per TEU using HFO: 113.71 EUR;**

**i) Approximate cost per TEU using MGO: 137.53;**

j) Represented increase of costs: 17.3%.

Such estimations only represent a scenario where different type of fuel is used and it does not include the investment costs of engine rebuilding. So, more accurate estimations would indicate an even larger increase of costs. Since in

<sup>33</sup> Bunker prices - Rotterdam. Bunkerworld.com. <http://www.bunkerworld.com/markets/prices/nl/rtm/> (viewed on 21.03.2014)

many cases there are no alternatives for sea transportation or other modes of transport increase the cost and/or lead-time even more, the incremental costs will be allocated to the service users – the cargo owners.

4) In 2010 it was estimated that 3000 of world's biggest companies would lose at least one third of their profits if they were to be kept financially accountable for all the environmental damage they supposedly have caused. It has been calculated that 3000 of world's biggest companies have caused damage to the environment of approximately \$2.2 trillion (1.6 trillion EUR). However, the overall financial liability from polluting parties is most likely even higher due to the fact that pollution from neither regular households, nor governmental structures have been included in the calculations. An actual allocation of such damage costs would influence not only the financial performance of allegedly polluting companies but also their customers, investors, pension funds etc. Illustration below shows the environmental damage expressed in monetary values caused to the environment by different business fields.

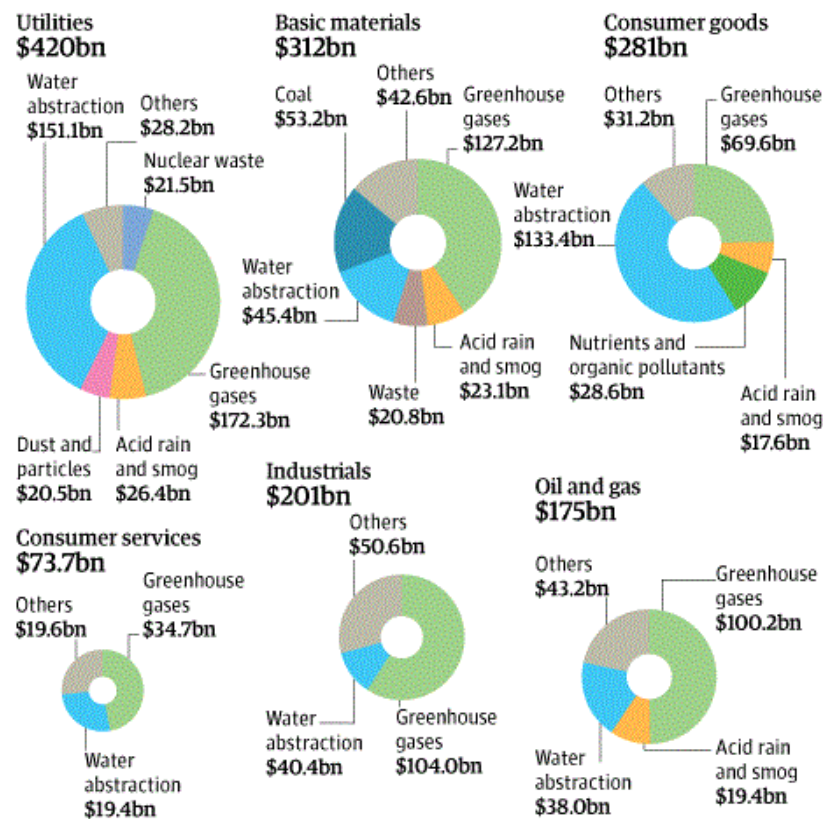


Figure 7. The cost of damage to the environment by business sectors<sup>34</sup>

<sup>34</sup> World's top firms cause \$2.2tn of environmental damage, reports estimates. Jowit J., The Guardian. February 18th, 2010. <http://www.theguardian.com/environment/2010/feb/18/worlds-top-firms-environmental-damage> (viewed on 21.03.2014)

If pollution costs actually were to be allocated and shifted to the polluters' expense portfolio, the whole world's economy would most likely suffer a significant recession causing job losses, business closures, tax income reduction etc.

5) From the philosophical point of view, it is believed that the environment should not be turned into a tradable market economy commodity. It might sound reasonable enough to decrease environmental pollution especially if that is something a business will have to pay for. However, at some point it becomes basically meaningless to treat the nature and the environment upon which the whole human and wildlife being depend on as mere commodities with a price for trading. "For example, what price would you put on the additional ton of carbon which, when burned, triggers irreversible, catastrophic climate change? Who would have the right to even consider selling off the climate upon which civilization depends? The avoidance of such damage is literally priceless".<sup>35</sup>

### Proponents

1) Primary of all, necessity of the PPP can be examined from business ethics point of view. The fact that environment around the society influences its behavior and different levels of health, is unassailable. Business is a very special and specific type of activity that, in a sense, cannot be called ordinary. To satisfy society's material needs and desires, business uses society's resources as input to offer this output. Businesses are responsible for the creation of employment, the generation of society's wealth and economical development. "Therefore the decisions of businessmen should be governed by the concern for the society, rather than by selfish motives".<sup>36</sup> So the code of business conduct and ethics in a way states that if something is to harm the society (in this case – pollution), business must act to preclude it (in this case

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<sup>35</sup> [Direct quote] The price of environmental destruction? There is none. Simms A., The Guardian. February 18th, 2010. <http://www.theguardian.com/environment/2010/feb/18/price-of-environmental-destruction> (viewed on 21.03.2014)

<sup>36</sup> [Direct quote] Business Ethics. Gavai A.K. Dr., Himalaya Publishing House, Global Media. Mumbai, IND. Pgs 7-15. 2010.

– bear the costs of eliminating or at least limiting the negative effects of environmental pollution).

Another principle of business ethics is the so called “The rule of spirits of services”. It dictates that business activities must be carried out in a manner that only the best possible practice of certain activities is to be used if the public is served and income off of this activity is generated. (36) In a way this rule also complies with PPP. If there is a reasonable possibility to perform certain business activities like cargo transportation excluding completely or to the maximum limiting the impact on the environment, such practice must be carried out since it would be the best practice.

In a similar matter to the two upper mentioned rules some of the business ethic rules may also be associated with PPP on a philosophical level:

- a) Service first and profit next;
- b) Business must be just and human as well as efficient and dynamic;
- c) With the growth in the size of business, attention must be paid to the growth of human values;
- d) Every business has a basic obligation of making the best and fullest use of its input etc. (36)

2) It is believed that there is a clear linkage in PPP between the environmental law and the property law. Environmental goods, for instance, fresh air, clean water etc, as well as the environment itself are not marketable objects, meaning, it is impossible to allocate the property right holder of them. So an irrational and illogical phenomenon occurs when either the polluter or the pollution victim is to be proclaimed as the owner of such goods. However, in real life there is a major contradiction between two scenarios:

- a) If no legislation is implied to ban activities causing pollution, it can be assumed that polluters are in favor towards obtaining property rights of the environment and its goods;
- b) As activities causing pollution gets worse and society’s welfare gets affected more dramatically, the pollution victims will band together to claim their right to protect the environment. This will lead to legislation which again will shift the property rights towards the victims.

The strength of these scenarios will fluctuate until equilibrium will be attained – an intersection between the marginal abatement cost for the polluter and the marginal damage cost schedules for the pollution victim. Figure 8 illustrates the collision between PPP and Victim pays principle (VPP) where X-axis represents the proclamation of property rights by one or the other party (measured in  $Z^0$  to  $Z^{\text{Max}}$ ) and Y-axis represent the allocation of costs towards one or the other party.

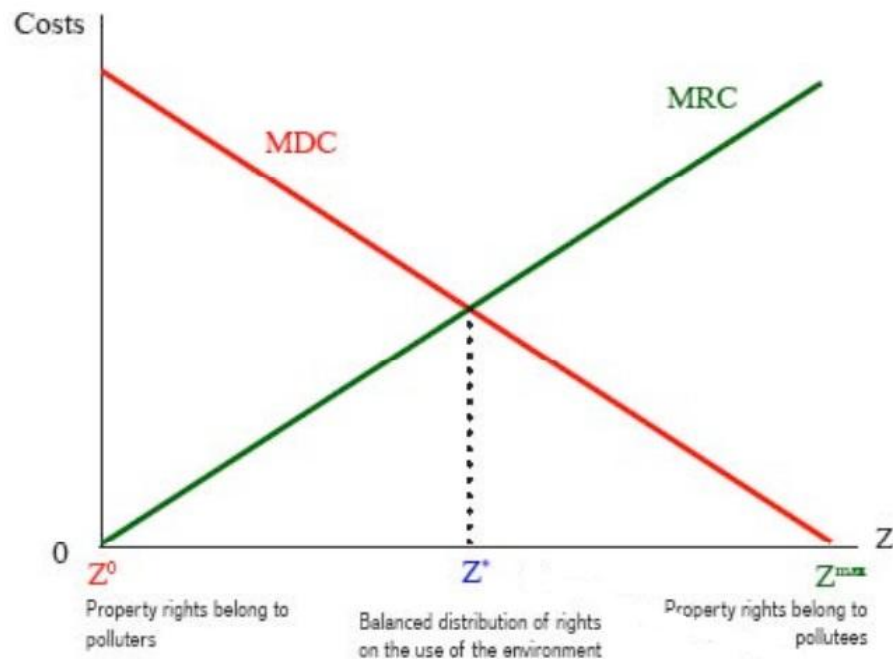


Figure 8. Collision between PPP and VPP

As shown, marginal damage costs (MDC's) are at its peak when polluter is unrestrained by pollution limitation or extraction laws and at its lowest when legislation is in full favor towards environmental protection. Thus, marginal remediation costs (MRC's) goes vice versa.

Point  $Z^*$  represents the previously mentioned equilibrium point at which both parties are expected to be satisfied. However, in many cases, depending on different reasons, point  $Z^*$  cannot be achieved in real life or it does not satisfied one of both of the parties.<sup>37</sup> Such theory assesses that polluter must

<sup>37</sup> THE COASE THEOREM AND PROPERTY RIGHTS. Economie de l'environnement Ecologie de l'economie. Gonzague Pillet. Helbing & Lichtenhahn. MESO Comparative Programme. July, 2006. [http://www.meso-platform.org/spec/meso/download/MESO%20formation/MESO%20PSUT\\_Lecture\\_2.pdf](http://www.meso-platform.org/spec/meso/download/MESO%20formation/MESO%20PSUT_Lecture_2.pdf) (viewed on 24.03.2014)

compensate the caused damage to the victims to create a fair balance between, so to say, impossible ownership of undefined property rights.

3) Another approach to argue for PPP is through an economics prism. If the environmental goods and environment itself are assumed to be limited in its abilities to satisfy the ongoing demand for it, economics theory on demand and scarcity can be applied. Figure 9 represents the well known economics rule of demand.

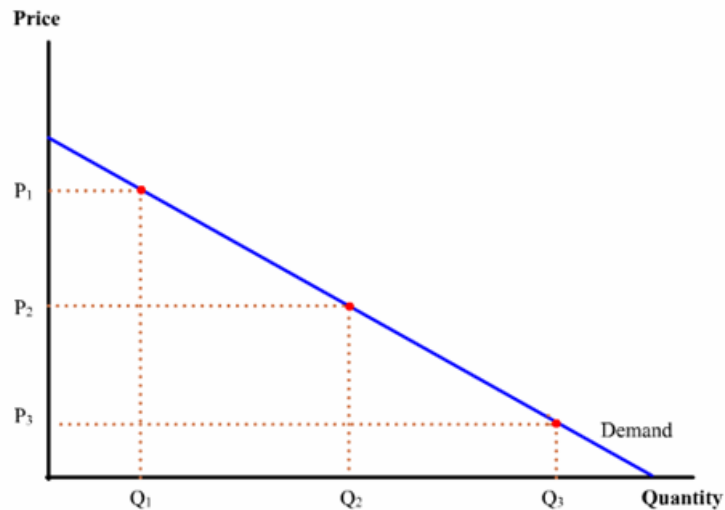


Figure 9. Economics rule of demand

By classical means, demand curve represents “a set of price-quantity points that depicts how quantity demanded of a good is affected by changing prices”.<sup>38</sup> Though, in means of PPP the line segment could be looked at the other way around – how the price is affected by changing demand in quantity. By such approach, a conclusion can be made that in times of limited resources, price which must be paid for use of them must go up. Meaning – the higher demand, the higher price.<sup>39</sup>

So if there is to be an assumption that the use (pollution) of the environment is in demand from polluters and environment is limited in its ability to satisfy their “needs” to damage it, they must be obligated to pay appropriately higher cost for doing so compared to a situation where “resources” are not in such

<sup>38</sup> Demand schedule (curve). Living economics. <http://livingeconomics.org/glossary.asp#D> (viewed on 24.03.2014)

<sup>39</sup> The Resource Shortage Is Real. Moyo D. Time., June, 2012. <http://ideas.time.com/2012/06/08/the-resource-shortage-is-real/> (viewed on 27.03.2014)

scarcity, for example – workforce. Using the same type of demand graph, PPP can actually be depicted visually in Figure 10 – when indulgence towards pollution is low (quantity), the costs that polluter must bear is/must be high. For example, The Baltic Sea is one of the most polluted seas surrounding Europe. For that instance it is to be incorporated in the new SEC area in 2015.<sup>40</sup> It will drastically increase the costs for ship owners and operators. However, such costs can be seen as appropriate taking into consideration the level of pollution in The Baltic Sea.

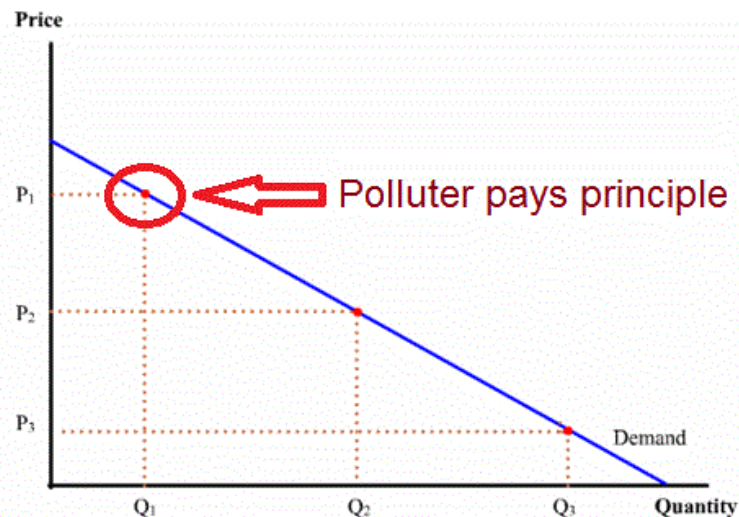


Figure 10. PPP on the demand line segment

#### 4.2. Scientist viewpoint

During the Baltic Breeze 2014 seminar at Kymenlaakso University of Applied Sciences, two doctor degree holders of the opposite fields gave their opinions on the PPP and its impact on the transportation and environmental issues.

The leading researcher/assistant professor at Riga Technical University and chemistry lecturer at Latvian Maritime Academy Dr.sc.ing, Sergey Gaidukov (Sergejs Gaidukovs) gave an interview concerning a wide perspective of PPP:

*Q: Do you think that Polluter Pays principle is clearly enough apprehensible for wider group of people and the society in general not just scientists, functionaries of particular fields and politicians?*

<sup>40</sup> Air pollution from ships. AirClim, Seas At Risk, Bellona Foundation, North Sea Foundation etc. Sweden, 2011. [http://www.seas-at-risk.org/1images/111128\\_Air%20pollution%20from%20ships.pdf](http://www.seas-at-risk.org/1images/111128_Air%20pollution%20from%20ships.pdf) (viewed on 29.03.2014)



A: No, PPP is not clear enough for the society in the developing countries. It should be more discussed at different levels of EU.

*Q: On your opinion, should the PPP, in different juridical levels, be defined clearly and unambiguously or it is acceptable that it stays in current expression form where its force lays in the level legal consciousness and spirit? Why?*

A: Yes, it is. I agree that PPP should be put into EU and also national regulation acts for better everybody (society, industry) understanding. Otherwise, there is no possibility to develop PPP way of thinking and doing business for better environment.

*Q: Already now there are many mechanisms that are said to be implementing the PPP in different legislations (taxation, emission control etc.). Would it be necessary to establish one package-legislation which then could be called a full implementation mechanism of the PPP? Why?*

A: Yes, it is possible. At the moment there is no joint EU strategy in the field. May be some legislation acts similar to EU REACH regulation, which was adopted for chemicals at EU level, can be adopted also for environment and PPP to control the full process and all pollution stages.

*Q: So who, on your opinion, should be named the polluter in transportation field – the society who creates demand for the service or the owner of a particular transport unit who actually creates pollution?*

A: By my mind, the combined approach needs to be applied. Both are considered in charge and share the responsibility for pollution. Otherwise, you cannot stimulate the automobile industry to develop more environment friendly transport solutions and users to choose the best vehicles form environment point of view.

*Q: From your point of view, do polluters, based on current legislation on national and EU level, financially cover enough damage done to the environment or should there be more firm control and restrictions?*

A: It should be more controlled than nowadays. So called, authorization,

restriction processes in the field of PPP can be applied.

*Q: On your opinion, is society in different parts of the world, including Europe, ready to pay extra to preserve the environmental surrounding?*

A: It should be. But society and industry do not wish and are not ready now. They must prepare in the nearly future. Some transition period can be applied.

*Q: Do you think that the PPP should be implemented and respected equally in all polluting business fields or there are fields where the liability should be borne by the society? (Which fields? Why?)*

I suppose that all fields of PPP should be considered similar. However, high hazard and risk and very dangerous processes to society must be strictly controlled. Life cycle assessment and risk analysis can be applied to define them (for example, nuclear, substances of very high concern).

Another academic, professor of seaports and logistics centers operations at West Pomeranian University of Technology, Szczecin, Poland, Ludmila Filina-Dawidowicz, PhD, commented the topic as follows, when asked for her opinion on Polluter pays principle in international transport and how it concerns the Polish transportation market:

*„Due to various reasons like traffic congestions, emission exhausts and transportation costs there are many uncertainties which mode of transport to use for cargo and passenger transportation. The latest trends are that more and more cargoes are being shifted from roads to rail and inland shipping. Also in means of traffic congestions and emission control, public authorities strongly encourage society and develop many projects to promote the use of public transportation instead of private.*

*A very stirring change to come for the maritime industry in context of polluter pays principle is the new EU regulation on sulphur emission control area coming in force in 2015. Such sulphur restrictions will dramatically lower the competitiveness of Polish seaports and the whole Baltic and Nordic seas region by significantly increasing the shipping costs. Shifting such major costs*

*on to the waterborne transportation sector in selected regions only is unfair. The costs of proper adjustments of ships traveling in this area to comply with the new regulations are inadequate compared to the environmental damage they cause right now. Also it is unreasonable to put restrictions upon parts of the world where environment is damaged significantly less than in other parts (like China). Such restrictions may cause the redirection of cargo flow from the Nordic and Baltic seas to Mediterranean and Adriatic Sea regions (eg. non-EU countries [Albania, Montenegro]). In this case land transport carriers will benefit who will deliver the loads in European countries, including the countries of Nordic and Baltic seas regions.*

*It is hard to say why such tough restrictions have been agreed upon in Europe so sudden. There are different opinions about that, some of which do not even rule out a possibility that some very powerful and influential industries might be standing behind it”.*

## 5. DEFFINING POLLUTER PAYS PRINCIPLE

Previous research has emphasized some core issues and shortcomings of the PPP. However, many positive and well performing aspects have been introduced as well. This chapter can be looked at as the recapitulative part of the research where the previous findings are compiled to generate an optimal, entirely original PPP definition and implementation mechanism.

### 5.1. Optimal definition of PPP

Considering previous findings, scientific opinions, fact and figures, the following definition of the Polluter pays Principle can be proposed:

*Polluter pays principle is a juridical principle inspired by the beliefs and understanding of the right of the society which obliges the society governing and serving entities, as do the society itself, to control, limit or/and completely eliminate pollution of all kinds of the surrounding environment as well as to carry out a proactive action and in adequate amount cover and bear the costs to fulfill these processes and/or the costs of liquidation of consequences in case of failure to execute these processes.*

The proposed definition in an adequately wide range covers all the main aspects, edges and core values of the PPP. If analyzed in details the following key points of the proposed definition of the principle can be distinguished:

- 1) It is a juridical principle. It means that in the narrower sense the principle is applicable via some kind of legislation and thus it is binding for everyone under this legislation. However, at the same time, under different legal systems, it can also be applied with no written legislative background;
- 2) Inspired by the beliefs and understanding of the right of the society. Since in its core, legal acts like laws and principles are considered the will of at least the majority of the society, PPP is also created to express the consciousness of the society;
- 3) Obliges particular behavior or actions. Such section covers the possibility of inadequate interpretation. If this particular definition would to be recognized by the governing bodies of whichever legislative level, this would just require

incorporating a clause in the legislation which would state that the particular legislative region adopts this definition. No major further explanation or definitions would be required since the proposed definition also lists the required behaviors;

4) Puts obligation upon all parties. The definition suggests that “the society governing and serving entities, as do the society itself” are to be kept liable for causing pollution. Such section clearly defines that polluters which is supposed to bear the costs of pollution can be businesses (serving entities) – as it is most commonly seen, governments and their subordinations and also every member of the society as well.

5) Covers all types of pollution. Some of the current definitions focus on some particular type of pollution. An expression “pollution of all kinds” cover also such modes of pollution like noise, soil etc. which are in many cases neglected;

6) Proactive action is required. The proposed definition, in comparison to many others, states that the polluter must not only bear the costs of pollution but also act proactively to minimize the potential damage as in many cases polluters choose to just deal with financial consequences since organization of damage relief tend to be the most difficult part of an accident aftermath;

7) Adequate amount of financial liability. A term “adequate” in its core is an extensive term. However, more precise linguistic expression is not necessary to not over-complicate the overall definition. Decision of “adequate” amount can be left for broader defining for courts or legislators;

8) Obligation to cover and bear costs. The difference between these two terms in this case depends on the action taken by the polluter. If polluter undertakes efforts to limit or minimize pollution causes by its action – he/she/it bears the costs of these efforts. If an accident has occurred, he/she/it covers the costs of elimination of the damage caused to the environment.

## 5.2. Universal implementation mechanism for transportation sector

Since transportation is a very specific and separate field which accounts for large proportion of the environment pollution, a precise package of measures and specific approach must be carried out. Since water pollution, waste

management and material use are widely covered in different levels of legislation already involving taxtions, restrictions and specifications, the basic concept and framework of PPP implementation mechanisms for pollution by emissions and noise are to be proposed.

### Air pollution

To estimate how much an air polluter in transportation field must pay, at its basics two figures must be obtained: amount of emissions ( $Q^e$ ) and a pre-determined coefficient ( $C^{air}$ ). The coefficient must vary depending on multiple factors concerning the paricular area where transportation activities are carried out:

- 1) How much emissions is still acceptable;
- 2) How dense is the natural inhabitent population;
- 3) How ingestive of emissions are the surrounding environmental objects;
- 4) How dense is the traffic;
- 5) How dangerous are the emitted exhausts.

The listed factors cover every major aspect upon which pollution may negatively interfere with the environment and all kinds of natural inhabitants. Further in-depth studies must be performed my local authorities to determine the coefficient. An extra coefficient ( $C^x$ ) must be added if particular area is surrounded by distinct infrastructure object like hospitals, schools, kindergartens etc. Such evaluation upon whether an extra coefficient should be added must be determined by local governments or municipalities.

Air pollution emissions, for instance  $CO_2$ ,  $CH_4$ ,  $N_2$ ,  $O_2$ , should be measured using gas chromatograph or other appropriate equipment.<sup>41</sup> The measurements should be taken on regular bases by the person creating pollution. However, random, unscheduled checks of the measurements should be carried out by local authorities as well.

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<sup>41</sup> Text of Test Method 3C -  $CO_2$ ,  $CH_4$ ,  $N_2$ ,  $O_2$  – TCD. Technology Transfer Network Emission Measurement Center. <http://www.epa.gov/ttn/emc/methods/method3c.html> (viewed on 07.04.2014.)

### Noise pollution

Similar approach needs to be carried out when determining the amount necessary to bear for noise pollution. Instead of emission quantities, amount of noise in the area outside an approximate of 1km radius from the source of the noise measured in decibels must be determined ( $Q^{dB}$ ) in cases of seaports, railroad hubs and other areas where transportation operations are undertaken as the main activity. Additional to that, amount of time (T) during which the polluting noise occurs must be taken into equation. Further on, a coefficient representing the nature of the surrounding ( $C^{noise}$ ) must be estimated based on the following factors:

- 1) How dense is the natural inhabitant population;
- 2) What is the current noise density;
- 3) What is the layout of the environment surrounding the source of noise;
- 4) What are the possibilities to decrease the noise;
- 5) What is the condition and relief of transportation motion surface.

The layout of the environment surrounding the source of noise is necessary to be determined since there are many ways how from physics point of view how noise level can be decreased if the sound wave gets in contact with different obstacles like water, buildings, forests etc. However, sometime noise cannot be decreased due to technical reasons or even simple impossibilities of particular movements.

Similarly as in case of air pollution, further in-depth studies must be performed by local authorities to determine each coefficient. In before, an extra coefficient ( $C^x$ ) must be added if particular area is surrounded by distinct infrastructure object like hospitals, schools, kindergartens etc.

In transportation hubs authorized environmental stationary or semi-stationary noise sensors should be installed by the seaport/railroad hub operator. Random, unscheduled checks of such equipment should be carried out by the public authorities. The cost of noise pollution must be borne by the hub; however, such cost can then be appropriately allocated towards the initial source according to hubs internal regulatory enactment.

## 6. RESULT ANALYSIS AND CONCLUSIONS

As the result of the study, it can be concluded that most of the emphasized goals and objectives of this study were reached. The main goal - academic research on current situation of polluter pays principle implementation in different legislations in correlation with international transportation sector – was carried out entirely and can be regarded as a reliable source for bases of other studies as many high-profile sources and knowledge based on previous studies were used.

Studies upon legal principles and their status in legal systems in general were performed so parts of the research are valid for use not only for transportation sector but legal and legislative as well. Certain sections of the thesis paper were in strong tie with economical, financial, management and political fields as well.

The conclusion part about universal implementation mechanism and definition is the core of the study. If the latter completely satisfied the initial vision and idea, then the former only partially complies with the initial idea of it due to the lack of technical knowledge, expertise and experience in fields of finance and physics. However, the idea of creating a comprehensive implementation mechanism based on mathematical formula was replaced by theoretical, management/political-style reasoning stating criteria and noteworthy factors for such mechanism. Therefore, a more technical approach could be the basis for further studies of the topic.

The pros and cons list, presented in subsection 5.1., can be assessed to be innovative conclusions of the topic as only literature about different subtopics were used leaving the main ideas of different approaches as true novelties.



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