SOCIAL COMMITMENTS OF THE SCIENTISTS, PHYSICS AND CORRUPTION

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Abstract. *Physics may offer powerful tools to be used by socially committed scientists to model social, political and economic phenomena, among them corruption. The word corruption was used in Physics and Philosophy, in Antiquity, to describe an alteration of the actual motion (behaviour) of a body, with respect to that expected to be, due to the physical law applicable. The alterations of the actual motions of bodies have been explained by physicists by using Physics models. The authors have used Physics models to find characteristics of social corruption, characteristics which are exposed in the paper. A few simple Classical Physics models are introduced in the paper - the three Newton laws, conservation laws, dimensional homogeneity, and the basics of the processing of data. These models are being used by the authors to explain some classical or contemporary examples of social and economic corruption, and may be used by socially committed scientists to identify and understood corruption, possibly suggesting how to fight and forecast concrete cases of corruption, models being applicable to explain many other everyday life phenomena.*

Key words: *Corruption, fraud on law, physics models, action and reaction, inertia, proportionality, conservation principles, dimensional calculus, dimensional homogeneity, error estimation, sociophysics, sociooptics.*

Introduction

Following the financial crisis of 1720 (known also as ''South Sea Company bubble''), some governments decided to encourage research, development and engineering.

Scientists have been at the origin of the later progress due to the enormous social impact of science and of technology which have lead to: the industrial revolutions, the discovery of radioactivity, of nuclear reactions and of the structure of matter, the revolution in information technology.

This progress has also significant ecological impacts, a positive one but also a negative one. It generates the necessity of a new kind of "intelligent" growth, to which socially committed scientists are to play an important role. That may be helped if research and its applications be based on interdisciplinary education, so preventing specialists from being inhibited by a lack of general scientific overview.

Particularly, because Physics has large spectra of models and it is studied from the school age as a component of scientific literacy, Physics is called on to suggest scientists and to help them to apply laws, principles, methods, structures, models and ways to understand, identify, describe, manage and control social and economic phenomena, by analogy with physical natural phenomena.

The authors have make use of such models to investigate corruption, an alteration from a lawful behaviour, comparatively, in Physics and in society. They have drawn, by analogy, a few conclusions on the characteristics of the social corruption. These characteristics are presented in the paper to assist socially committed scientists to deal with corruption, by using simple models relying upon: the Newton's laws of Mechanics, the conservation principles, the dimensional analysis, the processing of experimental data.

Quantum mechanical types of behaviour of ensembles of human individuals previously developed by authors are not introduced in this paper.

The authors give a few examples of modelling recently described concrete situations of social corruption, analysed using the introduced in the paper Classical Physics models, to suggest how to fight and even, forecast and prevent some types of corruption when considering different world sceneries for different social and economic phenomena at different levels, thematic, space and time horizons.

Definitions of corruption

The word "Corruption" comes from Latin **corruptio**.

In contemporary dictionaries, "corrupt" (L corruptus) means: broken in pieces, destroyed; corrupted (ptp. of corrumpere), equiv. to **cor-** + rup- (var. s. of rumpereto break) + -tus ptp. Suffix; when used as an adverb corrupt literally means "utterly broken"

In modern English usage, the words corruption and corrupt have many specific meanings, like:

- **Political corruption**: the abuse of public power, office or resources by government officials or employees for personal or group gain, e.g. by extortion, soliciting or offering bribes (including Electoral fraud, slush funds).
- Nepotism, cronyism, favoritism. ·
- **Bribery** in politics, administration, management, justice, army or sport (including **match fixing**).
- Baksheesh.
- **Police corruption**.
- **Corporate corruption**: corporate criminality and the abuse of power by corporation officials, either internally or externally.
- **Putrefaction**: the natural process of decomposition in the human or animal body or of plant body following death.
- **Linguistic corruption**: the change in meaning to a language or a text introduced by cumulative errors in transcription as changes in the language speakers' comprehension.
- **Data corruption**: an unintended change to data in storage or in transit in a system of processing information.

Legally, corruption is an occult disregard of the law, the violation of legal provisions in their meaning and spirit**.**

This disregard of the law may be or may be not relying upon other laws. Frequently, in legal courts, the corruption is connected with fraud on law.

There is reckoned fraud in law, when certain legal rules are not used for the purpose for which they were enacted, but to circumvent other mandatory legal rules.

The interest in corruption is continuously increasing with the increase in societies' diversification, interaction, informatisation and with the progress of globalization.

Institutions dealing with corruption

The contemporary corruption is so important that, there are being frequently founded institutions dealing with political and economic corruption, from world to local levels.

Transparency International, since 1995, has published an annual Corruption Perceptions Index (CPI) listing and ranking the countries of the world according to "the degree to which corruption is perceived to exist among public officials and politicians, as determined by expert assessments and opinion

surveys". The organization defines **corruption** as "the abuse of entrusted power for private gain" or "the misuse of public power for private benefit".

The CPI draws on 13 different surveys and assessments from 10 independent institutions: the African Development Bank, the Asian Development Bank, the Bertelsmann Foundation, the Economist Intelligence Unit, Freedom House, Global Insight, International Institute for Management Development, Political and Economic Risk Consultancy, the World Economic Forum, and the World Bank. Countries must be assessed by at least three sources to appear in the CPI.

As of 2010, the CPI ranks 192 countries "on a scale from 10 (very clean) to 0 (highly corrupt)."

In 2011, India ranks 95th, with 3.1 pt, Romania 75th with 3.4 pt.

The CPI measures perception of corruption only, due to the difficulty of measuring absolute levels of corruption.

There are to be mentioned and other important institutions: the ''Grouped'Etatscontre la Corruption'' (**Group of States Against Corruption**), a body established under the **Council of Europe** to monitor the implementation of instruments adopted by member states to combat political corruption;

D. N. A. National Anti-corruption Directorate (a prosecution entity) in Romania, with national headquarters and 15+3 local branches; India Against Corruption, a movement created by a group of citizens from a variety of professions and statuses to work against corruption in India, currently headed by Anna Hazare; local Indian NGOs, like Association for Social Transparency, Rights and Action (ASTRA) in Karnataka; the LokSatta Movement which has transformed itself from a civil organization to a fully-fledged political party - the LokSatta Party, visible in Andhra Pradesh, Tamil Nadu, and Bangalore.

"Corruption" has been firstly described in Physics

In dictionaries, in social studies and in media, there is not even an allusion about the Physics' origin of the word „corruption".

But, the word „corruption" was firstly used in Physics, since Antiquity, to describe an alteration of the actual motion (behaviour) of a (celestial) body, with respect to the expected motion, subject to the physical law applicable.

Along History, physicists have measured and explained corruption in Physics, starting with the irregularities in planets' motions, have modelled them and have found ways to deal with, to master, to reduce or sometimes to eliminate apparent corruption. By studying corruption, physicists have found unknown macro- and micro- bodies, new laws of behaviour, new structures, new forces a. s. o. Sometimes, the fight for eliminating apparent corruption led to unsuspected results: for example, to the discovery of the planets of Earth, Neptune (1846) and Pluto (1930).

Because Physics has large spectra of models able to describe social, political, economic, human, psychical, biological, chemical and engineering phenomena, not only physical, ones, by analogy with Physics models, Physics seems convenient to be applied to study and deal with corruption, being called to suggest and/or develop models, laws, principles, methods, structures and ways to understand, to control, to forecast or to fight and even prevent corruption.

A few characteristics of corruption in society

By their comparative approach of corruption in Physics and in society, using Physics models, the authors have drawn a few conclusions about corruption in society:

- Corruption has cosmic studies origins and the term designating it has been continuously used in Physics since Antiquity;
- Corruption means alteration of a lawful behaviour because of an external influence, (disregarded when the law of supposed behaviour had been formulated);
- Corruption has its rules;
- Corruption may be generated by an external individual influence, a tandem or a group (family, ethnic group, tribe) influence, which have particular interests opposing the general ones or by another influence (environmental, climatic a. s. o.);
- The external influence at the origin of corrupted behaviours is also subjected to rules;
- The rules governing corruption may be known and by a refined, extended or diversified research, the path might open a new perception of the structure and future evolution of the corrupted phenomenon;
- An approach at a higher level of understanding might describe simultaneously both the basic law and the rules giving rise to previously „corrupted" behaviour as regards the basic laws;
- The new more general law may describe „corrupted" behaviours until a new kind of corruption (or a refined one, or an inter-disciplinary one or a far range one) is discovered and the cycle: applied corruption, theoretical explanation and unification of corruption rules and basic laws, restarts;
- In society, the basic social laws or regulations may be infringed by "the legal corruption", by existing valid laws covering „corrupted" behaviour as regards the basic law, through "fraud on law";
- Laws permitting corruption generate system (society) structures, organized, managed, run and acting (at least, partially) subject to corruption rules, eventually by fraud on law;
- Corruption is facilitated by a superior norm (law) and/or higher level structural (institutional) frame permitting corrupts to regulate or promote corruption at lower levels, facilitating that one subsystem of a system make profit on the loss of other subsystems, for example financial and industrial ones; army and civil ones, private or state ones;
- Corruption propagates legally and structurally from universal to local levels and is financially supported reversely, by the black money collected by corruption and by a culture of bribing, favouritism and nepotism;
- Corruption is making profit of the incompetence and/or corruption and/or subordination to corruption interested groups or individuals of the members of the society who normally are in charge of fighting corruption;
- Inequalities in socio-economic status as a result of corruption generate corruption and are expanding by corruption;
- Corruption is stimulated by existence of social segments having Quantum Physics type behaviours - parliament, justice, other state institutions managing society's power (police, army a. s. o.) and take advantage from the competition between such groups and groups where there are valid Classical Mechanics type rules of behaviour (as for the society at large);
- Applied corruption (directly seen by media and laymen) is ensured and operated by networks, self interested closed cliques, old boys networks, structures extended horizontally and vertically;
- Corruption is self-sustainable in the absence of a strong, permanent, general, sustained society's will to fight it, when there is illiteracy and lack of education among population;

- The social corruption may be more versatile, refined, deep, extended, interdisciplinary, than the physical corruption;
- Corruption is not inexorable, because it is subject to social laws which are subjective, being generating by human groups or individuals on behalf of the whole society referred; these chosen laws, have a local in space, in time and domain validity; they may be changed by the society, in opposition to Physics, where laws are natural ones, time and space independent, objective ones, not dependent of humans;
- The result on human control of social laws may be not only a decrease of corruption but, also, an increase, an enlargement, a deepening, a diversification, a flourishing of corruption if those groups or individuals subjectively generating social, political or economic laws and regulations are corrupted themselves as individuals or as a group or are incompetent or are obeying to orders from persons or groups (lobbyists) interested in generating a given kind of corruption, for a given period of time, in a given region, concerning a given activity.

Physics, by its models, may suggest: how, where, when, in connection with what, to find corruption, depending of the type of the law to be broken by corruption and may identify corruption which breaks laws; may show how to find the corruption rules; which kind of laws are contributing to infringe the main law; what is the mechanism and the hierarchy of the laws and of the structures (institutions, networks) implied in facilitating visible corruption; analyze different explanations for the given social findings.

The fraud on law might be diminished by proper competence in applying Physics tools (f. e., by showing how by fraud on law are infringed the action-reaction and/or proportionality postulates, deriving from the laws of Mechanics, the dimensional homogeneity) to prevent fraudsters for using their rights to elude their obligations.

Socially, too, it is convenient to find general laws to include both basic laws and laws considered responsible for corruption, by fraud on law. This path might open a new perception of the structure and future evolution of the corrupt phenomenon, an approach at a higher horizon and level of understanding, like to the discovery of new satellites in Physics when the motion of planets appeared as being corrupted.

To reduce social corruption, the Parliaments and Governments have to amend those laws and rules and regulations facilitating corruption by infringing, by fraud on law, provisions of the Constitution and of other organic laws.

There seems necessary, as regards legislative procedures, to improve the legislative regulations leading to the passage of laws in Parliament or of adopting Government's ordinances or of issuing institutional advices and reports as well as to increase the responsibility of all legislators, which must decide in the favour of public interest but not in the private interests of some individuals or lobbying groups, deeply seeking to be favoured.

The legislators are protected when taken their decisions, even in their own advantage, by immunity. and as well as judges (who, more, are nominated for life) and because for them are valid Quantum Mechanics type behaviour rules, which eventually, may hide and favour corruption, there is necessary a social control of their behaviour (of statistical type, f. e.), made possible by encouraging a large transparency and by the monitoring of their decisions.

A few Classical Physics models for social corruption

These characteristics of corruption and simple Physics models may be used, by socially committed scientists and not only, to improve social environment by recognizing, measuring, modelling, forecasting and fighting corruption.

When applied to society, relationships might have some characteristics a little different from those of the Physics laws. Social laws and the definitions or the conditions for space, time, objects, and interactions are relatively less rigorous than in Physics. We shall consider social laws, when possible, as being postulates (acceptable, based upon partial check) and less rigorous.

There are two complementary approaches useful for socially committed scientists:
- to find a Physics model to explain a chosen type of social, politic or economic corruption or
- to start from an existing Physics model and to find social, political, economic phenomena where this Physics model may, eventually, fit successfully - like in the next part of this paper.

Here following are described a few simple Physics models to be used by any scientist, in the everyday life.

Newton's laws of motion

The three laws of motion were first compiled by **Sir Isaac Newton** in his work ***PhilosophiæNaturalis Principia Mathematica***, first published on July 5, 1687.

Newton used these 3 laws to explain and investigate the motion of many physical objects and systems.

These laws describe the relationship between the **forces** acting on a body and the **motion** of that body due to those forces.

These laws have been expressed in several ways over more than three centuries and may be summarized as follows:

First law: Everybody persists in its state of being at rest or of moving uniformly straight forward, except insofar as it is compelled to change its state by the force impressed.

If the **resultant force** (the **vector sum** of all forces acting on an object) is zero, then the **velocity** of the object is constant:

$$\sum F = 0 \Rightarrow \frac{dv}{dt} = 0 \qquad (1)$$

Consequently, an object that is at rest will stay at rest unless an unbalanced force acts upon it; an object that is in motion will not change its velocity unless an unbalanced force acts upon it.

Newton's first law is often referred to as the **law of *inertia***. It is a restatement of the law of inertia which **Galileo** had had already described. It permits the introduction of inertial reference frames.

Second law: The **net force** acting on a particle is equal to the time rate of change of its **linear momentump,** in an **inertial reference frame**:

$$F = \frac{dp}{dt} = \frac{d(mv)}{dt} \qquad (2)$$

where, for constant-mass systems, the mass can be taken outside the **differentiation** operator by the **constant factor rule in differentiation**; thus, for constant-mass systems:

$$F = m\frac{dv}{dt} = ma \qquad (3)$$

where **F** is the net force applied, m is the mass of the body, and **a** is the body's acceleration. Thus, the net force applied to a body produces a proportional acceleration.

Any mass that is gained or lost by the system will cause a change in momentum that is not the result of an external force. A different equation is necessary for variable-mass systems.

Consistent with the **first law**, the time derivative of the momentum is non-zero when the momentum changes direction, even if there is no change in its magnitude; such is the case with **uniform circular motion**.

The relationship also implies the **conservation of momentum**: when the net force on the body is zero, the momentum of the body is constant. Any net force is equal to the rate of change of the momentum (as a vector, in magnitude or in direction).

Third Law: To every action there is always an equal and opposite reaction; or the forces of two bodies on each other are always co-linear, equal in magnitude and are directed in opposite directions.

The Third Law means that all forces are interactions between different bodies and thus that there is no such thing as a unidirectional force or a force that acts on only one body.

Whenever a first body exerts a force **F** on a second body, the second body exerts a force −**F** on the first body. **F** and −**F** are equal in magnitude and opposite in direction. This law is sometimes referred to as the **action-reaction law**, with **F** called the "*action*" and −**F** the "*reaction*". The action and the reaction in Physics are simultaneous.

A force means an interaction; it acts between a pair of objects, and not on a single object. So, each and every force has two ends. Each of the two ends is the same except for being opposite in direction. The ends of a force might be considered as mirror images of each other.

Newton's third law may be stated, more generally, as:

Given two objects A and B, each exerting a force on the other,

$$\sum F_{a,b} = -\sum F_{b,a} \qquad (4)$$

where $\mathbf{F}_{a,b}$ are the forces from B acting on A, and $\mathbf{F}_{b,a}$ are the forces from A acting on B.

Newton used the third law to derive the law of **conservation of momentum**; however from a deeper perspective, the conservation of momentum is the fundamental idea.

Laws of conservation

In modern Physics, the **laws of conservation** of **momentum**, of **angular momentum** and of **energy** are of more general validity than Newton's motion laws, since they apply to both light and matter, waves and particles and to both classical and non-classical physics. This can be stated simply, "Momentum, energy and angular momentum can neither be created nor destroyed."

Conservation of energy was discovered nearly two centuries after Newton's lifetime, the long delay occurring because of the difficulty in understanding the role of microscopic and invisible forms of energy such as, that time, heat and infra-red light.

A few examples of classical social applications of Newton's Laws

To Newton Laws (in social applications is better to be called "Postulates") correspond causality, which is the relationship between an event (the cause) and a second event (the **effect**), where the second event is a consequence of the first, in the special situation when antecedence is reduced to simultaneity, understood as for social phenomena (as having a much larger time constant).

The previous equations observe the order cause – effect of their terms.

Though cause and effect are typically related to **events**, candidate quantities in social life may include: **objects**, resources, **processes**, **properties**, variables, **facts**, rights, actions. The quantitative analysis of causes and effects of a process, based on these three Laws (social Postulates) may stay at the basement of any social analysis.

"Status quo antem" corresponds to 1st Postulate: "no action leads to any change in motion".

To the 2nd Postulate may correspond principles and rules of proportionality: - "the variable cost is proportional with volume of the goods or services of the same nature (considered within defined limits)"; - "the value added tax is proportional with the added value"; - "the number of seats for the representatives of a state in the federal parliament is proportional with the number of inhabitants", - "the penalty is proportional with the damage". Alterations in applying such rules or laws suggest searching for corruption.

For example, to quote Indian sources: there have been several cases of collusion of officials of the income tax department of India for a favorable tax treatment in return for bribes; preferential award of public resources, iIlegal mining in India favoured by local authorities; public land in areas with short supply of water awarded to private concerns at negligible rates; (black) money removed from the official economy (via corruption, bribery, tax evasion, etc.) and stored outside of the country; corruption involving senior armed forces officers.

Proportionality is a principle in law ('second Postulate') which covers two distinct (although related) concepts: within Criminal Law (at national levels) and International. Law.

In Criminal Law, the punishment of a certain crime should be in proportion to the severity of the crime itself. In practice, systems of law differ greatly on the application of this principle. In some systems, this was interpreted as lextalionis, (an eye for an eye). In others, it has led to a more restrictive manner of sentencing. For example, all European Union countries have accepted as a treaty obligation that no crime warrants the death penalty, whereas some other countries in the world do use it.

The proportionality principle, moreover, is regarded as a fundamental element of regulatory policy and public administration. In this context, the principle is considered to find its origins in German constitutional and administrative jurisprudence. Over the past fifty years, however, it has become a preferred procedure for managing disputes involving an alleged conflict between two rights claims, or between a rights provision and a legitimate state or public interest.

From its German origins, the proportionality analysis spread across Europe and into Commonwealth system.

In International Law: the incidental (i.e., unintended) harm caused to civilians or civilian property must be proportionate and not excessive in relation to the concrete and direct military advantage anticipated by an attack on a military objective.

The principle of proportionality has played an important role in preventing undue invasions of basic rights for the purposes of countering terrorism.

The characterizing of the causal relationship may be the subject of much debate in each case.

Contiguity, implied in causality (Max Born), postulating that cause and effect must be in spatial contact or connected by a chain of intermediate things in contact is always implied.

The Physics action-reaction Law, as an *action-reaction postulate* (ARP), may model many non physical phenomena. These phenomena might have some characteristics different from those of the physics law of action–reaction, but not, essentially, affecting it. The time constant might be different, for example, the nature of the reaction might be also different.

The *action-reaction postulate* has analogies in many non physical issues:

- Vedas "if one sows **goodness**, one will reap goodness; if one sows **evil**, one will reap evil".
- Karma in **Indian religions**, treated in **Hindu**, **Jain**, **Buddhist** and **Sikh** philosophies, is the belief that a person's actions cause certain effects in the current life and/or in future **life**, positively or negatively.
- Hegel's dialectic principle of "unity and conflict of opposites (contraries)".
- In Economics, the demand and the offer act reversely; or if the action means expenses, the reaction would mean income.
- In the theories on Law, the rights are always accompanied and conditioned by obligations. If the action means more rights, the reaction would mean more obligations. The reverse allegation is also valid.
- A civic principle asks that one should take responsibility for all his own actions.

Complying with the action reaction postulate (rights vs. obligations) is a requirement at the basement of judges' reasoning.

The observation of the action-reaction postulate is evident in the major part of provisions of national Constitutions: „national citizens, foreign citizens, and stateless persons shall exercise their constitutional rights and freedoms in good faith, without any infringement of the rights and liberties of others"; „no budget expenditure shall be approved unless its financing source has been established".

Typical examples of breaking action-reaction postulate (ARP) are offered: by media campaigns, by the official names chosen for some organizations, by barristers who usually stress only action or the reaction component, by many of those making petitions or complaints to authorities.

Other typical examples of breaking action-reaction law are offered by the requests of the representatives of some groups on behalf of those groups to gain financial and other gains without offering society nothing in return for their demands or at least by indicating where from to take the supplementary required resources,. One could mention, f. e., some trade unions, which ask increased salaries without indicating the source of the new demanded funds (where to diminish spending) or what they offer to increase revenues of the patronage (including the State) – for example, the unions do not ensure the upgrading of the training of their union members with regards the use of IT technologies or of the contemporary standards of quality or of learning international languages.

Sometimes, politicians do not evaluate the possible reactions to their declarations, consequently suffering severe consequences.

The same is valid for political parties which, during electoral extended campaigns, to gain votes, do pass laws in Parliament providing for uncovered budgetary future expenses, which shall lead to future chronic State Budget Deficits.

But, in spite of constitutional provisions („no budget expenditure shall be approved unless its financing source has been established"), the State Budget Deficits of many countries have continuously increased in the last years, some Governments being obliged to implement them, not being possible to infringe previously passed laws which have been providing for unsustainable social expenses and salaries. Some constitutional provisions may be infringed by other laws, previously passed by Parliaments, by „fraud on law".

The solutions for the Governments would be to identify and amend those laws generating corruption, through the infringement of the provisions of the national constitutions.

This refers to the reduction of opportunities for corruption created in the past.

For the future, there seems necessary, as regards legislation procedures, to improve the legislation regulations leading to the passage of laws in Parliament or of adopting Ordinances by the Government or of issuing institutional advices and reports and to increase the responsibility of all legislators, including the Parliament members which, must decide in the favour of public interest: "In the exercise of their mandate Deputies and Senators shall be in the service of the people"(Constitution of Romania), but not in the private interests of some individuals or groups, deeply interested to be favoured, as have been accused, sometimes.

The European Union is in course of implementing constitutional changes to limit the breaking of the 3rd postulate in dealing with the national budgets.

An analysis of the Constitutional content, at the next Revisions of Constitution, by considering the mentioned Postulates (of proportionality and of rights and obligations) seems necessary.

When educating people, the action-reaction postulate is introduced very early, even before hearing about Physics, for example, when a mother is conditioning the feeding of a baby by a certain behaviour of the baby (by generating a conditional reflex); later on, in earlier childhood, f. e., when a baby is told not to knock or to kick hardly because this will result in hurting himself. The ARP is applicable everywhere, every time, in every interaction, subjected to conditions of stability of the implied system, mentioned above.

A typical example of breaking action-reaction postulate in early school education is offered by a pupil who is wishing a higher mark without doing more work for reaching it, but by cheating.

Corresponding to the ARP, the pupil is to be trained to have a proactive approach in expecting an increase in his compensation by the reaction of the environment, that meaning to perform a more intense action or a longer time one or a better one.

Some canonical rules, taught early to pupils, may also be explained and modelled by the action-reaction postulate, f. e.: not to take other's goods without paying for them and other commandments.

For educating a responsible citizen, there is important to teach pupils to try to be inventive, creative in *observing* the action-reaction postulate, not in finding ways to infringe it.

The observation of the action–reaction postulate is essential in ecological education of pupils, by showing them the possible negative consequences of their bad ecological actions, as a result of the reaction of the environment to their unhappy actions, starting from simple actions as not keeping their body and their close neighbourhood clean, as wasting water or throwing plastic foils and bottles and even home waste everywhere.

The "problem solving" and "solution oriented" approaches might be introduced in teaching Physics and other topics by applying ARP, through emphasizing the gains of such approaches as the results of reaction to the pupil's actions.

Changing the signs of some of the data in a statement of a problem could demonstrate the role of reaction in the studied phenomenon.

It is useful to ask the student to every time think, also, to non Physics applications of the physical law, tool, method used, to suggest ways for judging the different approaches in those non physics applications and for improving the precision of the physics model used. There are to be mentioned here the unhappy titles of some important international treaties like ''Human Rights Charter'' or names like ''Court of Human Rights'' titles which, without intent, may encourage the abuse of requiring more rights by those who do not observe their correspondent obligations.

But, his infringement of the Action-Reaction Postulate is not seen for the name of the new Indian "citizen's charter" or at classic thinkers.

F. e., on the tomb of Voltaire (François-Marie Arouet, 21 November 1694 – 30 May 1778), a great French Enlightment writer, there is mentioned that ''he fought for the human rights against the feudal abusive obligations''. "He fought the fanatics" may be interpreted as to refer to Voltaire's observing the second postulate – of proportionality, not observed by the fanatic people.

Fig. 1. Voltaire's tomb in the Pantheon in Paris (since 1791)

Some applications of Conservation Laws (as social Postulates)

Newton's laws are the result of conservation laws of the quantities non regenerative and non perishable in a conservative system (referring, in Mechanics, to the total energy, the total linear or/and circular momenta), to ensure the stability of the system in its stationary evolution. But, conservation laws are acting in all fields.

In biology the concept of "areal" is used (i.e. minimum surviving area for an individual animal of given specie, in a given environment), the size of an areal being determined by conservation laws, subject to the speed of regeneration of renewable resources.

Conservation laws are present, too, in social life of humans, when having a limited resource for a defined social group, under specified conditions, subject to defined space and time horizons and the conservation postulates might limit the social development, particularly, in the present time of globalization, at global level (industry, agriculture, tourism) mainly due to the consumption of limited, non-renewable world resources (fossil fuels, gold, f. e.).

May be, the conservation laws impose that a further development of developed countries observing traditional patterns is not a solution, on the actual pattern, if we consider a worldwide homogenizing of the level of development. Some world finite resources may limit the world development to a couple of years, only.

Maybe, it is the case to speak of ''re-development'' and of other ''intelligent'' ways of development.

If a sustainable increase of known resources is possible, the speed of this possible increase of available resources put limits to a sustainable rhythm of development. Of course, progress in science, technology and management in replacing limited resources with others, renewable or less scarce ones, make a sustainable development possible on a longer run, on a larger human and geographical scale.

The conservation laws may require redistribution of world resources or of their rhythms of consumption and these requirements may generate conflicts.

A debt on the future is not an unlimited resource as it is seen by some governments, but it is leading to a spiral of debts, taxation, discouraging business but promoting corruption and regress in the middle run and more, in the long run. These debts generated by an egocentric generation are to be paid by future generations.

Dimensional Analysis

Dimensional Analysis (D. A.), largely used not only by physicists but by almost all scientists, is easy to be understood and applied, allows and stimulates creative approach, may be largely used almost everywhere and may be introduced into the curriculum of any undergraduate Science program.

In the following, there are exposed basics of D. A., how to find dimensional equations, examples of their applications in different fields.

The basic principle of Dimensional Analysis was known to **Isaac Newton** (1686) who referred to it as the "Great Principle of Similitude". Important contributions were made by the 19th century French mathematician **Joseph Fourier**, based on the idea that the physical laws (like $\boldsymbol{F = ma}$) should be independent of the units employed to measure the physical variables.

This led to the conclusion that meaningful laws must be formulated as homogeneous equations in their various systems of units of measurement.

In Physics, D. A. refers to the operations with dimensional equations and with units, describing the nature of physical quantities. In other sciences D. A. operates with other specific quantities.

The value of a dimensional physical quantity **X** is written, within the dimension **[X],** as the product of a unit **{X}**and of magnitude, **x,** a dimensionless numerical factor:

$$\mathbf{X = x\ \{X\}} \qquad (5)$$

Because a physical quantity **X**has not to depend of what unit, **{X_1},** it is expressedone may write:

$$\mathbf{X = x_1 \{X_1\} = x_2 \{X_2\},} \quad (6)$$

where $\mathbf{x_1}$and $\mathbf{x_2}$ are the magnitudes (values) of the same quantity **X**expressed with the units **{X_1}** and respectively **{X_2}** and consequently, all the commonly used systems of units in physical science have the property that the number representing the magnitude of any quantity (other than purely numerical ratios) varies inversely with the size of the unit chosen.

This universal property of unit systems, often known as the ''absolute significance of relative magnitude'', determines the structure of all dimensional formulas.

Because physical quantities may be connected, in many ways, there is necessary to select a set of physical quantities to be considered a fundamental (basic, primitive or primary) set, from which all others physical quantities, the derived (secondary) quantities, could be defined.

The choice of the basic set of dimensions is, thus, partly a convention, but cannot be arbitrary, because the dimensions must form a basis: they must **span** in a multi-dimensional space and be **linearly independent**.

Basic units are defined for fundamental quantities, possibly in different ways, in different fields, in different historic periods.

The fundamental quantities (and their symbols) and their units (and symbols), currently agreed in Physics, established by international convention, form the International System of units (SI) and are:

length, **L** (m, meter); *time*, **T** (s, second); *mass*, **M** (kg, kilogram); *electric current*, **I** (A, ampere); *thermodynamic temperature*, **θ** (K, kelvin); *amount of substance*, **M** (kmol, mol); *luminous intensity*, **J** (cd, candela)**.**They form a set of **fundamental dimensions** and may be seen as a vector space over rational numbers.

Dimensions

It can be proved that every secondary quantity which satisfies the condition of the absolute significance of relative magnitude is expressible as a product of powers of the fundamental quantities:

$$\mathbf{X = C* L^{\alpha} *T^{\beta} *M^{\gamma}*I^{\delta} *\theta^{\varepsilon}*\mu^{\zeta}*J^{\eta}} \quad (7)$$

where **C** is a dimensionless constant. There are no conversion factors between dimensional symbols.

The magnitude **x** being a dimensionless constant (a real number), like **C** is, one may introduce **[X] -** the dimensional expression (equation) of **X**, as:

$$\mathbf{[X] = L^{\alpha} * T^{\beta} * M^{\gamma} *I^{\delta} * \theta^{\varepsilon} *\mu^{\zeta} *J^{\eta}} \quad (8)$$

The form (4) of the dimensional expression **[X]** of **X** (equation, formula) is valid for every physical quantity, primary or secondary one.

Percentages are dimensionless quantities, since they are ratios of two quantities with the same dimensions.

Therefore, besides unit **{X}** and magnitude **x,** each physical quantity, **X**, may be characterized by a dimensional expression (equation) **[X],** as an algebraic product of basic quantities at whole numbers or fractional powers, basic quantities expressed by their dimensional equations represented in S. I., simply, by their symbols: **L; T; M; I; θ, μ** and**J**.

The exponents **$\alpha,\beta,\gamma,\delta,\varepsilon,\zeta,\eta$** of the symbols of the basic quantities **L; T; M; I; θ,μ**and **J** (in S. I.), in the dimensional equation **[X]** of the derived quantity **X,** are called the „dimensions of the derived quantity**X** in S. I.".

For example, the physical quantity,speed, may be measured in Mechanics, in units of meters per second, miles per hour etc; but regardless of the units used, speed is always a length divided by a time, so we say that the dimensions of speed are length divided by time, or simply **[v] = L/T**.

The choice of the dimensions or even the number of dimensions to be used in different fields of physics (and not only) is to some extent arbitrary, but consistency in use and ease of communications are very important.

The most basic consequence of dimensional analysis is that *only commensurable quantities (quantities with the same dimensions) may be compared, equated, added, or subtracted*.

This conclusion is valid in any domain of knowledge.

Thus, dimensional analysis may be used as a **sanity check** of physical equations: *any equation must be ''dimensionally homogeneous'', for all fundamental dimensions*.

Scalar arguments to **transcendental functions** such as **exponential**, **trigonometric** and **logarithmic** functions, or to **inhomogeneous polynomials**, must be **dimensionless quantities**.

The dimensionless constants could not be computed by D. A.

Dimensional equations

The deduction of the form of unknown dimensional equations may be done by using Rayleigh's method or by **π** theorem.

The application of dimensional analysis to the derivation of unknown relations depends upon the concept of completeness of equations: an expression which remains formally true no matter how the sizes of the fundamental units are changed is said to be complete.

The Rayleigh's method involves the following steps:

a. Gather all the **independent variables** that are likely to influence the **dependent variable**.

b. If **X**is a variable that depends upon **n** independent variables **X_1, X_2, X_3, ..., X_n,** then the **functional equation** can be written as

$$\mathbf{X = F(X_1, X_2, X_3, ..., X_n).} \quad (9)$$

c. Write the above equation in the form:

$$X = CX_1^a X_2^b X_3^c \cdots X_n^m \quad (10)$$

where **C** is a **dimensionless constant** and where **a, b, c, ..., m** are unknown exponents, to be found.

d. Express each of the quantities in the equation in some **fundamental units** in which the solution is required, by considering (in S. I.) the dimensions of each quantity $\mathbf{X_i}$ $,\alpha_i,\beta_i,\gamma_i,\delta_i,\varepsilon_i,\zeta_i,\eta_i,$of the symbols of the basic quantities **L; T; M; I; θ,μ,** and **J** .

e. By applying **dimensional homogeneity**, obtain a **set** of **simultaneous equations** involving the exponents **a, b, c, ..., m**.

f. **Solve** these equations to obtain the value of exponents **a, b, c, ..., m**.

g. **Substitute** the values of exponents **a, b, c, ..., m**. in the main equation and eventually form the **non-**

dimensionalparameters by **grouping** the variables with like exponents.

Units

Dimension is a more abstract concept than scale**unit**: mass is a dimension, while **kilogram** is a scale unit (choice of standard) in the mass dimension.

The units of chosen fundamental quantities in a system of units are also chosen by convention (f. e.: **m, s, kg, A, K, mol, cd**, in S. I.) but the units for the derived quantities are to be established as to be able to eliminate parasite factors of conversion between the units for the same quantity and to preserve simultaneously valid the equations (5), (8), (9).

Such a system of units is called a coherent system of units.

The coherence of a system of units is the result of recognizing the existence of essential relationships among physical quantities.

When using units belonging to a coherent system, the functional equation for magnitudes:

$$x = F(x_1, x_2, x_3, ..., x_n) \qquad (11)$$

would be of the same form as the functional equation for the physical quantities (9).

Strictly, when like dimensioned quantities are added or subtracted or compared, these dimensioned quantities must be expressed in coherent units so that the numerical values of these quantities may be directly added or subtracted, the equations connecting the magnitudes only, being exactly like the physical equations (11) are resembling (9).

Therefore, all conversion factors have to be equal to 1 and could be disregarded in practical work.

Conceptually, there is not a huge difficulty to add quantities of the same dimension expressed in different units. But, in such cases there are to be used the appropriate conversion factors between the different units used and paid deep attention.

Operations with dimensional equations; observing dimensional homogeneity

The dimensional expression of a physical quantity **X** neitherdepends of the magnitudes of the units through which it is expressed (because the magnitudes are numbers – dimensionless quantities) nor of the operations of addition and subtraction between the physical quantities of the same physical nature which are connected in the considered equation.

Only terms whose dimensions are the same may be equated.

F. e., the equation: **60 kg = 60 m/s !?** makes no sense, in spite of the implied magnitudes being equal (60 = 60, but what 60?).

A necessary condition for the correctness of any equation is that the two sides have the same dimensions, are measured in the same units, within the same system of units.

There is always compulsory to observe in each case (for products, powers), the equalities of the exponents (dimensions) of each basic physical quantity which enters in any term and in each member of a dimensional equation as well as any relationship among dimensional expressions be homogenous, relatively to all fundamental physical quantities.

Any physical equation:

$$X_1 = X_2 \qquad (12)$$

may be true when and only when the corresponding dimensional expressions of the members of the equation are identical:

$$[X_1] = [X_2], \qquad (13)$$

therefore, when:

$$\alpha_1=\alpha_2;\beta_1=\beta_2;...;\eta_1=\eta_2, \qquad (10_1\text{-}10_7)$$

that meaning that the equation may be true only when there is observed the propriety of homogeneity of the equation with respect to all fundamental physical quantities.

This homogeneity check may be easily done by expressing each of the quantities in the equation (13) in the **fundamental units** in which the solution is required, too.

For social modelling there be necessary to introduce specific dimensions for specific fields.

Some Applications of Dimensional Analysis

Dimensional analysis is mostly often used in Physics, Chemistry, Engineering - and in the Mathematics thereof - but finds applications largely outside of these fields as well.

D. A. analysis is a tool to understand the properties of physical (or other specific) quantities, independently of the **units** used to measure them.

Dimensional formulae provide a convenient shorthand notation for representing the definitions of secondary quantities and are helpful to define units and find relations between units, to change units from one system to another and to categorize types of physical or other quantities and units based on their relations to or dependence on other units, or their "dimensions", or the lack thereof.

D. A. may be always used to check the dimensional homogeneity of physical equations and not only. It is a help in the check of complicated analytic expressions. It affords a convenient means of checking equations used in other sciences.

Dimensional analysis is routinely used to check if **derived** equations and computations are plausible, in the deduction of the form of unknown relations, to derive relationships between the physical or social quantities that are involved in a particular phenomenon that one wishes to understand and characterize, to find new dependencies not so evident from experiments.

D. A. may be approached as a primary tool for obtaining information about physical (and other) systems, too complicated for full mathematical solutions being feasible.

D. A is also used to form reasonable hypotheses about complex physical situations that can lately be tested by experiment or by more developed theories of the phenomena.

Dimensional analysis is often the basis of mathematical models of real situations and generally of models design. It can allow one to make calculations about the phenomenon of interest and therefore be able to more efficiently design experiments to measure phenomenon features or to judge whether it is important.

D. A. enables one to predict the behaviour of large systems from a study of small-scale models, at a great saving in cost.

D. A. facilitates the study of interrelationships of systems (or models of systems) and their properties.

In Law, D. A. is essential to understand principles and to design legal norms.

In Finance, Economics, and Accounting, Dimensional Analysis, as a part of Econophysics, is most commonly used in

interpreting various **financial,** economics and accounting ratios.

D. A. applied in Sociology leads to solutions of problems that have not been solved before in regard to decisions, intentions, emotions, cognition.

Of course, the help of D. A. could not replace human decision-makers. A manager's domain expertise and tacit knowledge cannot be replaced by an automated algorithm. However, Dimensional Analysis can support and augment decision-makers' instincts and reasoning abilities.

Applying Dimensional Analysis to check the correctness of economic indices

F. e., D. A. when applied to appreciate the fairness of the formulae currently used for calculating State Budget Deficit, may indicate a few possible frequent errors introduced to corrupt public opinion perception about the state of the Budget Deficit.

In defining of the State Budget Deficit, D, there are being used the following quantities: government revenues, R and government spending, E, frequently and the gross domestic product, GDP, here, shortly denoted by P.

Defined as an absolute quantity (expressed in the chosen currency), the absolute deficit, D_a, is equal to:

$$D_a = E - R, \quad (14)$$

The quantities R, E, D_a are expressed as absolute (not relative) quantities, having the identical dimensional expressions:

$$[R] = [E] = [D_a] = C/T, \quad (15)$$

where C and T the symbols of the dimensions of the chosen currency and of time, for example dollar and respectively, year.

The condition of dimensional homogeneity has to be observed for each equation, for each side and for each term. The mentioned quantities have the same dimensional equation, the revenue, the spending and the deficit, are referring to the same State Budget components. Therefore, for the same economic system, they must be expressed in the same currency unit, per the same time interval, i.e. in Euro/year, dollar/semester, RON/trimester, Rupee/month including the same components (for whole Romania or India, i.e.).

Generally, there must be used the same units and be valid the unit's equations:

$$\{R\} = \{E\} = \{D_a\}, \quad (16)$$

A frequent error may be not to keep the unit {C} of the currency C, of dimension [C] as a constant and to compare the values r, e, d_a, of each one of these quantities R or E or D_a, for different equal periods of time, but by using different, currencies, at different instants, f. e Euro/y at the end of 2010 compared with Rupee/y at the end of 2009, without mentioning the chosen currencies and the evolution of their exchange rate (I. e. Euro/Rupee), during the interval of time implied.

Another dimensional error would be to compare each one of these quantities R or E or D_a, as absolute values but for different time intervals, even when using the same currency.

For example, there is compared the absolute State Budget Deficit on the first semester of 2011 with D_a for the whole 2010, with a false optimistic conclusion for politicians and media, unaware of the trick.

Another possible dimensional error is to compare the quantities R, E, D_a, for different periods, by using different methodology of computing them, for different periods, not the same one.

The State Budget Deficit may be defined, besides absolutely, D_a, also as a relative quantity, D_R, expressed as the percentage of D_a from the revenue, R:

$$D_R = D_a / R \quad (17)$$

More frequently, but dimensionally incorrect, the relative deficit is expressed as D_P , a percentage D_a of the gross domestic product, P :

$$D_P = D_a / P \quad (18)$$

Another dimensional error in operating with relative State Budget Deficit, D_R , is that dividing the absolute State Budget Deficit D_a for a trimester to the gross domestic product, P, for the whole year, D_{tPa} . In this case the relative deficit seems to be, relatively, 4 times smaller than the actual correct figure relative to P when observing the condition of homogeneity in Dimensional Calculus, which may ensure correct conclusions.

The definition of the Relative State Budget Deficit with respect to Gross Domestic Product, D_P, is preferred by politicians and by some international institutions like International Monetary Fund, World Bank, but, from a dimensional point of view, it is a rather unhappy definition and practice because the quantities: government revenue, R, government spending E, on one side and respectively the gross domestic product P, on the other side, dimensionally represent different types of economical quantities. Simply speaking, the whole State Revenue R may be spent by the government, but not the whole domestic product, P.

To better realize this essential dimensional distinction between the definitions (17) and respectively (18) of the relative deficit, let exemplify by the situation in Romania, reported (provisionally) for the whole year 2009.

The „Budget State Deficit" was then reported as being equal to ~ 8.3 %.

Looking at the detailed economical figures one may see that the report was about:

- a relative deficit, not about the absolute deficit $D_a = E - R$ (14);
- a relative deficit computed by dividing absolute deficit D_a=E–R, to P, that means as percentage of the gross domestic product, P: $D_P = D_a / P$ (18)

From this definition it would result, by ignoring dimensional requirements, that there would had been enough to splash state spending with 8.3 % to escape of the State Budget Deficit. The correct dimensional approach had would been to use D_R , the relative State Budget Deficit, as a percentage of D_a from the government revenue, R, quantities which have the same dimension and may be divided to offer a correct percentage (17): $D_R = D_a / R$,

D_R is larger than D_P, as much as P is larger than R.

The figures for the R/P vary between 31% and 32% (with or respectively, without, progressive taxes). Considering as acceptable, for the computations done here, an R/P value of approximately 1/3 (the revenue R being approximately only one third of the gross domestic product, P), the relative State Budget Deficit expressed as percentage of R, D_R , is equal to:

$D_R = \sim 3 * 8.3\ \% = \sim 25\ \%$.

Therefore, D_P, the relative state budget deficit expressed as percentage of P, seems to uneducated people 3 times smaller

than D_R and possibly, that is why D_P is preferred by politicians, because D_P is not so impressive for the media and laymen.

This figure of 25% of the relative deficit being equal approximately to a quarter of the revenue is the significant one by itself and exactly it has been used by the Romanian Government and the I. M. F., World Bank and E. U. when actualizing the loan agreement for the second semester of 2010.

The payments have been done on condition that Romania slashes public spending and boosts tax revenue to reach a D_R = ~ 25 %, which had be happen by diminishing all payments from the public budget by a quarter, with 25% .

This partially happened, only salaries being reduced, but had not been enough as shown by our dimensional reasoning. It would had been necessary to reduce all kinds of expenses with 25 %, including all pensions, all social aid, all bonuses, all spending on goods and services and all investment spending of the Government. This has not been possible, may be, because of possible political consequences of the social unhappiness generated by such an action.

Therefore, to comply with the law of action-reaction, the Government has had to try to increase, on the spot, its revenues, to cover the failed proposed slash of expenses.

As a consequence, the Government has decided to increase its revenues, by increasing the Value Added Tax from 19 % to 24 % from the added value tax in economy. That means, again by increasing VAT relatively with itself, with approximately a quarter (with 5%, from 19% of the added value, that meaning, roughly a quarter 5/19 = 26.3% of the initial value of 19%).

Again, this increase of revenue is not enough as required by the action-reaction law. It was necessary to: further drastically reduce expenses on goods and services and of the number of state employees but these partially implemented reductions had not been enough (because social expenses ~ 46 % of the State revenue were not diminished).

There seems necessary to more boost revenues, by: cracking down on tax evasion and austerity measures including rising the retirement age and ending public sector bonuses.

In a case of another state, having a sovereign debt of 200% of GDP, reasoning correctly from a dimensional point of view, the debt is as large as the revenues of the state for ~ 6 years. Considering, a 25% reduction in State Spending, there would be necessary two dozen years to reach the budget balance (if all other parameters be preserved).

It is clear that this debt cannot be paid in a reasonable perspective.

Seeking a large profit from high premiums, some people lent to the Greek government. As it turns out, they made miscalculations. In the process of promising gifts to voters, the Greek government has increased its financial obligations so far beyond what it can cover from its tax revenues that, now, no-one is willing to lend it any more.

Without borrowing more, however, the Greek government cannot repay the debts that are coming. Its current creditors are going to lose part of their deposits.

The exact steps are to be choosing following numerical simulations of different possible measures be taken, by modelling their correlations, too.

There is to be avoided that the harsh measures trigger series of public sector strikes and eventually violence on the streets (like it has happened in Greece), by governments taking gradual measures to allow social acceptance.

By its success in getting the IMF loan and by observing its engagements, Romania has gained a vote of confidence for the measures taken by the Government.

Romania has an open window to exit crisis, which may influence financial markets and this has to be honoured.

Measures to encourage development by attracting investment local, foreign and E. U. funds, accessible to Romania (insufficiently applied for until now) are to be taken.

Exactly measuring corruption statistically is difficult if not impossible, due to the illicit nature of the transactions and imprecise definitions of corruption. While "corruption" indices first appeared in 1995 with the Corruption Perceptions Index, all of these metrics only address different proxies for corruption, such as public perceptions of the extent of the problem.

Below some simple applications of D. A., connected with evaluating corruption are given.

The leverage when investing in bribing

D. A. has been suggesting the authors to quantitatively measure different social phenomena by using relative ratios of specific pairs of quantities which have the same dimensional values.

F. e., to relatively measure the absolute gain by corruption, G, one may deduce from the profit, P, generated with bribing the paid bribe B. .The relative gain through bribery, G_r;

$G_r = (P – B) / B = (I – E - B) / B$,

where P is the amount expected to be gained on the investment when bribing, B is the bribe, I is the expected income generated by the contract and E are the normal expenses to implement the contract (the investment).

A recent concrete example from a municipality of Romania: a contract of 72,000,000 of Euro has been preferentially allotted to a company who paid a bribe of 45,000 Euro to the Mayor of the town (now imprisoned for criminal investigations). In the contract, the computations were based on a declared 15 % relative profit P_r:

$P_r = (I – E) / I$

That meant that the profit would have been $P = P_r * I =$ 10.800.000 Euro and the absolute gain is $G = P – B =$ 10.755.000 Euro.

Finally, G_r = 10,755,000:45,000 = 239 = 23,900 %!

Let us relatively compare with a recent case related by media as being discovered in Argentina, where a bribe of 100,000,000 $ has favoured a contract of 1000,000,000 $, contract with an estimated relative profit of 40 % (media allegations).

The result computed for this Argentina case is that a relative gain by bribing, here equal to 300 %, is relatively, ~79 times less that computed for the Romanian previous example, but also much more than values accepted in some countries; 200% (a profit of 10 % expected by considering a commission of 5 % on the contract).

Responsibility of the members of Parliament (MP)

The responsibility of the members of Parliamentis expected to be high, but it is difficult to be measured.

To measure it, at least, relatively, let us compare it with the responsibility of a citizen. . Because responsibility covers many aspects, let us consider only financial responsibility.

We need to compare their behaviours in the same situation, at similar operations, based on objectively found quantities.

Let choose, f. e., the double voting.

Here following there are presented two recent examples from Romania:

1. the Judicial Commission of the Camera of Deputies has established, based on multiple proofs, that in the autumn session 2011, 8 MP (from all 3 main parties) have voted at least doubly and it sent its report to the Board of the Camera, with the proposal that those MP be penalized at the maximum: 15 days not to receive emoluments, that meaning about 10% of the monthly income of an average income of a MP.

If this maximum penalty for MP double voting is compared with the maximum penalty provided for double voting by the electoral law for the electors (laymen) in the local, general (national or European) poles, 5 years of prison it results that an elector of a MP has a loss in the salary corresponding to 60 months, that meaning a financial penalty 600 times relatively larger that one of a MP penalized for double voting.

Therefore we may conclude that the maximum financial responsibility of a MP for a double vote in specific similar activities, is 600 smaller that that of an elector of that MP.

Actually, those 8 MPs have actually been penalized, at December 22, 2012 at minimum: 1 day loss of emoluments for each MP, the minimum possible, by the regulations established by the Parliament.

2. Previously, on November 18, 2012, the Romanian citizen Marian Amza, has been arrested in Italia (Viareggio), subject to an European warrant, he being convicted to 4 y of prison (1461 days) for his double voting in the euro parliamentary elections of June 7, 2009, in Romania.

The actual ratio of financial penalties: voter/MP, in the mentioned two recent cases, is 14610. It results an elector is 14610 times more financially responsible than a MP.

The frequency of such infringements of the law, by double voting is, also much higher for MP then for their voters.

D. A. may help to operate with the risk on investment

If an investor chooses to invest in some sovereign bonds of a certain state, state which is offering a high premium, say of 8-10/%/y, instead of investing in to bonds of another Government which is offering a premium of only 1.5 – 2 %/y, there is to expect, considering the dimensional homogeneity which require here to compare chances of loss, that the chances of losing the investment are much higher (eventually considering the Gauss normal distribution for the premium and the relative frequencies) for the investor looking for the highest efficient investments That means that the chances to loose at least a part of the lent sum are much higher for the greedy investors.

Taxation of financial activities

From a D. A. point of view, taxation of purely financial activities is to be done at the same rate on operation than any other taxation on income. For example, in Romania, for small enterprises: a tax is of 3% of the total amount of the income due to each operation on the instant of the transfer of rights of propriety (or of equivalent ones).

If Government be applying such a 3% tax per each financial operation, the Government would discourage money short term speculations (some obligations being sometimes exchanged a few times a day) and significantly increase its revenue.

Of course, such an agreement might be universal (also required by the D.A. condition of homogeneity), not to favour some financial centres which are not applying such a taxation, on the loss of the governments and other financial centres where there is applied such a taxation per financial operation.

The social savings by diminishing bureaucracy (rather than by firing public officers, only)

Some analyses have shown that, in some places, about 80 % of the certificates required to citizens from state and local authorities, are of no use, these having been introduced by some public institutions to justify the hiring of more officers by nepotism or cronyism.

Let us compare the time lost by a citizen to get such a socially useless certificate - about two halves of a working day missing from the work, with the time used by the officers in charge of receiving and delivering the required certificate (about 20 minutes). The total work time lost per certificate, at the society's level, is not 20 minutes but 8 hours work time, that meaning 480 minutes = 24 times more than the time used by the implied officers for issuing a useless certificate.

That means that by not more asking such kind of certificates and consequently by being able to fire the implied officers in issuing them, there may be saved the working time of 24 working people for each fired officer.

It results a lot of social increase in the society's efficiency.

From this model there is appearing as evident an advice which might be given to the Government: do require the state and local officers to find which documents are useless, keep in office and promote those officers which prove firstly that their jobs are useless, promote them and ask them to act in the same way in their newly got positions.

Processing of errors

Other Physics tools in modelling the socio-economic life are the common procedures in Physics in processing the errors on experimental data.

Such procedures, might be used in improving the control of public expenditures, f. e., when selecting a winner of a public auction for services or goods (highways, mines, army goods a. s. o.) or for public-private partnership investments, by adapting the current regulations, such as to observe common procedures in processing the errors on the physical experimental data as to diminish corruption.

Let us suppose that the price offered at a bid by a company X is P_X and the price offered by the next ranked competing company Y, is P_Y , for the same package of goods and services in their offer, in the bid concerned.

If $P_X < P_Y$

$P_Y - P_X = \Delta P_{YX} > 0$,

the selected company to be the happy winner would be company X and the agreed price, would be P_X.

The corruption in those public authorities when allotting and implementing contracts is favouredbecause there is legally permitted a later increase in the price invoiced to be paid, without a new auction, just by simple mutual agreement of the implied parties. This increase might be higher than the settled price not only with a few percentages but even be a few times larger than the initial price (media examples of 6 time larger final costs than the initially agreed one are quoted!).

Knowing this possibility and based on relatively frequent leakage of information during bid time (information got by bribing), the favoured company X may offer a slightly diminished price than Y company, to be sure that it „legally" gains the auction. Later on, the price P_X , sometimes under the expected market costs, is increased much more over P_Y , by corrupted bilateral agreement only, not being compulsory that the increase of price be subjected to third party control.

Some possible actions to reduce corruption when auctioning public expenses would be:

- to provide for, in the public auctions law or in the auction rules on the individual bids, that the price is firm (for the engaged services or supplies), could not be increased and the risks belong to the company

or at least:

- to provide for in the auction law that following a public auction, the final price invoiced and paid could not be increased with respect with that initially agreed one by a supplementary agreement between the parties, at an amount larger than a fraction of ΔP_{YX}, the difference between the prices demanded by secondly and firstly ranked competitors.

The solution proposed by some Government to impose a limit on the relative increase of the price, during implementation of the contract, limiting the possible increase by direct negotiations, f. e. to 50% of the value of the contract:

$\Delta P_{YX} / P_X < 50\%$,

marks a progress, but also encourage corruption and supposes that the estimated profit of the winner (hidden in its offer) be ~50%.

The authors suggestions to change the current auctions regulations, as to limit the after auction increase in the price invoiced to be paid, possible by the posterior agreement of the implied parties, correlated with the existing high level of corruption in allotting public expenses on goods and services, would allow a ~ 25% reduction on public spending at auctions, by legally introducing the above proposed by the authors limitations. They seem being quite possible in some countries.

Procedures of statistical evaluation and control of averages and errors, might, for example, be used to improve the control of public expenditures when selecting winners of repeated public auctions for acquisition of services or goods.

The quantitative approach for the average values is to be completed with a quantitative estimation of the errors.

This approach may be useful to reduce f. e. corruption in the judicial system, by statistically checking the frequency of decisions taken by judges not validated at superior level,

The mastering of errors in applying physical laws, competence got at the Physics laboratory work together with the developing abilities for measuring, will make easier the process of modelling non physics phenomena, eventually of preparing, passing, granting and implementing the human (judicial) laws.

Usually, the goal is to minimize uncertainty and hence the error to the lowest extent, affordable and acceptable.

Further, there is the important aspect of reporting the measurements. They should be consistent, systematic and revealing in a context of accuracy and precision.

The checking of the dimensional homogeneity of the relationships modelled will help the explanation, the understanding and the interpretation of those modelled relationships.

The authors have used D. A. in developing models to compute the propagation of errors in economic forecasts.

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