

MATRIX APPROACH FOR ESTIMATING THE EFFECTIVENESS OF ECOLOGICAL BEHAVIOR

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*Abstract: The change in the paradigm of the economic system and the transition from individualistic concept to the eco-social concept in company's approaching, perceived as a dynamic element of the planetary metasystem, determined a reconsideration of the ethical values and behavioral norms in the business area. Civilization and the current technology do not allow the elimination of pollution but only the limitation and partial compensation of the inherent compromises. Adopting an **effective ecological behavior** by the company management, faced with a number of legal and economic **constraints**, depends largely, on the assumption of **environmental ethics** rules. Analyzing, based on a matrix model, the hypostases in which any company could be found, from the possible cause of disasters to an ecological maximized behavior (above the level required by rules), there is identified the possible involvement of the society or proximate community in supporting the pro-ecological attitudes and in solving the problems that it faces, in order to preserve a source of welfare (jobs, contributions to supporting the functioning of society and development).*

Keywords: *effective ecological behavior, environmental ethics management, constraints, compromise, compensation.*

JEL Classification: D12, D18, D22, G17, H55

INTRODUCTION

The paradigm of industrialism, interpreting decreasingly the phenomena and relationships through economic determinism and considering the financial profitability as

the main criterion of effectiveness of the company is currently not enough in the approach of human development issues.

The success of modern technology disjoins man from nature and the competitive processes disjoin people. Both, technology and competitiveness are progress and development creators, but both drive high entropy, causing imbalances in the eco-social system. Environmental failure derives from the methodologies applied which force towards division and subdivision into components, which approaches the disjointed parts of a complex system and ignores the priority of the whole over the elements. The eco-social holon anomia induced by the accumulation of disorders in operation, caused by the non-respect of the behavior rules concerning the environment, will generate the disintegration of the whole.

Under the pressure of the accumulation of large imbalances, of the re-assumption of responsibilities at macro and micro level, in terms of ethical standards, in the compliance of the economic system interdependence with the natural and social system, there is a period of deep changes in the perception of the company as a component of all three.

CONTENT

The actual economic theories circumscribe all the interested holders, in the area of the company's responsibilities, including community as an eco-social proximate environment, but also environmental issues extensions upstream (to the project and primary resources) and in downstream (to the end user), following the progress aspirations at the micro-level to the sustainable development at the macro level. These responsibilities are often incongruent or even contradictory (equity holders will maximize it, community wants more engaged workforce, involvement in local programs, solving environmental problems, so.), the company has the obligation to find a compromise at the highest degree of adequacy. The compromise, subsumed to ethical rules, which companies and society should adopt as a way of achieving consensus, requires mutual awareness of all interests and requirements, seeking solutions to maximize their convergence and minimize the coercion to impose of one party. Harmonious, the compromise adopted involves compensations (*contraria contraris curatos*), their basic function consisting in restoration, maintenance or strengthening/reinforcement of the effectiveness and balance affected by the compromise.

In relationship with the natural environment, the companies do not have additional compromise margins, any damage to it must be fully compensated by payments for remediation or rehabilitation (solutions are, however, partial and post-factum), which requires a totally connected behavior to the environment protection. The danger hanging over mankind, according to the theories of global warming and to the rapid disappearance of thousands of species, should have drastic consequences - stopping pollution, impossible to adopt with the current level of technology development without an economic collapse. We believe that even the charging for pollution is a great **compromise**, and the **compensation** obtained is far away from the real needs for

rebalancing. Under these conditions, the pro-ecological behavior of each entity is strictly necessary to limit the disaster.

"Fear of unpredictability is a given normal" (Bunget and Dumitrescu, 2010). The pro-ecological behavior is directed towards conservation and protection of the environment and of biodiversity, assuming an attitude of promoting the values of the natural environment. Speaking about pro-ecological behavior, there are taken into account three conditions: intention, voluntary initiating of the behavioral act and not require rewards. The existence of a coercive legal framework cancels the presumption of a voluntary behavior, and not pursuing any reward is also invalidated by establishing a rigorous system of rules, approvals, permits and taxes at the companies level. We believe that irrespective of the good intentions and personal attitudes formally declared as pro-ecological, we cannot talk about a generalized pro-ecological behavior, but only about an imposed ecological behavior, often unobserved. Attitude is, in its turn, the resultant of combining the affective, cognitive and co-native items, exercising target influences, motivation or evaluation of behavior. Linked to ethical values, attitudes are on certain vectors at the behavioral level. Attitude and behavior, even though they interrelate directly, cannot be considered totally overlapped or integrated. Attitude is considered by some sociologists as the probability to produce a certain behavior in a given situation, but it is possible for a certain attitude not to have behavioral effectiveness. Moreover, in social terms, it was found that the behavior change necessarily leads to the change of the corresponding attitude, while the change in attitude does not necessarily lead to change behavior (Zamfir and Vlasceanu, 1993). These breakdowns are considered necessary for the evaluation of the probability of the **effective** ecological behavior of the companies, most of them declare themselves in favor of environmental protection.

Attitude and declared behavior are not similar to effective **ecological behavior** on which we believe at least three groups of factors act, at the micro level (Figure 1):

- the legislative constraints of environment protection which determine the compulsory level of the effectiveness of ecological behavior;
- the economic constraints, specific to the evaluated entity, which often discourage ecological behavior;
- the ethical rules developed by the management in the environmental protection. We consider this group of factors that balance in the disjunctive reasoning imposed by the other two groups of factors.

The company will seek the **compromise** between the legislative constraints and the economic **constraints**. In fact, it will seek the **compromise** between the behavioral level required by the rules and their own opportunities of effectiveness.

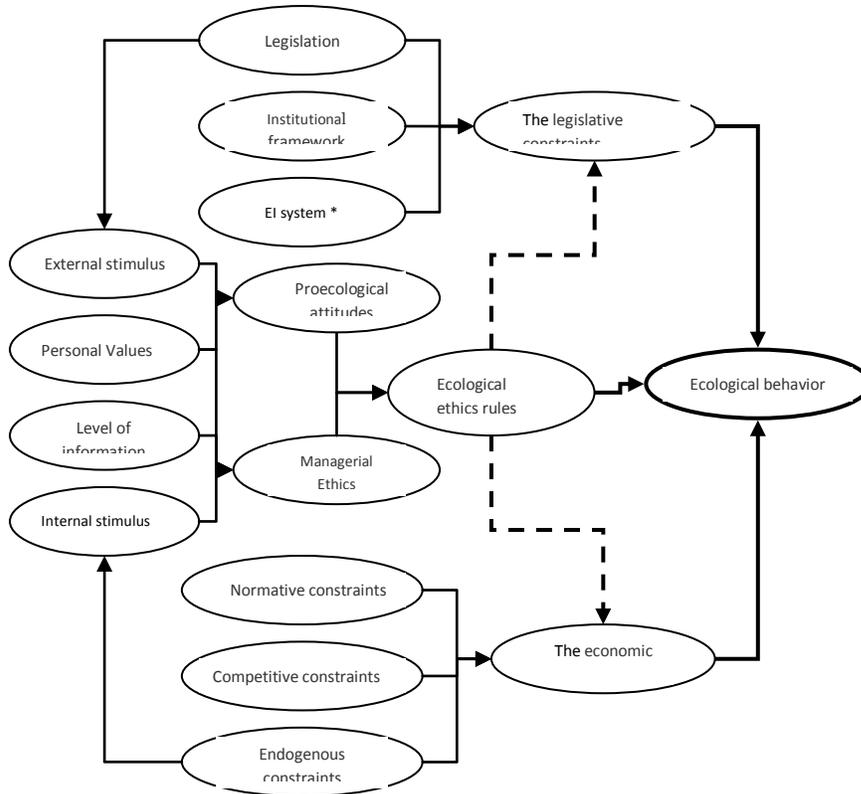


Figure 1. The system of factors which contribute to the effectiveness of ecological
 * EI system = economic instruments system

The materialization of the theoretical approach is made on the example of a drugs distribution network company and other associated products with the following characteristics:

- it pollutes with the cartons/cardboard packages, metal, glass, plastic, expired drugs;
- it has a satisfactory percentage of staff with higher education, knowing the importance of the environmental protection and biodiversity;
- it has additional economic **constraints** compared with the distributors in other areas.

The considered legislative constraint factors relate to:

- Legal framework - comprising the European legislation (EC Directives and ECE) and the Romanian one which is based on Ordinance no.195/2005 completed and approved by Law no.265/2006; this legal framework is detailed by government decisions, ordinances, orders for setting rules and instructions, the whole normative system being detailed in 12 groups of issues (Rojanschi, Grigore and Ciomos, 2008). This law provides that any socio-economic activity to be evaluated in terms of environmental impact and then, depending on the characteristics, the environmental requirements are set by opinions, agreements, permits or integrated environment authorizations. We consider that the existence of about 300 acts requires the manager of the environmental issues at central level to develop a guide for information and guidance;

- The institutional framework - is very broad, including the Government of Romania (gives consent/authorization for nuclear activities), the Central Environmental Authority, National Environmental Protection Agency, regional agencies, county agencies, the National Environment Guard, etc. We believe that the involvement of such a large number of structures overlaps and dissipates responsibilities;

- The economic instruments system (IE) - refers to all environmental taxes, fines, payment of pollution licenses or responsibility, performance guarantees and penalties for the violation of the environmental protection rules (from prison to fines to 80,000 lei). We believe that the current EI system is adequate.

These reasons are used in the factors scoring system that contribute to the effectiveness of the environmental behavior.

The economic constraint factors synthesized based on the correlation relationships are grouped into:

- The legal **constraints** - there are companies for which the governmental **constraints** are much higher than for others. Such examples are the enterprises that are required for provisioning the environmental rehabilitation after closure, reflected in their prices. For drugs distributors (case chosen for illustration), the trade mark-up is limited by the central public health (for deposits: between 10% and 14%, depending of price, drugs more expensive than 300 lei with limited mark-up to 35 lei; for pharmacy: between 12% and 24% and 35 lei for drugs with prices higher than 300 lei). The regulated limitation of the trade mark-up is directly reflected in the results of the work, limiting their capacity for adaptability and effectiveness of the ecological behavior;

- The competitive **constraints** - high competitiveness on the drugs market and the existence of a large distribution network of drugs throughout the urban area, with high power price support in the auctions organized by users, make smaller distributors reduce their prices, their market is mainly focused on hospitals (the share of drugs of the total hospital expenditure is less than 10%);

- The endogenous **constraints** - refer to the own retail capacity (spaces, labor, technology, network, financial resources) and its efficiency, the ratio between the time of collection of customers and the period of payment of suppliers (causing permanent liquidity gaps and the need to borrow).

The company chosen as an example presents the following data over five years:

Table 1

Years	Turnover (CA) million lei	Cost of goods (CM) million lei	Sales to hospitals (VS) million lei	Trade mark-up (AC) million lei	Operating expenses (CO) million lei	Operating profit (PE) million lei	Operating profit (RE) %
x_i^j	x_i^a	x_i^d	x_i^b	x_i^c		y_i	
N	62.0	53.5	28.1	8.5	6.5	2.0	3.2
N+1	71.3	60.5	38.4	10.8	8.6	2.2	3.1
N+2	72.0	59.7	39.9	12.2	10.0	2.3	3.2
N+3	71.1	61.8	39.5	9.3	7.7	1.5	2.2
N+4	70.5	61.0	39.5	9.5	7.7	1.7	2.5

$\sum x_i^j$	346.8	296.6	185.3	50.2	40.5	9.7	
$(\sum x_i^j)^2$	120,286.9	87,970.3	34,336.0	2,522.7	1,638.4	95.0	
$\sum x_i^j / 5$	69.4	59.3	37.1	10.0	8.1	1.95	

It was considered as a determining economic factor of the effectiveness of the company ecological behavior the operating profit that allows it to sustain any financial expenses resulting from unfavorable exchange rate differences (the main part of products is imported) and the interest for overdraft (the delays in receiving money from hospitals - more than 180 days - and much lower chargeability of debts to suppliers, usually 30 days, requires loan). In the same time, the operating profit is a result of the action of the variables characterizing each company.

For an objective award of grades for each factor there were calculated the sense and intensities of the correlations between indicators: turnover, sales to hospitals, trade mark-up and cost of goods considered explanatory variables or factors and the operating profit, considered explained variable or result. For this purpose there were calculated the correlation coefficients for each explanatory variable, based on the formula:

$$r^j = \frac{n(x_i^j \times y_i) - (\sum x_i^j \times \sum y_i)}{\sqrt{[n\sum (x_i^j)^2 - (\sum x_i^j)^2] \times [n\sum y_i^2 - (\sum y_i)^2]}}$$

Where: i = year (from N to N+4); j = a,b,c,d (symbolizing each explanatory variable)

The necessary data for the correlation coefficient calculation are presented in Tables 1 and 2:

Table 2

	$(x_i^a)^2$	$(x_i^b)^2$	$(x_i^c)^2$	$(x_i^d)^2$	y_i^2	$x_i^a y_i$	$x_i^b y_i$	$x_i^c y_i$	$x_i^d y_i$
N	3,840.1	790.1	71.4	2,864.1	3.9	122.4	55.5	16.7	105.7
N+1	5,089.5	1,473.7	117.4	3,660.8	5.0	159.8	86.0	24.3	135.5
N+2	5,177.0	1,588.3	149.4	3,567.5	5.1	163.1	90.3	27.7	135.4
N+3	5,050.4	1,556.8	85.8	3,819.7	2.3	108.9	60.4	14.2	94.7
N+4	4,969.9	1,559.7	89.4	3,726.3	3.0	122.3	68.5	16.4	105.9
$\sum (x_i^j)^2$	24,126.9	6,968.6	513.4	17,638.4	19.4	676.5	360.8	99.3	577.2

The sense and intensities of the connections between the explanatory variables and the operating profit, expressed by the value and sign of rj coefficient, are:

Table 3

The correlation	The correlation coefficients r ^j	Meaning
Turnover (Noted: x _i ^a) and operating profit	0.69	There is a direct link, above-average intensity, any increase in turnover will lead to increase in the operating profit

The sales to hospitals (Noted: x_i^b) and operating profit	- 0.08	There is a low intensity reversed connection, between two variables, the increase in sales to hospitals shall insignificantly reduce the operating profit
Trade mark-up (Noted: x_i^c) and operating profit	0.70	It is the strongest direct link, any change of the trade mark-up will result in significant changes, in the same sense, in the operating profit
Cost of goods (Noted: x_i^d) and operating profit	- 0.26	Between the two variables there is a feedback below average, but important because it shows that the increase in cost of goods isn't recovered through prices, affecting operational profitability.

It can be concluded that the influence of endogenous factors (the sales capacity expressed by turnover) and the influence of normative **constraints** that restrict the trade mark-up are determinants, being stronger than the competitive **constraints** which requires the company to reduce prices at the auctions for hospitals.

The above analyzed company, with an average trade mark- of 2.8% during five years, is extremely vulnerable for a short-term loan, with an interest rate higher than this level, which may reverse the effect of the financial leverage.

For the companies not subject to the economic normative **constraints** other factors may occur, along with the competitive **constraints**, which may affect the results, including the kind mentioned above (credit, large-scale development etc).

The provisions related to the environmental fund contributions, for the analyzed company, are tolerable (2 lei / kg of packaging for the difference between the amount of packaging placed on the market and the amount recovered/incinerated) and are not likely to jeopardize the major operational profitability. There also are companies for which the strong emphasis punitive charges, caused by the major impact of pollution over the environment (such as heavy metals), may become a discouragement of the ecological behavior.

Factors for assuming ethical rules by the environmental management. It was considered that assuming ethical rules of environmental protection by the management depends on:

- pro-ecological attitudes based on:
 - Co-native or behavioral elements, supported by its own system of generally human, ethical, social etc. values , able to generate pro-ecological actions;
 - cognitive elements, enhanced by information from the authorities and supported by his own;
- managerial ethics, as a set of management standards, principles, legal norms, criteria for ethical conduct. A significant part of the principles and norms concerning the environmental protection are stipulated in environmental regulations, the compliance and the approach of the moral issues depend on the discernment and ethical profile of the manager. The **managerial ethics** depends on the individual's personal values but also on:
 - external stimuli, such as: increasing competition, monopoly or oligopoly, legal system instability that may induce unethical behavior, etc.;
 - internal stimuli such as the rewards system for the management, the incentives provided to individuals to make the best decisions is a fundamental problem in the economy. The incentives problem is that individuals do not bear the full

consequences of their actions (Stilgitz, Walsh, 2005); the performance requirements imposed to the management, which condition their rewards, as well as the conflicts between the management and the stakeholders may cause deviations from the law to avoid costs.

The money market and the unlimited potential of the monetary rewards shaped and changed the entire basis of the economic activity (Ionescu, 2005) profoundly affecting business ethics.

The causative factors in assuming personal standards, although grouped on the two vectors: attitude and managerial ethics are common for both, their interference generating the moral profile of the manager the ecological behavior of the company depends on. These factors are difficult to quantify and therefore any assignment of weights and notes containing a high degree of subjectivity, which could be diminished by the existence of a sociological survey on a representative sample to provide enough information to establish parameters in the causal relationships between them. In this approach we consider that the existence of personal ethic rules regarding the environmental protection, at company management level, is a significant mediator between the effects of the actions of the two groups of factors, to maximize the probability of effectiveness of the ecological behavior.

Some possible levels may be structured on a scale of assessment of the ecological behavior effectiveness:

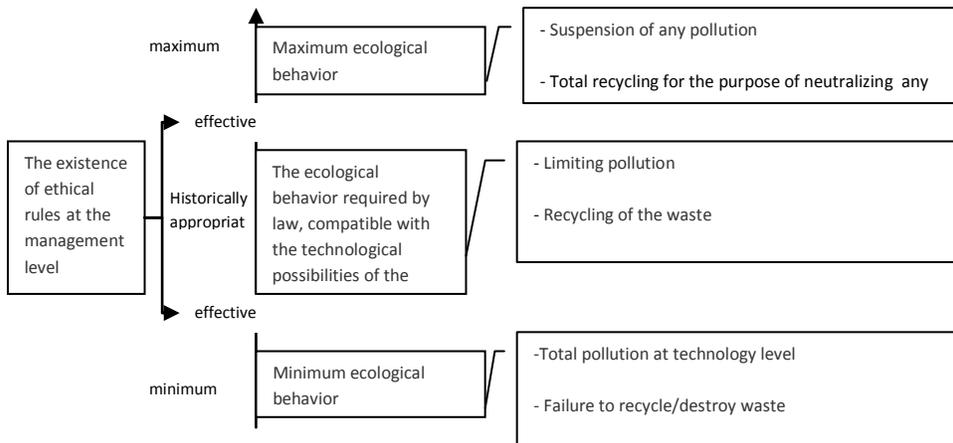


Figure 2. The **effective ecological behavior** scale

It can be seen that assuming some ethical rules by the management may place the ecological behavior of the company at a higher level than required by law and conversely, the absence thereof may cause major deviation from the rules of environmental protection.

For the positioning of the company on the environmental behavior coordinates set by the two types of **constraints** with an opposite effect, mediated by personal norms concerning the environmental protection, we consider a matrix pattern suggestive (Figure 3.). For this purpose, we consider as variables the normative **constraints** and the economic **constraints** determined by the characteristic factors identified on the two

groups. To measure and to combine them into indicators it was used a weighting system taking into account the above-mentioned and a scoring system from 1-5 (Table 4). As specified, the existence of the personal environmental and ethical standards ensures maximum effect and the non-existence thereof minimizes the possibility of achieving the effectiveness of the ecological behavior.

Table 4

	Weights	Notes	Values	Maxi - mum	Mini - mum	Meaning
1. The normative constraints	1		2.0	5	1	In this variable there were assigned higher weights to the institutional frame and to the economic instruments system the law enforcement depends on
1.1. The legislative framework	0.3	2	0.6	1.5	0.3	The legislative framework is adapted to current conditions (but far from the ideal suppression of pollution)
1.2. The institutional framework	0.35	2	0.7	1.75	0.35	The existence of many environmental institutions leads to responsibility dissipation and consumes funds that could be used for corrections
1.3. The economic instruments system	0.35	2	0.7	1.75	0.35	It is adapted to conditions, has strong components to avoid/correct the pollution and sufficient coercion
2. The economic constraints	1		1.55	5	1	The weights of factors were assigned according with the intensity of previously calculated links
2.1. The normative constraints	0.45	1	0.45	2.25	0.45	Any normative constraint concerning the price means a failure of the free market operation, even if it is caused by insufficient funds to support drug use of the population
2.2. The competitive constraints	0.1	2	0.2	0.5	0.1	The competitive constraints did not have a big impact in this case
2.3. The endogenous constraints	0.45	2	0.9	2.25	0.45	The analyzed endogenous constraints revealed the company's incapacity to counteract the trade mark-up constraint through sales volumes

The matrix (Figure 3) that we propose to evaluate the effectiveness of the ecological behavior indicates the conditions in which it is possible to record deviations

from the measured level. In the same time, considering environmental protection a major duty, the future of humanity depends on and the activity of the company strictly necessary in the eco-social environment, using labor and local resources, the contributions to the budgets (central and local) and to the special funds, including the environmental fund, the whole issue has to be assumed by the community and the society. In order to solve these problems it is necessary to be allocated both the resources related to the Environment Fund, as well as other sources, including from EU funds and budgets (central and local).

The matrix of the effective ecological behavior has the following structure:

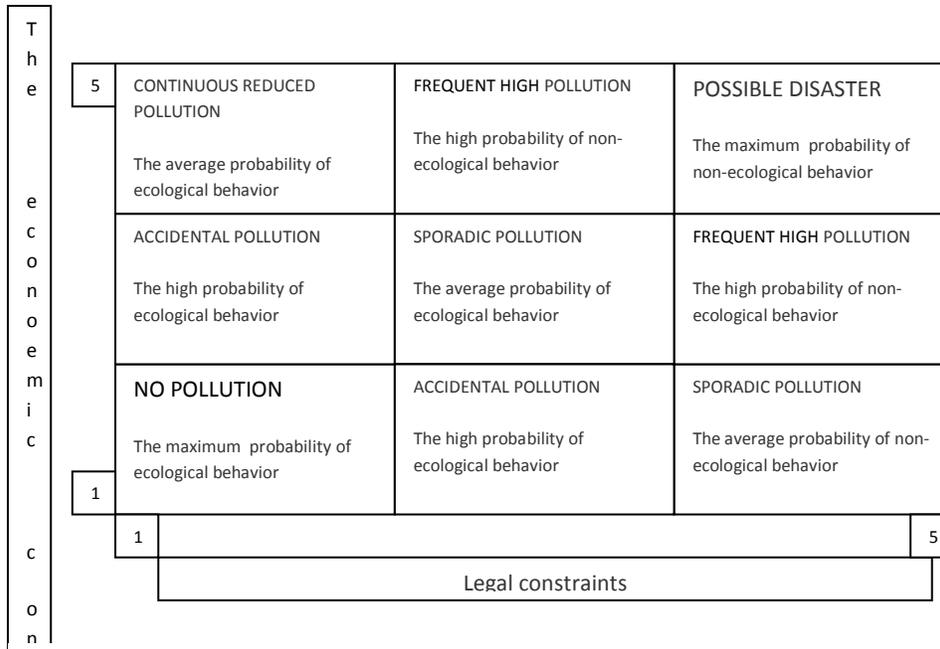


Figure 3. Strategic matrix of the ecological behavior

In this matrix the position of the company determined on the basis of the calculated values for the two variables is indicated by the gray circle, in the dial indicating the sporadic pollution.

Depending on the behavior detected in the matrix, there are identified in Table 5, without being exhausted, certain attitudes and actions of the central and local authorities needed to limit deviations from the level required by law (which, on the scale shown in figure2, are far from the maximum that would guarantee the stop of the imbalances).

Table 5

Effective ecological behavior	Authorities and proximate communities' behavior
NO POLLUTION	Control to maintain behavior.
CONTINUOUS REDUCED POLLUTION	Taking over the recycling/destroy of waste by the community. Suspension of penalties for the delayed payment of obligations justified by lack of liquidity.

	Rescheduling or changing the frequencies and the amounts of taxes for seasonal activity companies etc.
ACCIDENTAL POLLUTION	Strengthening control Additional penalties for negligence or, where appropriate, help in takeover and destruction or recycling of waste.
SPORADIC POLLUTION	Strengthening control Rescheduling of the obligations when proving lack of liquidity or additional penalties in case of negligence.
FREQUENT HIGH POLLUTION	Research financed by the authority to limit and eradicate pollution Grant for the purchase of the necessary equipment to reduce pollution. Taking over recycling / destruction by the authorities or local communities. Periodic evaluation of the status of solving the issues. Severe sanction of the negligence
POSSIBLE DISASTER	Regular strict control National research programs to reduce pollution and waste use Grant for the purchase of the equipment necessary for permanent measure and pollution reduction. Taking over recycling / destruction by the authorities or local communities. Extremely severe punishment of negligence

3. CONCLUSIONS

The cardinality of the preservation of the environment and biodiversity, orthoscopically focuses the concerns of the whole society, materializing in the legislative area in rules designed to achieve an effectively ecological behavior, historically adapted to the technological level of the society. “Understanding an ecological behavior is a *sine qua non* condition not only for the environment but also for the brand and the business. The growth and the development of destinations as well as of the T&T global area is a duty for the responsible stakeholders - both in terms of the social, cultural, economic and natural environment as well” (State and Stanculescu, 2012). As a political issue, the environmental protection is neither inoffensive nor irrelevant for the fundamental issues of social justice (Commoner, 1980).

The **effective ecological behavior** on the normalized level requires responsibilities equally incumbent by the companies, the community and the state in pollution reduction and in stopping the imbalances. The incongruent actions of the three grant responsible or imposing rules which cannot be fulfilled at a certain point will *sine qua non* create situations of deviations from the rules or will lead to the elimination from the economic life of some useful entities for the welfare of the society, resulting in entropies with negative consequences for the assembly. The right policies, focused on the community and national interests, assisting companies in assuming an ecological effective behavior, and the rigorous control of the compliance with the rules is the only way to settle such a complex problem.

The proposed matrix approach may point out to the environmental specialists the possible situations for a company and the appropriate measures.

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