DECISIONS BASED ON ENVIRONMENTAL INVESTMENTS AND SUSTAINABILITY

DAN IOAN TOPOR
LECTURER, PHD, 1 DECEMBRIE 1918 UNIVERSITY, ALBA-IULIA, ROMANIA,
e-mail: dan.topor@yahoo.com

CRISTIAN-MARIAN BARBU
SENIOR LECTURER, PHD, ARTIFEX UNIVERSITY, BUCHAREST, ROMANIA,
e-mail: doctrine.economice@gmail.com

SORINEL CĂPUȘNEANU
SENIOR LECTURER, PHD, DIMITRIE CANTEMIR CHRISTIAN UNIVERSITY, ROMANIA,
e-mail: sorinelcapusneanu@gmail.com

ILEANA-SORINA (BOCA) RAKOS
PHD. ASSISTANT, UNIVERSITY OF PETROSANI, PETROSANI, ROMANIA,
e-mail: nihilsinedeo_68@yahoo.com

DANA-MARIA CONSTANTIN (OPREA)
LECTURER, PHD, UNIVERSITY OF BUCHAREST, BUCHAREST, ROMANIA,
e-mail: danamartines@yahoo.com

Abstract

This work deals with the efficiency of the decisions based on environmental investments by the use of the cost-benefit analysis in the evaluation of an investment project of an aluminium industry company of Romania. The paper deals with the typology of the costs used in the evaluation of the environmental investment projects in point of managerial accounting, but also with the indicators used in a cost-benefit analysis. To analyze the data we used a questionnaire based on three questions whose results were analyzed and which were at the basis of the realization of our whole scientific approach. The case study on the cost-benefit analysis used in an environmental investment project has been realized at a company of the aluminium industry, of Romania, and the results obtained have been presented and analyzed adequately. The work ends with the au*thors'* conclusions related to the efficiency of the decisions based on environmental investments and sustainability and to the use of the cost-benefit analysis in the evaluation of the environmental investments projects.

Key words: sustainability, environment, managerial accounting, investments, decision, financial and non-financial information, cost-benefit analysis

JEL classification: E22, M41, Q01

1. Introduction

Providing reliable information in a relatively short time is one of the main aces guaranteeing the viability and efficiency of a managerial decision. During the last years, the managers and the specialists' interest in environmental protection has grown, following the application of the international environmental standards and green costs have played an important role in the substantiation of the decisions based on environmental investments and sustainability. Thus, green accounting becomes a main source providing the information necessary for the analysis of the environmental investment projects and the use of modern analysis methods indicates the direction to follow in choosing the most viable and efficient of them. The general objectives of this study refer to: (1) identifying some efficient analysis methods for environmental investment projects and (2) using the methods identified in the analysis of environmental investment projects, which also guarantees the efficiency of the managerial decisions in this sense.

2. Literature review

In the course of time, in the economic theory, the concept of investment has been approached and intepreted by various specialists of the domain, being perceived as an expense or investment of money at a certain moment considered the initial moment, to obtain subsequent effects in the near future. Other specialists [14] consider investments, in the economic growth models as equal to savings. A condition of the life quality increase is the growth of investments, while respecting the environmental conditions, in all the branches and activity domains of the national economy. The specialized literature offers a multitude of results of some researchers in this domain, and in related domains (innovation, green technologies, green products) realized in diverse approaches [1, 2, 12].

Decision making is the responsibility of each manager, and the stages of the decision making differ depending on their type of approach. Thus, some specialists in the domain [5] consider that the decisional process supposes the covering of three stages in seven steps, while other specialists [15] think that efficient decisions are made in five steps, and Chestnut believes that the decisional process supposes the covering of three stages, being an innovative process, yet more often than not the managerial decision is made under stress or with deadline, so that decision models are very useful instruments able to facilitate the decisional process regarding the environmental and sustainability investments.

The specialized knowledge and the very complex reality is the basis of the decisional process. In the decisional process, simplifying reality to construct a decisional model is the fundament for obtaining the most efficient decisions that can be made by managers. In the managerial decision-making process, the main modelling techniques used rely on classical approaches, such as mathematical modelling, multicriterial analysis, the ELECTRE method, the management of the environmental system, risk monitoring and evaluation, investments, biodiversity etc. [2, 4, 5, 11]. Other works of famous specialists [5, 8, 9, 10] rely on the computerized processing of the statistical data on platforms such as SPSS, SAS, HLM or on the use of other digital technologies [16, 18]. The decisional process of the investment aiming to obtain some economic-social benefits, during a certain period of time, in the context of the dedication of financial resources is expressed by some economists [3] by the cost-benefit analysis. According to it, the investment process actually represents optimal sets of investment actions based on rigorous planning, both on a sectorial and on a global level, based on which a combination defined by material, human, financial resources etc., determines an optimal economic and social development. Lately, the social need has grown more and more, natural and anthropic disasters, respectively international conflicts determine an increased consumption of resources, a fact triggering the adoption of resource allotment and use models based on performance and sustainability.

Whatever the technique used, decision modelling in order to obtain their efficiency supposes an approach correlating the quantitative research methodology with the qualitative methods. The desire of any economic entity is sustainable development, but "growth requires investment" [17].

3. Methodology of research

Considering the two main objectives of this scientific approach, the authors have realized a case study at a company of the aluminium processing industry in Slatina, testing the reaction of two categories of participants (managers and heads of departments), by means of a questionnaire that included the following questions: (1) Which of the methods enumerated below do you consider useful in the analysis of the environmental investment projects in our company? (2) Do you consider that the method identified by you contributes to the realization of an efficient analysis in environmental investment projects? (3) Do you consider that the method identified by you guarantees the efficiency of the managerial decisions regarding the environmental investments? (Table no. 1).

In the realization of this study we also took into account other research techniques and procedures such as: reviewing the specialized literature, observation, interview, data collection and processing, synthesizing the theoretical aspects and the research results.

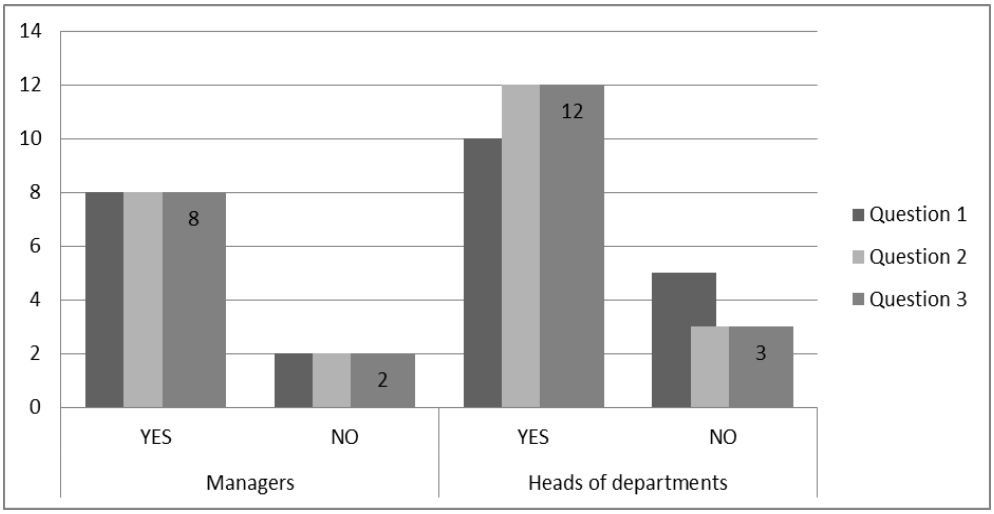
Table no. 1. **Categories of respondents and their answers**

Questions	Category of respondents			
	Managers		Heads of departments	
	Yes	No	Yes	No
1. Which of the methods enumerated below do you consider useful in the analysis of the environmental investment projects in our company?				
- accounting method (average profitability rate, recovery deadline)	5	5	9	6
- financial method (cost-benefit analysis (net present value, internal rate of return, payback period)	8	2	10	5
2. Do you consider that the method identified by you contributes to the realization of an efficient analysis in environmental investment projects?	8	2	12	3

3. Do you consider that the method identified by you guarantees the efficiency of the managerial decisions regarding the environmental investments?	**8**	**2**	**12**	**3**
Total	**10**		**25**	

Source: Elaborated by the authors

According to the graphic representation (Figure no. 1), after the analysis team has analyzed the questionnaires, it resulted that the most efficient analysis method for environmental investment projects is the cost-benefit analysis method since it is supported by financial indicators. At the same time, the cost-benefit analysis contributes to the realization of an efficient analysis for environmental investment projects, which also guarantees the managerial decisions' efficiency in this sense.



Source: Processing realized by the authors

Figure no. 1. **Graphic representation of the questionnaires' situation**

4. Evaluation of the environmental investment projects

Typology of the costs used in investment projects

The Accouting Department of the company analyzed by us has made an efficient analysis of the investment costs, identifying the following types of costs: (1) costs for the elaboration of the preliminary feasibility study, related to foregoing approvals (Romanian Waters Administration, firefighters, land fund improvements, water and sewage administration, salubrity, sanitary police and preventive medicine), costs for technical consulting; (2) costs for buying equipment, technology with a minimal impact on the environment; (3) costs for assembling the equipment and setting it into operation; (4) costs for maintenance and repairs; (5) costs for infrastructure development (connections to providers and facilities); (6) costs for environmental protection (costs for fighting the existing pollution and costs for preventing the future pollution); (7) costs for the retraining of the labour force from an ecological perspective; (8) taxation and taxes (only ecological); (9) costs for eco-taxes.

Typology of the costs used in the cost-benefit analysis

In point of managerial accounting, the categories of costs used in the cost-benefit analysis are [6]: direct costs (project cost, consulting cost, land cost, construction cost, technology cost, exploitation costs, management costs, training, funding cost etc.); indirect costs from externalities (ecological rehabilitation costs, pollution prevention costs, recycling costs, health costs caused by pollution or hostile environment etc.);

The costs related to the investments with impact on the environment are evaluated depending on: type of project (new objectives, rehabilitations, modernizations), construction type (civil, industrial, agricultural etc.) and private or public usefulness of the project. These types of costs are related to categories of benefits such as [6]: direct benefits, financial in nature (revenues from sales of goods and services), economic (economic development, local, regional, national – especially for infrastructure development projects, savings of resources used in production, brand image and consolidation of the position on the internal and external market in relation to one's clients and providers), social (increase of the number of jobs and social stability with effects on the economic and political stability), and indirect benefits from externalities, such as: market price (increase of property value, health benefits - decrease of the expenses for population health, benefits from education and ecological training, pollution prevention costs, increasing the

productivity of sectors such as: tourism, agriculture, fish breeding, economy of costs realized by decreasing the level of the ecological taxes) and shaddow price (conservation of the environment and of the eco-system, reducing pollution by noise, emissions and effluents; conserving natural scenery, preserving the historical, cultural and recreational areas, increasing the quality of the public and private services etc.).

Indicators used in the cost-benefit analysis

To realize the cost-benefit analysis we determined the following indicators: payback period, net present value and internal rate of return.

Thus, the first indicator, payback period (PP) which represents the number of years of exploitation of the investment during which the investment effort is recuperated based on the operational cash flows, is determined based on the following calculation formula:

$$PP = \frac{\text{Average annual cash-flow}}{\text{Investment cost}} \quad (1)$$

The second indicator called net present value (NPV) represents a value surplus resulted from the exploitation of an investment or the difference between the updated value of the earnings from that project and the initial investment (the result must be positive). This is determined based on the following calculation relation:

$$NPV = \text{Total updated cash-flow} - \text{Investment cost} \quad (2)$$

Where:

$$TUCF = \frac{\text{Cash-Flow1}}{(1 + RA)} + \frac{\text{Cash-Flow2}}{(1 + RA)^2} + \ldots + \frac{\text{Cash-Flow n}}{(1 + RA)^n}$$

The updating rate (AR) is used because the value of a future gain is in reality smaller than the value of the same gain obtained at present.

The third indicator, internal rate of return (IRR) represents the minimal profitability threshold of a project, under the level of which it is not efficient. This indicator must be at least equal to the average rate of the interest on the market or the updating rate. It is determined based on the following calculation relation:

$$IRR = \frac{\text{Investment cost}}{\text{Non-updated cash-flow}} \times 100 \quad (3)$$

Relying on the indicators presented previously, the cost-benefit analysis (CBA) is determined based on the following calculation relation:

$$CBA = \frac{\text{Total benefits}}{\text{Investment cost}} > 1 \quad (4)$$

The difficulty of applying the calculation formula resides in the fact that some benefits (ecological, social) are hard to quantify in terms of money.

Risk analysis for the investment project

The risk factors that could affect the investment proposed are: investment costs, sales, exploitation costs, modifications of the taxation and taxes during the period of time established, indirect costs pertaining to certain services (water, electric energy etc.). In the present economic and business environment, any investment decision is concerned by certain unforeseen modifications, more often than not negative regarding the environmental factors, and for this reason the negative impact on the investment project profitability refers to the project risk. During the period of investment project execution, the risk factors are determined by the technical features of the project, the experience and the way of working of the execution team, the exogenous parameters that can affect the sum necessary for funding. Thus, the risks that can appear are: (1) the risk of going over the costs (in the context in which they were not specified in the execution contract or in the investment budget); (2) the risk of delay (with negative effects on the increase of the need for funding or non-respect of the contractual clauses related to providers and clients); (3) the risk of cost indexation (in the situation in which in the contract no explicit clauses are foreseen regarding the finalization of the project at the costs foreseen at the date when the contract was signed).

5. Cost-benefit analysis of the investment made at an aluminium processing company in Romania

To reduce the influence of pollution on the environmental factors, a company of the aluminium processing industry of Romania realizes an investment in production equipment (band saw for aluminium bars) in the aluminium foundry section, and the cost of this investment is 380,000 lei. The equipment is bought in the month of May and the functioning and amortization duration for this equipment is 5 years, and during this period, economic-financial and social benefits will be generated. The total cost of the investment is presented on elements in Table no. 2.

Table no. 2. **Statement of the investment's total costs**

Elements	Sum (lei)
1. Costs for the elaboration of the prefeasibility study, approvals and consulting	4800
2. Acquisition costs	85000
3. Costs for assembling the equipment and setting it into operation	172000
4. Costs for maintenance and repairs	20200
5. Costs for infrastructure development (connections to services and facilities)	24500
6. Costs for environmental protection	40000
7. Costs for retraining the labour force from an ecological perspective	22500
8. Costs for taxation and taxes (only ecological taxes)	5500
9. Costs for eco-taxes	5500
Total costs of the investment	**380000**

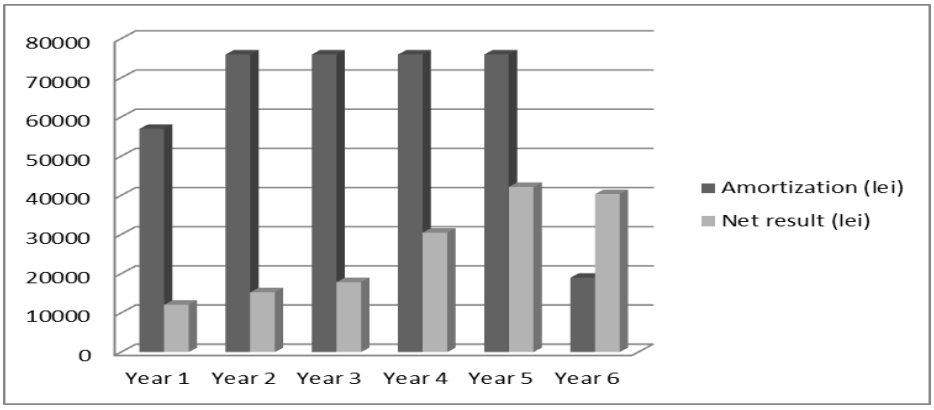
After setting into operation the equipment (in the month of May), it will generate revenues from the sales of products, but it will also consume resources that will be reflected in the operational expenses for materials and services from third parties, personnel salaries, amortization and taxation and local taxes. The revenues and the operational expenses have been estimated only for the period of economic amortization (5 years), starting from the 5th month of the first year of operation and up to the 5th month of the last year of amortization. During this period, it has been estimated that the investment will generate: revenues from exploitation 987,000 lei, exploitation expenses 828,764 lei and net benefits (profit) 158,236 lei. In order to realize the cost-benefit analysis, we calculated and analyzed the following indicators: payback period, net present value and internal rate of return.

According to the centralized data necessary to determine the first indicator, the situation appears as follows (Table no. 3):

Table no. 3. **Cash-flow statement**

Explanation	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total	Media
Amortization (lei)	57000	76000	76000	76000	76000	19000	380000	63333,33
Net result (lei)	12090	15280	17850	30500	42166	40350	158236	26372,67
Cash-flow (amortization+net profit)	69090	91280	93850	106500	118166	59350	538236	89706

Graphically, this situation appears as follows (Figure no. 2):



Source: Processing realized by the authors

Figure no. 2. **Situation of the amortization and of the net result during the period of realization of the investment project**

$$PP = \frac{380000}{89706} = 4.2 \text{ years}$$

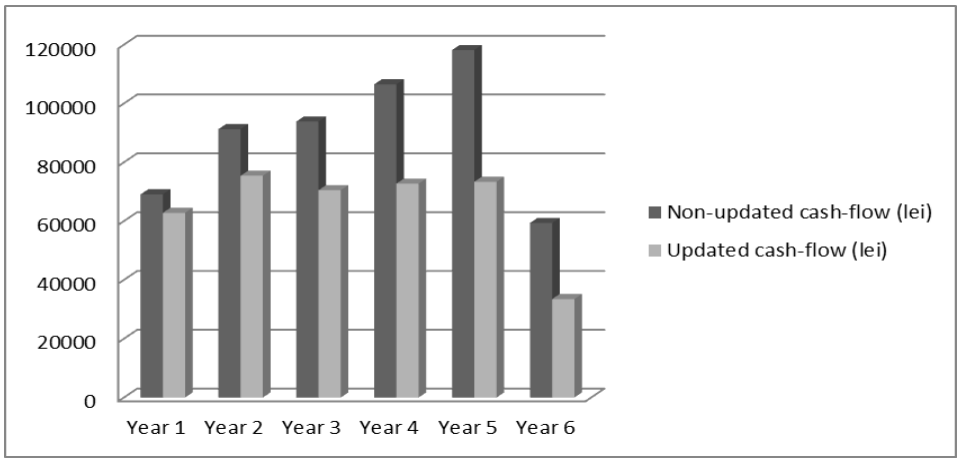
Payback period (PP) = 4.2 years is smaller than the investment amortization duration (5 years), which means that the investment is efficient.

Based on the centralized data, the situation of the updated cash-flow appears as follows (Table no. 4):

Table no. 4. **Situation of the non-updated and updated cash-flow**

Explanations	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Non-updated cash-flow (lei)	69090	91280	93850	106500	118166	59350	538236
Updated cash-flow (lei)	62809	75438	70511	72741	73372	33502	388372

Graphically, the situation appears as follows (Figure no. 3):



Source: Processing realized by the authors

Figure no 3. **Non-updated and updated cash-flow statement for the period of realization of the investment project**

Under these conditions, NPV = 388372 – 380000 = 8372 lei

NPV > 0, and this positive value means that the investment is efficient.

Using the data in Tables no. 2 and 3, IRR = 380000/538236 x 100 = 71%

The internal rate of return (IRR) = 71% is bigger than the updating rate (10%), which means that the investment is efficient.

Based on the data centralized in Tables no. 2 and 3, the situation of the CBA appears as follows:

$$CBA = \frac{987.000}{380.000} = 2.59 > 1$$

The ratio CBA = 2.59 and this value over 1 demonstrates that the investment is efficient, even if one were to take into account only the monetary benefits, to which one ought to add other benefits, such as the creation of new jobs, the improvement of the standard of living, premises for the development of other economic activities, environmental protection etc.

6. Results interpretation

Based on the data centralized and analyzed in the case study presented, one can conclude that the project is economically efficient, since: (1) The payback period is much shorter than the investment amortization duration; (2) The net present value is positive or bigger than zero; (3) The internal rate of return is bigger than the actualization rate. To avoid the risks during the investment project execution, adequate programming of the activities has been realized, the personnel has been trained and this avoided the formation of extra costs and the delay periods. At the same time, the team that carried out the setting into operation of the equipment has been carefully selected using in this sense the information available from the realization of previous contracts and the contracts' attentive negotiation. By the information provided to the management of the company, it will be able to make a very well-substantiated decision

which will guarantee its viability in time and will bring a valuable surplus of information to the company's green assets. The final decision will be made based on the dashboard made up of the above-mentioned and above-analyzed indicators (Figure no. 4).

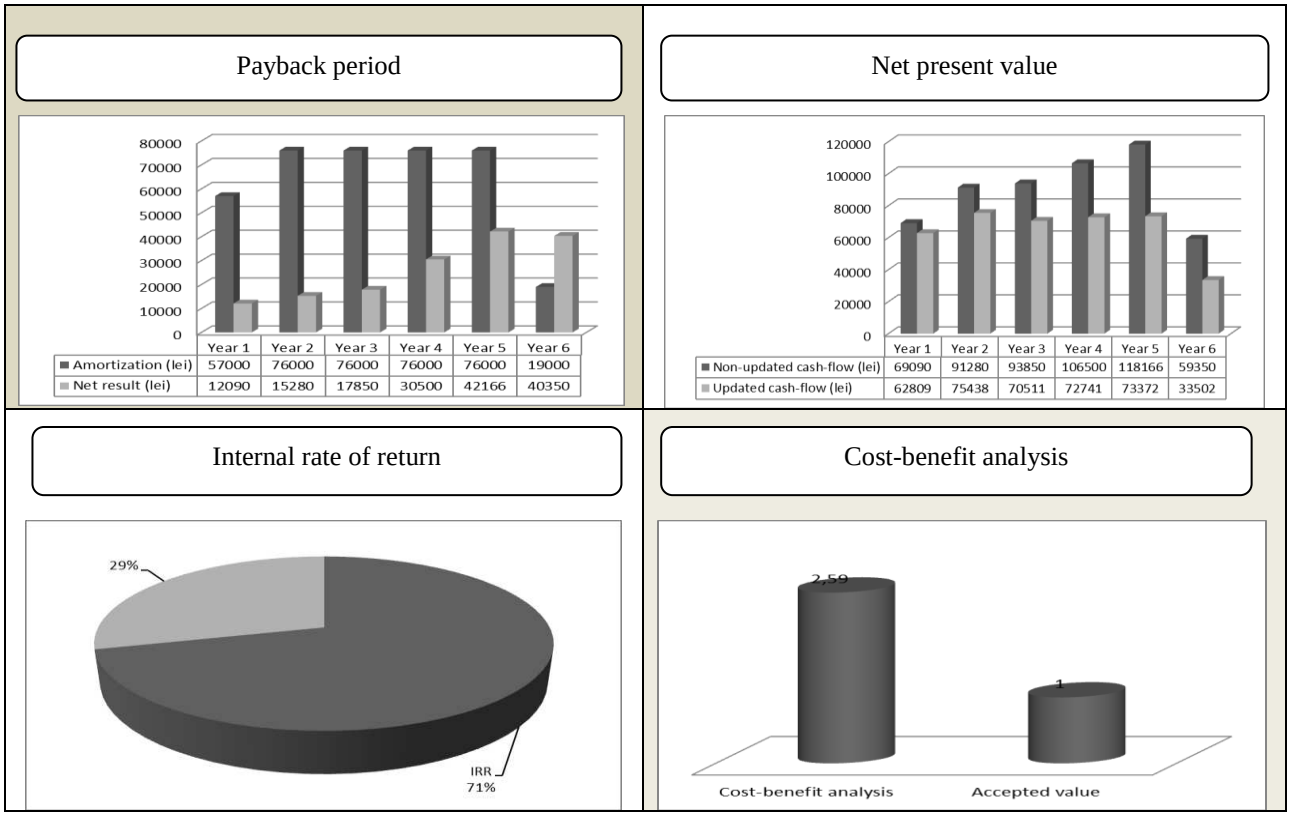


Figure no. 4. **The dashboard based on indicators pertaining to environmental investments**

7. Conclusions

The integration of sustainability in all the strategies and activities of a company is realized with difficulty at present, yet the managers can identify those ways of going over the obstacles of its implementation. As the sustainability implementation process becomes more evident and justifies the efficacy by the new challenges the company has to face, for the company it becomes obvious that it has responsibility regarding the resources used both regarding the environmental protection and the society, and economically, regarding the obtaining of profit. Thus, the capital of the company can be considered as made up of all those components of the environmental protection, of social equity and resource saving. The companies opting for sustainable strategies and practices will be able to obtain extra value as a consequence of the increase of their revenues by the manufacturing of products, reducing costs with the help of ecoefficiency, managing operational risks and the risks derived from more efficient regulations [7]. At the same time, they will be able to transform intangible assets such as the trademark and reputation and constitute networks for collaborating with the clients, the competitors and the providers, all these giving an impetus to the sustainability improvement process [13]. The decisions based on the cost-benefit analysis contribute to a rigorous substantiation of the information regarding the environment and the environmental investments, a fact confirmed by their efficiency in the decisional process during short or long periods of time.

8. Bibliography

[1] **Andrews, T., Scott, H**. What is Grounded Theory?, Available at: http://www.groundedtheoryonline.com/ what-is-grounded-theory, 2013.
[2] **Antonietti, R., Marzucchi, A.** Green investment strategies and export performance: A firm-level investigation, INGENIO (CSIC- UPV) Working Paper Series 2013/02, Institute of innovation and knowledge management, Valencia, Spain, 2013;

[3] **Anthony E. Boardman; David H. Greenberg; Aidan R. Vining; David L. Weimer,** Editura ARC, Analiza cost-beneficiu, concept şi practică, Ediția a II-a; 2004;
[4] **Aras, G., Crowther, D.** The durable corporation. Strategies for sustainable development, Gower, MPG Books Ltd., Bodmin, Cornwall, GB, p.254, 2009;
[5] **Azevedo, S., Cudney, E.A., Grilo, A., Carvalho, H., Cruz-Machado, V.** The influence of ecoinnovation supply chain practices on business eco-efficiency", MPRA, Paper No. 42704, Available at: http://mpra.ub.uni-muenchen.de/42704/, posted 18 November 2012;
[6] **Bănacu, C.S.** Analiza cost-beneficiu (ACB) instrument util pentru studiile de fezabilitate la investiţiile din domeniul public, Management, Economia 1/2014, pp. 65-66;
[7] **Barbour, R.** Introducing Qualitative Research, SAGE Publications Ltd., 2013;
[8] **Blunch, N.,** Introduction to Structural Equation Modeling Using IBM SPSS Statistics and Amos, SAGE Publications Ltd., 2013;
[9] **Boardman, A.E., Greenberg, D.H., Vining, A.R.,** Cost-benefit analysis, Concepts and practice, 4th ed., Pearson Prentice Hall, New Jersey, 2012;
[10] **Bragge, J., Korhonen, P., Wallenius, H., Wallenius, J.**, Bibliometric Analysis of Multiple Criteria Decision Making/Multiattribute Utility Theory, IXX International MCDM Conference Proceedings, (Eds.) M. Ehrgott, B. Naujoks, T. Stewart, J. Wallenius, Springer, Berlin 634: pp. 259–268, 2010;
[11] **Brandimarte, P.,** Quantitative Methods: An Introduction for Business Management, Willey, 2011;
[12] **Chestnut, D.** Theory Management on Decision Making, Available at: http://www.ehow.com/facts_6962551_theory-management-decision-making.html (web, 20 noiembrie), 2012;
[13] **Danciu, V.** Întreprinderea sustenabilă. Noi provocări şi strategii pentru îmbunătățirea sustenabilității corporative, Economie teoretică şi aplicată Volumul XX, No. 9(586), pp. 4-24, 2013;
[14] **Keynes, J. M**., Teoria generală a ocupării forței de muncă, a dobânzii şi a banilor, Romanian translation. Mădălina Haita, Ed. Publica, Bucureşti, p.227, 2009;
[15] **Lindenberg, N**., Public Instruments to Leverage Private Capital for Green Investments in Developing Countries, [on line], Discussion paper, No.4/2014, German Development Institute, Bonn, 2014;
[16] **Paulus, T., Lester, J., Dempster, P.**, Digital Tools for Qualitative Research, SAGE Publications Ltd., 2013;
[17] **Zenghelis, D.**, A strategy for restoring confidence and economic growth through green investment and innovation, Grantham Research Institute in Climate Change and the Environment, London, 2012;
[18] **Zhou, M., Pan, Y., Zhimin Chen, Z., Yang, W., Li, B.,** Selection and evaluation of green production strategies: analytic and simulation models, Journal of Cleaner Production, Volume 26, May 2012, Elsevier, Pages 9–17. 110. Zwtsloot, G.I.J.M (2003) From management systems to corporate social responsibility, Journal of Business Ethics 44 (2/3), 201-07, 2012.