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ABB-ABC-ABE-ABM Approach for Implementation in the Economic Entities from Energy Industry

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Abstract

The purpose of this article lies in demonstrating the effectiveness of four connection methods ABB-ABC-ABE-ABM conducive to successful implementation and improving the performance of an economic entity. The objectives of this study are focused on: (1) the application of ABB-ABC-ABE-ABM within an economic entity within the energetic industry and (2) highlighting performances, including environmental performance. In the framework of this article the contributions are brought by the mix of methods on the national and international level, namely the modalities and stages of their specific within an economic entity. Environmental components are addressed within the mix of economic entity methods used, their benefits and limitations. Based on case study prepared by the authors, the results of applied methods mix to improve environmental performance within the surveyed entity are presented. The article ends with the conclusions of the authors related to the efficiency of the use of the ABB-ABM-ABC-ABE for improving performance, including environmental performance within the surveyed entity.

Keywords: ABC, ABB, ABM, ABE, Emissions, Performance

1. Introduction

Technological innovation and changes in the business environment triggered by global competition have led to innovations in the use of financial information and the non-financial entities. Environmental component is becoming more and more present in these financial and non-financial statements, offering data on costs and performance in terms of processes, activities, services and customers. To obtain on-time reliable information on costs, managers have turned to reshape some devoted managerial accounting systems to benefit from additional sources of information related to the environment. Remodeling cost calculation systems has brought some significant contributions of information not only for managers or decision makers, but also organizational culture. Relying on multiple integration tools for measuring and monitoring the performance of economic entities, the contemporary costs calculation methods have adopted many of these and thus contribute to the production of complex information and reliable required decisions of managers or decision-makers.

The increasingly application of more mix cost calculation methods led us in studying certain aspects of environmental integration regarding the ABE method under the triptych ABB-ABC-ABM in the case of economic entities in energy industry based on fossil fuel (coal) from Romania. The central goals of this article focus around two issues: (1) the application of ABB-ABC-ABE-ABM system within an economic entity within the energy industry and (2) highlighting performances, including environmental performance thereof.

2. Literature Review

ABC method is one of the most controversial methods of cost calculation in terms of the advantages and disadvantages offered by implementing in various activity sectors or branches of the savings on the different continents. Starting from the limitations offered by traditional methods of cost calculation, the experts have been trying to find solution for the identification of real costs of products, services or executed works, and one of these was the Activity-Based Costing (ABC) method. From its appearance, ABC has seen several variants more or less extensive in respect of cost management or calculation, be simple, or in combination with other methods.

In the past 20 years the experts have also begun to consider environmental costs relating to the emissions in the environment, both in the financial accounting and managerial accounting plan. We can rely on the research undertaken by specialists on various components of the environment: emissions into the atmosphere (Depoeres, 2000; Hughes et al., 2001; Deegan, 2002; Chavent et al., 2010); worldwide environmental reporting (Holland & Foo, 2003; Nyquist, 2003; Jorgensen & Sodorstrom, 2007; Yusoff et al., 2007; Yumamoto et al., 2007); environmental reporting at the national level (Larrinaga et al., 2002; Deegan et al., 2002; O'Donovan, 2002; Burrit, 2002; Taylor & Rafai, 2003; Șendroiu et al., 2006; Sumiani et al., 2007; Briciu & Sas, 2008; Ivan et al., 2017). Of the methods studied and enshrined in terms of emissions in the atmosphere we can rely on Activity-Based Emissions method (ABE) (Recker et al., 2011). Another method derivative to the ABC method is the Activity-Based Budgeting method (ABB) which represents a realistic solution to the budgetary side of activities of an economic entity (Tinkler & Dube, 2002; Essam, 2005).

Strategic management accounting tools such as ABC/ABM can help economic entities in decision-making (Căpușneanu & Martinescu, 2010) and in the management of environmental costs for sustainable business. The ABC/ABM system was and is used to improve cost structure that combines their allocation mode with the process of activities management (Cokins & Căpușneanu, 2011), this slide allowing economic entities to allocate better resources and to improve its production processes to reduce costs.

3. Method

Based on the two main objectives of the scientific approach we achieved a questionnaire at the energy complex from Romania which has identified two categories of opinion of participants (managers and directors of departments) on the following questions: (1) What measurement tool of environmental performance would be indicated to use within your company? (2) The tool for measuring environmental performance can contribute to its improvement inside your company?

In this questionnaire we have been envisaged the use of information sources based on discussions and interviews, the collection and processing of data, synthesis of theoretical and practical aspects and review of the literature in the field as regards the results of research made. The sample was conducted on a number of 126 respondents, of which 42 managers and 84 directors of departments. After the analysis of the questionnaires, the analysis team presented the obtained results (table 1). In accordance with the opinion expressed by the participants in the survey, the best tool for measuring the environmental performance in the company is a mix of methods that rely on the ABC and ABE methods in the context of the run-up and planned resource management, that is to say the quadruple ABB-ABC-ABE-ABM. It is responsible for improving the company's performance within the energy industry, offering the possibility to measure and improve the environmental performance and ensuring a cleaner and sustainable environment.

Table 1. Categories of respondents and their answers

Questions	Category of respondents			
	Managers		Directors of departments	
	Yes	Not	Yes	Not
1. What measurement tool of environmental performance would be indicated to use within your company?				
- ABE method	20	22	45	39
- ABC-ABE method	22	20	53	31
- other methods or mix of methods	34	8	58	26
2. The tool for measuring environmental performance can contribute to its improvement inside your company?	32	10	67	17

Source: Prepared by the authors.

4. ABB-ABC-ABE-ABM Implementation in the Economic Entities from Energy Industry

4.1 Approaches to Environmental Components within the Mix of Methods Applied to the Level of Economic Entities

Currently, more and more economic entities integrate environmental components into own management or at the strategic level or at the operational level. Information management of these entities is geared on the collection, processing and communication of environmental information. The ownership on resources (water, air, soil etc.) cannot be of an entity that uses these resources, though its heritage is given the totality of the rights and obligations with economic value belonging to a natural person or legal and economic assets to which they relate. Therefore, an entity must take account of all aspects relating to the environment, since these contribute to cost-efficiency and profitability of the entity.

The environmental researches have established the semantic reconsiderations framework in national/international context of concepts such as: production process, cost, profit, economic growth. Therefore environmental accounting is responsible to take environmental aspects considering that they are the basis of decision-making. This reasoning also had in mind some aspects such as: (1) the limitation of financial accounting and widening its framework by including environmental aspects; (2) the performance of an economic entity includes also the environmental performance; (3) quantification of emissions is based on an appropriate model which illustrates the principle of ABC method adapted to the environmental component (activities consume resources, but they are not inexhaustible); (4) the provision of information related to the environment (real, accurate and on time) constitutes the guarantee of solid managerial and effective decisions.

ABC method consists in establishing a correlation between established activities according to the list of activities and their specific cost drivers and application of ABC-ABM for environmental costs determination involve the identification of environmental costs and environmental hidden costs in the indirect costs of an economic entity. Determination of environmental costs on costs' carriers will help identify all the activities related to the environment, but also to the total costs of the economic entity.

Environmental costs are assigned correctly as well as to the actual production and the provided production (budgeted). The non-inclusion of recycling and remediation costs of environmental aspects in the total cost of production will lead to the achievement of incorrect total costs.

Therefore, for the allocation of expenditures related to the environment will be used specific cost drivers that will take account the impact of activities on the environment. Within the analyzed entity, there have been identified three criteria or specific environmental cost drivers to which it will allocate the expenditure related to the environment: the degree of toxicity of the emissions, the volume of emissions and/or sterile dumps kept under control and emissions/the impact of emissions on the environment.

Using ABC method, the environmental costs are treated distinctly under the indirect costs,

which are included in the production cost, by identifying the consumed resources, the activities and related costs (related to auxiliary sections). It is obtained a clearer record of performance in respect of each centre cost, sector of production.

From the economic point of view, taking into account by the economic entities of environmental aspects in the cost of the works, services or products to allow them a better rationalization of natural resources and energy, but also satisfying the requirements concerning respect for the environment and human health. For a better understanding of those aspects we exemplify the inclusion of environmental cost through ABC-ABE according to the specificity of the entities from energy industry. The general framework of the initiative undertaken by the case study to the investigated entity was based on Figure 1.

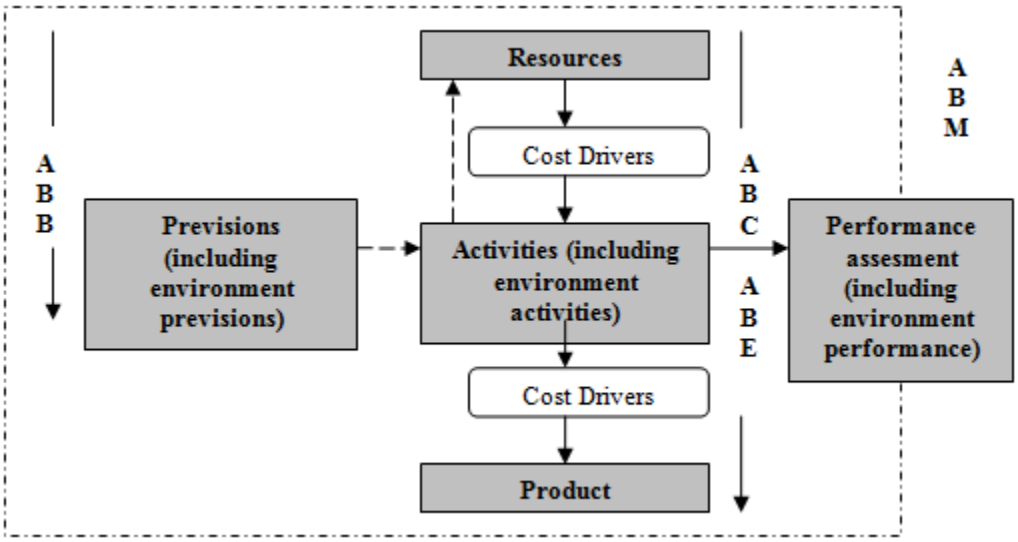

Figure 1. Using quadruple ABB-ABC-ABE-ABM within an economic entity

Source: Authors' own processing.

4.2 Stages of ABE Integration into the ABC-ABM Mix to the Level of Economic Entities

Integrating the ABE analysis under the ABC-ABM mix aims at determining and measuring emissions of CO into the atmosphere and the costs associated with routine cleaning emissions and other types of pollutants. Thus, the information collected may be used for the development of reporting complex situations where information relating to the environment is included in properly harnessed managers' decisions. Economic entities that already use the ABC-ABM mix will browse through the following itinerary regarding the integration of ABE method:

Stage 1. Setting the products, types of emissions and their monitoring

At this stage, establishing the goal is priority to the start of the whole approach of integrating

ABE method. Thus, the purpose of the entity subject to the analysis consists in measuring the carbon emissions in the atmosphere and related costs for the obtaining energy based on coal combustion. In order to ensure the success of the integration for the ABE method it is necessary that the whole involved staff (managers, directors of departments, direct and indirect productive personnel) to agree and to have understood the advantages offered by its implementation. On this occasion, it shall be established those responsible for monitoring and measuring the direct or indirect carbon emissions in the atmosphere based on the application of specific/local industrial standards. In determining and measuring emissions, the economic entity recorded emissions on each process/activity. The obtained data should be kept for a longer period of time to be able to perform analyses or comparisons over time.

Stage 2. Identification of processes or activities which require the determination of the CO and other types of pollutants

In order to establish processes or activities which consist in the determination of CO emissions, will be collected information on:

- Financial accounting information records regarding: wage costs, material costs, material costs, discretionary spending, vendors, customers, other expenses of the economic entity;

- Information on human resources: identification of working people (personal codes), their place of employment and their work hours;

- Information about emissions: measuring data directly or through sensors from noxious fumes or exhaust pipes;

- Information on emission factors: the quantity of emissions associated with a particular activity (e.g., CO expressed in mg/m^3 of air or the amount of waste resulting from the technological process expressed in cm). Emission factors are usually supplied by a third party and will vary depending on geographical location and other variables.

- Metric information about resources and activities: the volume of the activity which creates emissions (e.g. the amount of electricity consumed by an activity).

Stage 3. Determination of cost drivers related to environmental activities or emissions drivers

In order to determine CO emissions and other types of pollutants, these were demarcated on two areas:

• Implementation field 1 for direct CO emissions within the economic entity;

• Implementation field 2 for CO emissions arising from organizational activities, such as: waste disposal or materials purchased from third parties.

Stage 4. Calculation of CO emissions costs related to processes and activities based on emissions drivers and other types of pollutants

Stage 5. Determining the full cost of the product by including the costs of emissions

Determining the final cost of the product shall be carried out according to the ABC method,

namely:

Total Cost = Direct Costs + Indirect Costs (of activities, including the green activities) (1)

4.3 Case Study on Determining Depollution Costs to the Level of Economic Entities

In the context of an economic entity in the energy industry, the following processes (activities) were identified: (1) the supply-to-sell process (activities: supply, sales); (2) the production process (activities: production, maintenance, transport, environment and depollution); (3) administrative process (activities: financial-accounting, cost-pricing, performance indicators calculation, quality assurance, organization and planning of work, personnel/salary, administrative). The situation regarding the identification of the main processes and activities of the economic entity in the energy industry is shown in Table 2 and the situation of direct and indirect expenses (by activity) in Tables 3 and 4. For example, it was chosen to determine the cost drivers for the depollution activity (Table 5) and to calculate the costs of the depollution activity (shown in Table 6).

Table 2. Identification of the main processes and activities of the economic entity in the energy industry

Process	Main Activities	Main Activities Components
Supply-to-sell	1. Supply	• supplier selection
		• launching and reception of orders
		• supply plan draw up/follow
		• stock
	2.Sales	• coal-sell
Production	Main Activities	Main Activities Components
Process	1. Production	• preparation of the works
		• extraction/mechanized extraction
	2. Maintenance	• operating machinery, repairs
	3. Transport	• transportation
	4. Environment and depollution	• Monitoring emissions (sedimentary dusts and particulate matter)/Quantity of waste resulting from the process wear (cubic meter)
Managing Process	Main Activities	Main Activities Components
	1. Financial-accounting	• accountability (financiary, management)
		•calculation, costs reckon up
	2. Assigning costs-prices	•costs audit
		•selling prices assess
	3. Performance indicators calculus	•performance/environment performance calculation
	4. Quality assurance	•quality control
	5. Work organizing and planning	•assess norms and regulations
	6. Human/salary resources	•staff manning/inventory
		•salarization
	9. Administrative	•general administration

Source: Prepared by the authors.

Table 3. Situation of the direct expenses of the economic entity in the energy industry

No.	Direct Expenses	Sum (RON)
01.	Consumption of raw materials	861278.00
02.	Expenditure on electricity and water	113365.57
03.	Expenditure on damping - treatment plant	733000.00
04.	Expenditure on inventory items	4178.45
05.	Expenses with GFR transport	536200.00
06.	Expenses on packaging	253.01
07.	Expenses on the materials transport	38147.82
08.	Salaries expenses	2290308.00
09.	Expenses on salaries accessories	1124838.00
	Total	5701568.85

Source: Prepared by the authors.

Table 4. Situation of indirect expenses (by activity) of the economic entity in the energy industry

No.	(Indirect) Activities Expenses	Sum (RON)
01.	Consumption of various materials	3874.00
02.	Fuel consumption	3465.00
03.	Spare parts	19584.26
04.	Expenses on electricity for auxiliary and main sections	935439.85
05.	Expenses related to auxiliary heating thermal energy	29060.00
06.	Expenses on amortization of auxiliary and main sections	51633.24
07.	Expenses with amortization	405
08.	Expenses on repair of auxiliary machinery equipment	29491.76
09.	Expenses on services provided by third parties for ancillary services	551189.88
10.	Expenses with antidotes for the auxiliary section	175.38
11.	Expenses on salaries related to auxiliary and principal departments	1810500.00
12.	Expenses on salary accessories related to auxiliary and principal departments	776121.00
13.	Expenses of general interest of expenditure on administrative activities	1607351.19
14.	Expenses for depollution	67947.80
	Total	5886238.36

Source: Prepared by the authors.

The cost drivers identified in the environmental and depollution activities of the production process are: number of analyses resulting from emission monitoring (sedimentary powders and particulate matter); the amount of waste resulting from the wear process (cubic meter).

Table 5. Determination of cost drivers related to depollution activities and units of measurement

Process	Main Activities	Activities Components	Costs Inductors	U.M.	Quantity
Production	4. Environment and depollution	Emissions Monitoring	Analyses number	bulletin	4
		Waste Monitoring	Waste Quantity resulted from the wear process	cm (cubic meter)	10050

Source: Prepared by the authors.

Table 6. Calculation of depollution costs

Expenses for depollution (RON)	Monitoring emissions/waste	
	Analyses number	Waste Quantity
67947.80 of which: - analyses 5208.40 - waste 62739.40	1302.10 RON/bulletin	6.2427 RON/cm

Source: Prepared by the authors.

Calculation of total production cost: 5701568.85 + 5886238.36 = 11587807.21 RON.

Unitary Cost on kwh is = 11587807.21 RON/21462876 kwh =0.5399 RON/Kwh

4.4 Evaluation of Environmental Performance

In assessing the environmental performance of an economic entity it is necessary to calculate specific environmental indices. The environmental index calculated for carbon monoxide, I_{CO} was based on a simple mathematical formula: I_{CO} = quantitative emission or pollutant concentration/standard emission or admissible limit value expressed in mg/m^3 (Rojanschi et al., 2008). According to the law no. 104/2011 on the ambient air quality with respect to the limits for the protection of human health, the permitted limit value for the CO pollutant is 10 mg/m^3 for 8 hours (APMH, 2017).

Based on the data from the economic entity, we calculated the carbon monoxide index (I_{CO}) using the above formula, for the 2014-2015 time frame at the annual quantitative emission level, for the two industrial and urban areas, with the values:

- *industrial base*: 0.019 mg/m^3 for 2014 and 0.016 mg/m^3 for 2015;

- *urban background*: 0.017 mg/m^3 for 2014 and 0.02 mg/m^3 for 2015.

5. Conclusions

The activity-based cost method provides a quantity of financial and operational information necessary to determine performance, respectively environmental performance. By taking into account the real use of equipment and resources (technological and human) within the

activities identified through the processes at the level of the entity, the necessary information can be collected for the realization of a multi-level architecture that also highlights the information related to the environment. Based on the ABC analysis, the Activity-Based Emissions (ABE) analysis can be performed on each process and on each activity to determine and calculate CO emissions. By identifying process/activity emission drivers and determining environmental costs, the emissions-based method contributes to highlighting the impact on alternative resources that help the process. Determining the costs of emissions and adding to the other direct and indirect components of the costs can determine the costs of products, works or services. By providing an accurate view of reality, activity-based emissions analysis contributes directly to identifying the positive or negative impact of CO emissions on processes or activities within the entity. This information is also the basis of the process of future design of the processes and activities specific to the environment, but also the basis for decision-making by the management of the economic entity. By measuring the environmental impact of a process/activity, analysts and/or managers are determined to take into account their environmental decisions, having the ability to execute or make changes in the processes within the entity. Considering the efficiency of using the mix of methods to determine the costs or performances of economic entities, we believe that future mixes will be used between the ABC method and other methods used to highlight or calculate emission/immissions or other categories of pollutants at the process/activity level. Our empirical study is particularly limited, by taking into account only the narrowing of mining category—specific pollutants in determining and calculating emissions.

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Glossary

ABB: Activity-Based Budgeting.

ABC: Activity-Based Costing.

ABE: Activity-Based Emissions.

ABM: Activity-Based Management.

Kwh: kilowatt per hour.

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