A modern approach on modeling the cost behavior by ABC/ABM method

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Abstract

The article intend to prove that the traditional methods of cost calculation do not correspond anymore to the actual principles imposed by the global economical competition which is focused more likely on the structure expenses, the conception period, the information sources and the value.

The ABC method, the most popularized of all administration methods, presents the advantage of identifying the places where is found the origin of the waste, which are the activities with a low added value, where are located the unused capacities and how the costs are constituted.

Adapted to the requirements of the Romanian economy, the ABC method can be applied in two stages, which are presented in the paper. There were identified the activities, the processes and the products and inside them, we proceeded to the modeling of the cost behavior, modeling which includes the EAD and APD concepts. The peculiarity of the method applied in the Romanian enterprise is that through the processing information, there can be determined the production cost for every line production, every activity, every floor, on the time unit (minute or hour) and on the product, as it is mentioned.

By studying the specialty literature, we noticed some opinions regarding the possibility of integrating the ABC method with EVA, an aspect which is not possible, for now, to be applied to the studied enterprise. EVA remains an indicator for presenting financial performances through a new perspective, being useful especially for firms that perceive the capital as a source of funds without any costs and where the financial results are measured just through some profit indicators.

The conclusion is that the utility of the method in taking strategic decisions regarding the selling cost and the best fabrication quantities remains uncertain because there can not be attached the principles of determining the breakeven point or the marginal contribution as long as the method does not allow the grouping of fixed and variable expenses. The solution could consist on developing a mixed alternative method which takes into consideration the activities behavior through which could be identified the cost of some specific activities that can allow determining the profitability of each product.

Key words: cost, value, activities, process, performance, Romanian enterprise

1. INTRODUCTION

For a long time, the enterprise managers have considered that the only way to face competition is the one of dominating through costs, a reason for which they acted in the direction of accomplishing a large volume of production and savings.

Inverting the pyramid of costs under the impact of advanced technologies in the field of production as well as information and communications, determines that the traditional methods of cost calculation based on the principle of analysis centers do not agree to the actual interests, at least for the following considerations:

- distributing certain indirect expenses (electricity, phone calls, electricity expenses, etc.) on the analysis centers is realized using distribution keys which contain inevitably an arbitrary part, and as a consequence, the final cost of products loses its objectiveness;

- analysis centers making a diversity of tasks and this make impossible to find a satisfactory explicative factor; in difficult conditions, the choosing of the work unit is based on a known and easily measurable element, a reason for which it appears as being purely conventional; the force of habit leads to keeping the work unit without taking into consideration the causative relation which may disappear under the organizational or technical circumstances;

- the division of the enterprise on analysis centers is not based on a economical modeling, but on technical-economical entities from the organizational structure of the enterprise;

- the double classification of the expenses in function of two criteria - affectability and variability - is equally conventional, because it depends on a certain reference point in relation to which the classification is made;

- determining the accounting administration period is very conventional and does not correspond to any economical reality. The real time of the enterprise is not a conventional time, it is a time that corresponds to the own rhythms of the enterprise life;

- a traditional accounting model may be qualified as "volumetrical" because it is based on a one and unique explicative variable: the volume of manufactured or sold products. If the "volumetrical" relation is unquestionably in what concerns direct and variable expenses, it is very contestable for the indirect expenses which have not always depended on the production volume, but, especially, on the operations of administrative management.

But the actual principles for the global economic competition are oriented more likely towards the domination of structure expenses, the conception period, the information sources and the value.

The conclusion that Berliner, C. and Brimson, J.A (1988) reached was that the essence of the added value and of the waste as well are situated in indirect expenses, expenses which are neglected, often treated in block and conventionally distributed over products based on the consumption of direct expenses, especially the manual work. This aspect can lead to a diagnostic error, motivated by the fact that the managers of the enterprises are interested first on the direct expenses, losing from sight that indirect expenses are generated not only by the production process, but also by a series of transactions which take place inside the enterprise: logistical operations, marketing operations, operations for improving the products quality, current operations for updating the products range, fabrication nomenclature, standards, etc. (Porter, M., 1986:107)

From another point of view, the traditional calculation is interested only on the expenses which are generated by the cycle of fabrication. This stable stage of the life cycle tends to diminish (for example, the case of computers) and this is the reason for which the result research for a single stage of fabrication becomes a non-sense. The future performances are judged from the moment of conceiving the product, a reason for which it is necessary to follow the product from the conception until the moment of its finalization, meaning the entire life cycle of it. In other words, just through a better knowledge of the ensemble of the product functions, the cost system can contribute to the increase of the enterprise performances.

The traditional calculation involves just costs, all costs which can be gathered, without discrimination that is without considering if they are generated by good faith or by waste. Therefore there are mixed up two base economical concepts: "value" and "cost" because it is supposed that all expenses generate a value at least equal to their cost. Certain operations have a cost but they do not generate any value for the client (storing in all fabrication stages, transporting and manipulating materials from one place to another, circulation of multiple useless information, changing equipments and adjusting machines, superficial control of quality, low expenses for publicity etc).

Therefore, the value and the cost have to be dissociated. The cost precedes value in time and it is already predetermined by the stage of conception; in exchange, the value is submitted to the market from where it appears as estimation from the client view.

Finally, certain costs are provoked by dysfunctions at all levels, where can be used the expression: "added waste" (rejected pieces, activity interruption, same information sent for many times, absences, etc.).

Focusing without discrimination on the costs can not be accepted. The starting point for another orientation of administration systems is the dissociation of the costs with added value from the costs without added value, because it is intolerable the conception of considering just costs and ignoring value.

These are the reasons for which a series of American researchers (R. Cooper, Kaplan, Porter, Miller) and French researchers (Mevellec, Labas, Lorino) have designed and developed another administration system known as ABC (Activity Based Costing) or ABM (Activity Based Management) which we are going to present concisely inserting also the concept of EVA (Economic Value Added) .
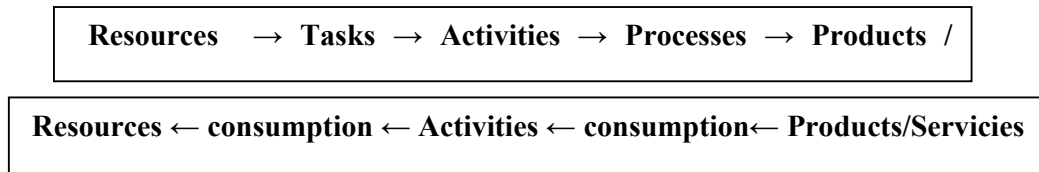
2. THEORETICAL FUNDAMENTS

At present, the mechanical model for functioning the enterprises is in opposition with the new administration logics, which are imposed more and more from the production field. It tends to stop the development of the enterprises. In fact, the mentalities and the representations are in essence much more tenacious than the technologies.

The competition analysis had the role of proving also other possible strategies, especially the differentiate or isolation strategy, and of focusing on the costumer and the value problem. All processes need to be oriented towards satisfying the costumer (internally or externally), which gives a value to the functionalities of the offered services. This value creation has to be obtained with efficiency, that is with the lowest costs. Optimizing the value-cost relation is the fundament for the new analysis on administration.
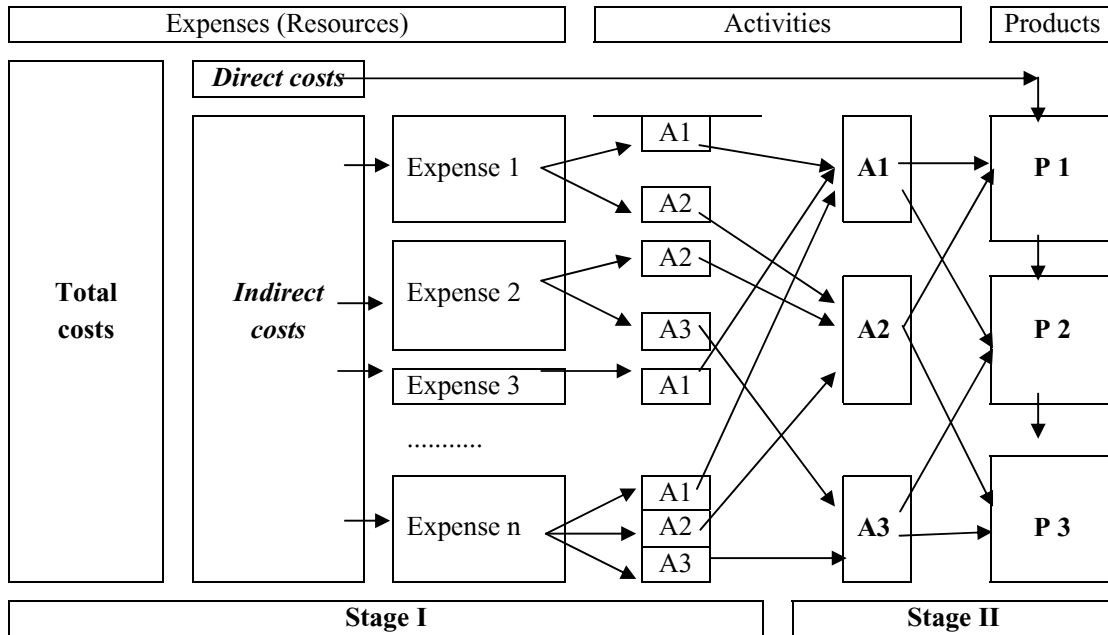
2.1. ABC Method

At the middle of 1980, as a result of the issues appeared in CAM-I, the first activity based costing systems were applied in the United States. The main objective was to remediate the costs distortions noticed in a large number of American enterprises, which used to lead to wrong decisions.

The concept of the ABC method, initiated by R. Cooper and R. Kaplan, begins from the fact that not the products are those which consume resources, but activities, and different activities of the enterprise are used by products. (Figure 1).

Resources → Tasks → Activities → Processes → Products /

Resources ← consumption ← Activities ← consumption← Products/Servicies

Figure 1. The conception of the ABC method

Or, the other way, considering the succession of causality connections and not the cost distribution on products starting from conventional distributing keys, we structured the scheme of the ABC method (Figure nr. 2):

Figure nr. 2. The model of ABC method

We can notice that the enterprise needs to be perceived as a network of activities in the service of the internal or external customers, and not under the form of a organism.

An activity is an ensemble of elementary tasks, homogeneous, which regards the value creation for an internal or external client. A chain of activities which compete to achieve a common objective is named "process".

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The first stage consists in choosing the significant activities which will constitute the support for costs and performances, being known the fact that the activities involve resources consumption and the cost bearers involve the activities.

From this point of view, the activities can be classified as follows:

- critical activities, which are indispensable to accomplish strategic priorities;
- main or primary activities, which correspond to the enterprise maintaining and which will not be abandoned without losing their identity;
- secondary activities, which the enterprise has to posses for the normal development of its activity field;
- activities without added value for the client, which can not be taken into consideration.

Once the objectives are determined, it appears the problem of attributing consumed resources by them as well as in the case of the classical methods. The difference consists in the fact that, for expenses which do not have a direct feature towards the activity center, it will be used "a resource driver", which play the same part as the distribution keys. The knowledge of the available resources (labour, raw materials and information) allows the estimation of the "theoretical capacity" for an activity. In essence, the concept of theoretical or "normal" capacity corresponds to a reality of the activity level, even if it is often arbitrary for an activity center and it can not be based on a specific activity.

The activity pattern is supple enough for adapting to a large number of cost bearers to the cost calculation. Their choosing varies in function of the administrating problems which need to be solved or the decisions which need to be taken. It could be mentioned the products, the costumers, a project, an order, a responsibility center, an element, a chain of values, etc.

The calculation period can vary and it should not correspond to an accounting period.

For each cost bearer it will be established the list of necessary activities, and for each of them, the number of consumed drivers (for example, for an activity there are needed 6 stitches, so we will need 6 drivers).

Taking in consideration the figure 2, it can be noticed the possibility of constituting a matrix of expenses activity dependent (EAD) in which the expenses are placed on rows, and the activities on columns. As a result, an expense, "j" identified in "i" activity is found in "ij" cell. Therefore, it can be created the next model of establishing the value for the consumed resources (CTA) at the level of "i" activity:

$$CTA_{(i)} = \sum_{j=1}^{n} R_{(j)} \times N_{(i,j)} \qquad (1)$$

where:

$R_{(j)}$ = the consume of a certain resources category "j";
i = the activity;
$N_{(i,j)}$ = the inputs i, j in the matrix or expenses activity dependent (EAD).

A second stage supposes attributing the costs of the activities on the cost-bearers (products, transactions, services). The unit of measuring the activity, allowing the connection with cost-bearers, will be named "driver activity" (a new work unit), in function of which it is determined the unitary cost, as follows:

$$Cu_{da} = \frac{CTA_{(i)}}{N_{da}} \qquad (2)$$

where:

Cu_{da} = the unitary cost of a driver activity;

N_{da} = the number of driver activities.

Knowing that the unitary cost of a driver activity, it can be determined the value of a activity "j", attributed to a product "i" ($TCAP_{(j)}$), according to the next formula:

$$TCAP_{(j)} = Cu_{da} \times Ndas_{(i)} \qquad (3)$$

where: $Ndas_{(i)}$ = the number of drivers activity specifically to the "i" product.

Accordingly with the figure number 2, referring to the second stage, it can be noticed the possibility of building the second matrix of activities product dependent (APD) where the "j" activities are placed on rows, and the "i" products on columns. It results that the found values in each product (TCP_i) would be based on the following relation:

$$TCP_{(i)} = \sum_{j=1}^{n} TCAP_{(j)} \times APD_{(i,j)} \qquad (4)$$

where : $APD_{(i,j)}$ = the input i, j in APD matrix.

The driver activity is different from the classical units through its will of reestablishing a causality connection with the resource consumption, a reason for which there may be distinguished four categories of drivers:
- Drivers related to the volume of the fabricated products (hours-machine, hours-employees, kilograms of consumed materials);
- Drivers related to the operational organization (number of lots, number of orders, number of deliveries, number of bills, etc);
- Drivers related to the existence of the product (number of technological cards, number of execution drawings, number of fabrication networks, number of derogations, etc. which are independent to the number of products);
- Drivers related to the existence of a capacity (places, machines, people).

We have not to ignore that the last calculation relation (4) refers to the indirect cost attributed to the product. To find out the total complete cost ($TCC_{(i)}$) of the product it is necessary to add the direct costs for each product ($CDP_{(i)}$) according with the relation:

$$TCC_{(i)} = TCP_{(i)} + CDP_{(i)} \qquad (5)$$

This costs modeling can lead to the followings:
- analysis of the products margins depending on clients or products-clients couples;
- elaborating traditional budgets (it is enough to start from the volume of predictable objectives deducting the necessary activities and from regrouping on budgetary centers);
- estimating the elements of the value chain through adding all activities afferent to the same subdivision (conception, logistics, fabrication, selling, services);
- regrouping activities in activity centers, according to a process, a project, an action. An activity center can be thus built from an ensemble of support activities, convergent to the same objective: budget, human resource management.

But the expenses of the cost-bearers and their regrouping should not become the essential concern, because the competitiveness can be won at the level of activities which must include the main performance sections.

The performance of an activity may be estimated mainly through the driver of costs, but also through other drivers such as those of quality, of interval and flexibility.

The costs driver needs to attract attention from the activity drivers, which is not recognized in all cases by the literature based on ABC (Activity Based Costing). They correspond to the deep causes of resource consumption at the level of an activity and as a consequence, it is the basic criteria of performance. Certainly, ABC is not limited just to calculate the costs; meanwhile it allows improving activities by reducing the resources consumption or by eliminating certain activities without value

2.2.   ABM Method

In its initial form, we can talk about "the first generation - cost system " a reason for which many authors sustained the idea that, in essence, the ABC method did not bring anything new and for a long time it was assimilated to the traditional methods of cost calculation.

Introducing the ABC method does not imply any organizational change or managerial preoccupation. In its first stage, the method is limited to locate the activities inside the analysis or responsibility centers and of re-adding a new stage in the allotting process, as it is seen in the figure 2.

The interest manifested for the ABC method outlines the cost system in its second generation, that is ABM (Activity Based Management), which is not limited just to obtain reduced costs and isolating activities. The analysis of authors from the second generation is based on an entirely different vision about the enterprise, much more transversal, which leads to replace the traditional responsibility centers into their rights.

These authors are oriented towards the client and the processes designed to serve him. There are identified, first of all, the processes, then the activities which allow performing the processes. The connections between activities have priority and studying them concern continuous improving or reconfiguring of the processes.

Focusing on activity and process management, measuring performances through cost and performance drivers become a priority for the actions' orientation.

As it can be noticed, it is not compulsory to hold only one driver for each process, but there rise the problem of a possibility which has the merit of simplification.

From another point of view, the "support processes" cost may be distributed in function of the service supplied to the "direct processes", which are those that maintain a direct relation with the cost bearer, and this leads to the conclusion that the reasoning is here identical with the one used by the first generation's cost system.

The third generation cost system is focused on the *strategic horizon* despite neglecting the cost calculation but where there are located the main stakes (the first and second generation cost systems are concerned first of all about the operational and tactical stages).

The problem is not attributing the activities cost over the cost bearers, not improving processes, but studying how they can be used for creating a competition advantage, or other said, how can be used the drivers in order to increase the long term competitiveness.

Formulated by Michael Porter (*L´avantage concurrentiel - Inter Edition, Paris, 1986*), the chain of value concept begins from the idea that value is created near the final or intermediary costumer and that, starting from the origin of the resources, there are a series of transformations represented by the value creating activities. These activities may be created through one or many enterprises.

Constructing a chain of value supposes to decompose a sector in different strategic activities, so there can be calculated for each activity, the cost, the quality and profitability.

Developing the competition advantage gives the possibility to maintain a control of cost and quality drivers most advantageous for the competition, the reconfiguring the chain of values for obtaining a high efficiency and, in function of it, the processes reconfiguring inside the enterprise.

Outrunning the traditional boundaries of the enterprise and considering the global chain of values for the strategic segment involved, the ABM method becomes a real method in developing the firm administration and management.

2.3. A new system of measuring performances by integrating EVA

The concerns for finding a new system for measuring the cost and financial performances lead to opinions regarding the possibility of integrating the ABC method with EVA (Roztocki, 2000).

But what is EVA? EVA is an indicator that appears as a value excess which is resulted from the operation profit after covering the expenses with the invested capitals. EVA is determined as a difference between the operational profit after taxes (Pe) and the cost of the capital invested (Cci), as follows:

$$EVA = Pe - Cci \qquad (6)$$

If we consider that the report between the cost of the capital invested (Cci) and the size of the capital invested (Ci) represents the cost of the capital invested ratio (Rci), and the report between the operational profit (Pe) and the capital invested (Ci) represents a form of the return on the invested capital (Re), then:

$$EVA = Ci \times (Re - Rci) \qquad (7)$$

The invested capital includes the amount of financing sources used by the enterprise for which it has to pay remuneration and therefore, the invested capital (Ci) has two components: the equity (Cp) and the borrowed capital or total debts (Dt) which involves interest cost. Thus, the cost of the invested capital, in absolute terms, has its own two components: the cost of the equity (Ccp), respectively the dividends expected by the shareholders and the cost of the borrowed capital (Cdt), respectively the interests which have to be paid to the creditors.

If we consider that the medium rate of the invested capital (Rci) is determined as an average between the rate of the equity (Rccp) and the rate of the borrowed capital (Rcdt), it results that the rate of the cost of the invested capital may be calculated as follows:

$$R_{ci} = \frac{Ccp}{Ci} + \frac{Cdt}{Ci}(1 - Ri) \qquad (8)$$

where: Ri = the income tax.

In case of the postfactum calculation, the cost of the equity is the opportunity cost of it, respectively the medium profitability which could have been obtained if this capital were invested elsewhere.

The cost of the borrowed capital is settled on the credit market and it depends, especially on the medium interest rate of the economy. In these conditions, it can be said that the interest rate for a credit given to a firm is determined by adding the interest rate of some financial assets without any risk (usually the interest rate afferent to the treasury bonds) with the risk bonus afferent to the respective firm. For establishing the cost of financing through credits, we have to consider that using borrowed resources generates financial expenses with interest, which are deductible fiscal, determining a reduction of the income tax, what makes the real level of borrowed sources to be smaller than the nominal level, where the next relation comes from:

$$Cdt = Dt \times Rcdt \times (1 - Ri) \qquad (9)$$

Narcyz Roztocki (2000) expresses his opinion that measuring performance based on value helps to determine the minimum level of profitability which a firm has to maintain to satisfy its current investors and attract new investors. This minimum level of profitability may be calculated with the relation:

$$Cci = Ci \times Rci \qquad (10)$$

where the signification of the notations are the mentioned ones.

Apparently things are simple and allow integrating EVA in the ABC system, as it is demonstrated by N. Roztocki. In reality, things are more complicated practically if we consider, on one side, the calculation relations presented earlier, and on the other side, the work volume that is implied by applying such a cost modeling. Also, the expenses which the ABC method refers to are indirect expenses attached to the activities. This separation – direct/indirect expenses - does not have the importance which the traditional method of calculating costs revealed. What is important inside the ABC method is knowing if an expense is attachable to a cost-bearer or not.

Attachable activities do not necessary own a direct relation with the products, but they may be inducted by a direct activity: for example, the products unleash the activity on a fabrication line (direct activity), which its found itself at the origin of the intervention or maintenance activity (support activity). There may be said that the maintenance activity is attachable, because it may be attached to products in a significant way.

But not all support activities may be thus attachable, a reason for which we have to face the non attachable activities and as a result, there appear difficulties in correct determination of EVA for the products.

Of course, EVA remains a performance presentation indicator through a new perspective, being useful especially to the firms which see the capital as a source of funds without any cost and where the financial results are measured only through some profit indicators. This situation can be found also in the Romanian economy.

3. RESULTS

The ABC method has been and is now applied to a representative Romanian confections enterprise which works in lohn system a diversified gamma of products for export.

Applying the method was possible because the costs with raw materials are supported by the customers, the general expenses are very high in comparison with the direct manual

work, the activities are much diversified, the conception of the products and fabrication processes are different from a client to another and it is expensive, the delivery costs are high, the enterprise has a high technology.

We also mention that applying the ABC method was possible because the organization of the production process and this corresponds entirely to the ABC method presented in our paper. Concretely, the enterprise develops its activity on 6 floors, each floor executing same activities (cutting, sewing, ironing, storehouse-delivery, direction-production, general management) but for different costumers and products of different nature which outlines two types of processes, respectively heavy and light. Regarding the expenses, they were grouped in four categories: expenses with gross salaries for the staff, the social costs, the general technical expenses afferent to fixed assets and general technical expenses with maintenance and functioning of fixed assets. This grouping leads to limit the drivers costs and thus, is determined a faster calculation of the production costs.

Through the way of processing the information it may be determined the production cost on the production line, on each activity, on each floor, on the time unit (minute or hour) and for each product

Applying the ABC method lead to a better knowledge of the enterprise, the activities, the processes and to an active involvement of the staff. In this view, the improving processes identified through the ABC method was coupled with the activity management, and the enterprise seen as a unique entity has the possibility of improving the administration of its strategically activity fields. Thanks to administrating and cost allocation costs solutions offered by the ABC method, the enterprise has the possibility of really knowing the costs and the margins associated to each client, product or process realized.

Anyway, we have to admit that, beside the fact that the ABC method transforms the indirect costs into direct costs, it is reduced to the problem of distributing expenses as in the case of the traditional methods of calculating costs. The cognition of the relation products-activities and activities-resources remains illusory. What enterprise may pretend such a knowledge?

4. CONCLUSIONS

The ABC method, the most popularized of all administrative methods, presents the advantage of identifying places where the origin of the waste is found, which are the activities with a low added value, where the unused capacities are located and how costs are formed.

The true utility of the ABC method consists in underlining the main role of the processes, but remains less relevant as it concerns an exact calculation of the costs, considering, as we mentioned before, the existence of non attachable activities, the difficulty of attributing to certain activities some expenses such: rents, fiduciary expenses, interests expenses, fees and commissions which are going to be distributed also on the base of conventional criteria.

It remains under the question mark the utility of the method in taking strategic decisions about the selling cost and the best fabrication quantities because there can not be attached the principles of determining the profitability or the marginal contribution as long as the method does not allow grouping fixed and variable expenses. The solution would consist on developing a mix alternative method which takes into consideration the activities behavior, through which can be identified the cost of specific activities that will permit the determination of the profitability per product.

REFERENCES

1.   Berliner, C., Brimson, J.A., (1988), *Cost management for today's advanced manufacturing – in CAM-I Conceptual design,* Harvard Business School Press, Boston

2.   Cooper, R., (1990), *Elements of Activity-Based Costing*, Emerging Practices in Cost Management, Boston : Warran Gorham & Lamont

3.   Cooper. R., Kaplan, R.S., (1991), *The design of cost management systems*, Text, cases and Readings, Enlewood Cliffs, Prentice Hall

4.   Iacob, C., (1988), *Contabilitate analitică şi de gestiune*, Edition Tribuna Economica, Bucuresti, 1998, pp.180-190

5.   Johnson, H.T., (1991), *Activity Based management: Past, Present, and Future*, *The Engineering Economist,* Vol.36, No.2, (Spring), pp.219-238

6.   Kaplan, R.S., (1999), *Activity-Based Costing. A4 of Cost management for service Industries*, Ed.James B. Edwards, Boston : Warran Gorham & Lamont

7.   Mevellec, P., (1990), *Outils de gestion – La pertinence retrouvée*, Editions Malesherbes, pp.107

8.   Porter. M., (1986), *L'avantage competitife*, Inter Edition, Paris

9.   Roztocki, N., Needy, K., (1998), *An Integrated Activity-Based Costing and Economic Value Added System as an Engineering Management tool for Manufactures*, ASEM National Conference Proceedings, Virginia Beach, October 1-3, pp.77-84

10.   Roztocki, N., Valenzuela, J.F., Porter, J.D., Monk, R.M., Needy, K.,(1999), *A Procedure for Smooth Implemenation of Activity Based Costing in Small Companies*, ASEM National Conference Proceedings, Virginia Beach, October 21-23, pp.279-288

11.   Roztocki, N., (2000), *The Integrated Activity-Based Costing and Economic Value Added information system*, Proceedings of the Society for Advancement of Management, International Management Conference, St.Augustine, Florida, March 30 – April 1