

COSTING IN THE CHEMICAL INDUSTRY

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Abstract: *The calculation system that we propose is supposed to be constituted from an ensemble of methods, techniques and procedures, which help us in scheduling the production costs, in establishing and analysing in an anticipating, operative and a postoperative way the cost deviations compared to their standard level and on this basis to determine the costs by centers of costs and actual production cost.*

Practically, the proposed system combines the Standard-Cost Method with the Cost Centers Method, its base being the standardization of the costs and the budgeting of spendings, all this using the automatic calculation technique.

We turned on the possibility of achieving this integration starting by the particularity of the chemical fertilizer activity, and also the particularity of the influence factors involving a specific cost structure.

Keywords: *entity sectorisation, cost centres, cost standard method, deviations from the standard costs, method of managing through exception.*

1. INTRODUCTION

Most of the decisions taken at the level of a single entity, including the chemical industry, are based on information which refers to the production costs.

Pertinent and efficient decisions are influenced, in a preponderant way, by the quality of the information provided to the managers and the promptitude of their spreading.

The calculation methods used in the entities from the chemical industry, the global method and the method on stages, present series of deficiencies such as the historical character, the list of efficiency and anticipation.

Taking into account that in the current circumstances the entities must function in a more stable and risky environment as well as the deficiencies of the calculation methods of the costs used in present, there is a necessity to introduce a managing system through costs whose objective is to ensure that the process of management at the level of the entities from the chemical industry is performed due to the efficient and pertinent economic information.

Generally, the managing evaluated methods through costs meet the requirements of the economic management, but taken one by one they present some limits. This is why we consider that the optimal organisation of the costs calculation which aim to realise the complete capitalization of the necessary information in order to manage the production processes and to guide the activity of the entities, can be made only if there are simultaneously used various methods and techniques integrated in a system which would take from these what is essential and what present advantages for the entity that apply it.

In this context, the calculation system proposed by us starts from the general content of the complex managing methods, of the unitary framework in which each of these are performed using the appropriate means and instruments and from which infer the following more relevant characteristics: the objectives that must be fulfilled; the concrete methods used in order to fulfil the objectives (different instruments, procedures, techniques etc); the elements that concerns the motivation of personnel to fulfil these results; the activity programme; the organisation of the informational-decision-making system which will be in accordance with the method, will ensure the efficient use of the personnel and will make possible the fulfilment of the pre-established objectives.

Starting from these grounds, the concerned calculation system is projected to be formed of an ensemble of methods, techniques and procedures, due to which one can programme the production costs, can establish and analyse in a projected, operative and postoperative manner the deviations of the real expenses from their standard level and, on this base, to be calculated the real expenses on centres entailing the expenses every month and the real cost of the production every trimester.

Practically, the proposed system combines the method of standard costs from which it takes the technique and budgeting instruments of costs and of following the deviations, with the method on cost centres from which it takes the instrument of establishing the causes and the responsibilities for the noticed deviations, as well as with the method of managing through exception with the aim of informing the managers at a different hierarchical levels selectively. The system base is the cost programming through the standardisation of direct expenses and the budgeting of the indirect expenses, all these actions being performed using the automatic calculation technique.

We chose the possibility of accomplishing this integration starting from the specificity of the activity object of the chemical industry and of the influencing factors which imply a certain structure of the production cost.

There are enough similarities between the entities of the chemical industry. We consider that the researches and the experiments that have been made with the aim of using some methods through which the objective continually harmonize with the resources, even if in the beginning only a single entity was regarded, can be adapted and generalised at the level of all the entities of the chemical branch. In this context, our research has as a reference model an entity from the chemical fertilisers industry.

The practical use of the proposed calculation system supposes certain actions in order to prepare the necessary conditions for the appliance such as: the scientific ground of the standard indicators concerning the costs because they will finally represent the objectives that must be fulfilled: the rigorous setting of materials and labour force consumptions; the optimal delimitation of the budgetary centres within the company and of the costs centres that point out all the costs; the rationalization of the informational system; the use of the automatic calculation technique. Without these preparation measures, the system implementation in the entity cannot be realised, and the management board will apply a calculation system based only on experience, intuition or context instead of using scientific methods.

Taking into account the basic principles of the proposed system, there are series of necessary stages, techniques and instruments for implementing them: entity sectorisation on costs centres; establishing the standard costs and elaborating the budgets of expenses; establishing, monitoring and analysing the deviations from the standard costs; the calculation of the real cost; costs revaluation in the entity's management process.

2. ENTITY SECTORISATION ON COSTS CENTRES

The planning, monitoring and calculation of the production expenses on costs centres represent one of the main directions of improving the costs informational system in the chemical fertilisers industry.

The calculation method on costs centres consists in collecting all the production expenses and their calculation on the base of the expenses centres which are built as calculation units [2].

When organising the calculation using this method, the most difficult but essential problem is to determine and delimit the costs centres correctly, their position and role in the organisation of costs calculation.

The problem is not to really divide the entity in new sections, but to try to better organise the existent divisions which shall fulfil the objective of the production expenses calculation and of the results on costs centres.

The starting point consists in the research of the responsibilities of the different organisational levels, through the existent functions taking into account the specificity of the entity activity, that is the object, the peculiarities of the production technology and the organisational structure and functional production.

The main functions of the entity (supplies, production, sale and administration) can be divided into sections, workrooms, work places, functional services, offices etc., each of them representing an activity centre if it is composed of a group of material means used for the same purpose, being subordinated to a person responsible of it, and its activity can be measured either taking into account the production, or the sales amount, but always the workload.

There is a direct connection between the activity centre and the cost centres due to the fact that the activity centre is generating in the same time exploitation expenses and, consequently, each activity centre is a costs centre. We must specify that the activity centres not always superposed on the technical-organizational links. In consequence, not always the activity centres can have the role of cost centres because either it is impossible to delimit the expenses at this level either it is not efficient. On these grounds, in order to locate the consumption caused by the manufacturing process, in calculation we join many activity centres in a single costs centre at the level of vehicles group, installations, technological lines, workrooms, sections etc [2].

Since the calculation method on costs centres is also based on the existence of a certain responsibility at the level of each cost centre, and each of these administrate un budget of expenses, we can say that every costs centre becomes a responsibility centre. In this case, the aim is calculate the costs on responsibility centres, the direct expenses convey in transit as well as the indirect expenses and the products obtained in the those centres. The production cost of the semi-manufactured goods or of the finished products is calculated by adding to the production expenses which are directly affected, a share of the expenses of the activity centres through which the semi-manufactured goods (finished products) pass according to the technological process, including the sale expenses in order to establish the complete cost.

From the point of view of the connection with the entity technological structure, the costs centres can be divided into two main categories: productive centres which have a direct connection with the technological structure, the activity performed within them can be measured quantitatively, and the expenses caused by that activity can be identified with the product, work or the service and related centres that do not have a direct connection with the technological structure. The activity performed within them aims to organise, administrate and manage the production obtained in the productive centres or of the entity. This activity cannot be always quantitatively measured. It is measured from the point of view of the quality, and the expenses caused by the concerned activity that implies more productive costs towards which have an indirect relation, have a direct connection with the related centres [2].

At the entities of the chemical fertilisers industry, the productive cost centres are generally constituted on the main

manufacturing stages of the technological process. They consist in various processes that usually take place in a certain installation, well defined in space. On the concerned places, all the direct expenses, i.e. those expenses which identify themselves, are registered after the nomenclature of the calculation articles. For the registration of the indirect expenses which are generally formed of the indirect production expenses and those generated by the administration, a related costs centre is built at the level of each section and entity. After being collected in the related centre, when calculating the cost of the product, they are distributed in the productive costs centres.

We should mention that in this way of organising the costs calculation, the expenses of equipment maintenance and functioning are identified on these, since they are caused by the making sure that the installations are functioning normally, thus becoming direct expenses compared to the productive centres.

If we perform the sectorisation on costs centres of an entity from the chemical fertilisers industry, the following cost centres are formed:

- Ammonia section:
 1. Ammonia installation I;
 2. Ammonia installation II;
- Nitric acid section:
 1. Nitric acid installation I;
 2. Nitric acid installation II;
- Urea section:
 1. Urea installation;
- Ammonium nitrate section:
 1. Ammonium nitrate/nitrate of lime installation;
 2. Liquid fertilisers installation;
- Complex fertilisers section (NPK):
 1. Complex fertilisers section (NPK);
 2. Installation of complex fertilisers packaging (NPK);
- Urea/nitrate/lime nitrate packaging:
 1. Packaging installation.

We can conclude from this presentation of the real costs centres that they generally coincide with the technological processes (installations) of production manufacturing which constitute, as costs centres, objects of cost account and calculation.

There are also cases when a costs centre gathers many manufacturing processes so that the object of the cost calculation is the costs centre taken in its totality and not the manufacturing process. For example, in the costs centre represented by the manufacturing installation of the complex fertilisers which constitutes the object of cost calculation, many manufacturing processes are gathered: the proper manufacture; the evaporation-granulation; the conditioning of the finished product; the KCl drying. This thing is caused by the complex character of the work objects processing and by the fact that in some processes the consumptions cannot be determined, and consequently, planned and registered with the material and human factor. Thus, the calculation object is not anymore the manufacturing process taken separately, but the manufacturing stage or phase which gathers one, two or more processes as an object of the planning, monitoring and calculation of manufacturing expenses.

The sectorisation of the auxiliary activity on productive costs centres is generally made on the activity sectors, thus it results a work or a service which can be determined quantitatively with precision. The related costs centres are constituted one by one for each section, and for the sections with varied production another centre is formed at the level of the workroom. Consequently, at the auxiliary sections with a homogenous production for each installation or workroom which manufacture a certain product, a productive costs centre is constituted on which the direct expenses to that place are individualised, and in order to determine the indirect expenses to the productive expenses centres, a related costs

centre is constituted at the level of the entire section. For example, in the case of the auxiliary hydropower section, the productive costs centres on which the direct expenses are identified and registered, are: industrial water; drinking water; recycled and cooled water; demineralized water; waste water, and for the indirect expenses of these productive centres a single related cost centre is constituted at the level of the whole section.

In the administrative and managing sector of the entity, we consider that it is advisable to constitute only one related costs centre on which to register all the expenses, according to the type of expenses after the structure imposed by the legal provisions in force. A detailed presentation of the costs centres in this sector, on services and even on offices, would ensure wide information on the general administrative expenses which would lead to an increased efficiency of the control and decision-making, but, would also increase the expenses caused by the planning, account and calculation works (budgetary). The problem can be solved in the same way in the entities of the chemical fertilisers industry for the sale sector.

Taking into account the above mentioned data on the entities sectorisation of the chemical fertilisers industry on costs centres as calculation objects and responsibility centres, we conclude that they cannot be conventionally performed, representing the expression of technical-economic organisation of the production places where the expenses appear and the semi-manufactured goods or of the finished products are obtained.

A problem in the organisation of the planning, monitoring and calculation of the production expenses on costs centres is the influence of the result of the costs centre activity on the result of the other costs centres. That is why, the negative or positive effects of such a cost centre must not affect the other costs centres because their effort would not be correctly appreciated, the responsibility principle for the performed activity would not be respected anymore. This is a necessary thing in the entities of the chemical fertilisers industry which implies a high degree of technological integration and can be solved by using the standard costs.

3. COST STANDARDISATION

The standard cost method has the following peculiarity: allows the setting of a planned costs, considered as being normal, which are used for the fast evaluation of production and compared to which the expenses variations during the production process can be determined operatively, and, consequently, the managing through exception; the control administration using the analysis of the deviations from the pre-established costs, including by establishing the subactivity cost; dividing the expenses depending on their dependency on the production volume into variable and fixed expenses, thus being established the degree of plant's rigidity.

The tries which have been made concerning the application of a variant of the standard cost method – the normative method – in the economy of our country present some drawbacks, because it was applied according to the principles of the classic calculation methods in two different methods, before and after the production process. Although these tries contributed to the increase of the informational role of cost and efficiency, they kept the deficiencies of the classic methods. We especially refer to the high workload for the concrete drawing of the analytical account system, of the norms changes and deviations, by drawing up separate documents for all the quantitative deviations, identification on products and expenses places; differentiated monitoring of all the deviations; carrying out a minicalculation to obtain the total of deviations on each product and, then, the appropriate correction of the standardized cost in order to obtain a real cost; carrying out three budgetary calculations (planning), normative calculation, real calculation. That is why, the uses of the normative method, especially in wide entities, are only

partial applications, in most of the cases outside the costs accounting system. The most frequent cases consist in a system of monitoring the norms only for certain consumptions of materials and manual labour, in the same time with the integral monitoring of all the expenses and, then, the postoperative calculation of the real cost, the same as in the case of the classic methods.

In this context, as we have already mentioned, we aim to contribute through our researches to the improvement of the costs calculation methodology in the plants from the chemical fertilisers industry, by introducing the standard costs method, in the standard version – single cost, on cost centres and on products, but also by integrating some elements of the normative method such as: a wide nomenclature of the calculation articles; the periodical calculation of the real cost for every finished product or semi-manufactured goods, trying to prefigure a “model of exceptions”, considered a priori as the highest reference point of the concerns to improve the monitoring and operative control of the production expenses.

In the scientific works in this domain, some considers that the standard and standardized costs methods are alternative one to the other [1]. We consider that it is not necessary to present, for example, the standard cost as an alternative for the standardized costs because, taking into account the defining elements of the method, i.e. pre-establishing the costs based on standards (norms), it is the same thing. There are the same opinions concerning the issue of pre-established costs, but there are different opinions concerning the collecting system of the standard expenses (standardized) and of the deviations.

Concerning this aspect, there are different opinions in the scientific works in this field. Some authors sustain the analytical account system which aims to collect the expenses on calculation articles in a distinct manner, both the standard (standardized) ones and the deviations for each semi-manufactured goods or finished product [1]. On the contrary, other authors consider that this system leads to the doubling of the account work, and it is a working procedure that cannot be put in practice [3]. In these circumstances, the planned solution is the system of global account taking into account the expenses collecting on calculation articles in two different groups, standard expenses (standardized) and deviations from the standard expenses (standardized) for the entire production of a place of expenses (section, installation) and not for every semi-manufactured goods or finished product. Only the deviations will be detailed, determined on causes and responsibilities within each calculation article.

This system of organising the expenses collecting is considered to simplify the calculation, moving the weight of the activity on some qualitative elements which will determine the abnormal features, the consumptions that deviate from the standards (norms) and their causes, by eliminating the work of repeating the detailed account of the normal and known features. We believe that the supporters of this methodology have analysed the issue only taking into account the account manual labour without relying on the significant advantages of the calculation electronic technique, concerning the degree of giving details on the deviations.

We consider that there are two points of view concerning the option for a system or another:

- the way the collecting of the production expenses is performed and the way of monitoring the deviations;
- the way of establishing the unitary cost of the semi-manufactured goods and finished products.

Concerning these aspects, we consider that, in circumstances of economic stability, the standard cost can be considered a real normal cost, and it is not necessary to determine the real cost of each finished product or semi-manufactured goods. In these circumstances, the collecting of the standard expenses and of the deviations shall be

performed at the level of the expenses places on calculation articles for the entire production.

But, taking into account the economy of our country, due to the frequent changes especially of the value standards, it is necessary to determine periodically the real cost of every finished product and semi-manufactured goods, in order to identify those products whose unfavourable deviations from the pre-established conditions make them unprofitable. It can be organised an analytical and efficient account of the deviations from the standards at the level of each costs carrier (semi-manufactured or finished product) or we can reach the same result starting from the calculation on costs centres.

We consider that the idea of some authors according to which the deviations on the calculation unity must be determined on the base of some deviations coefficients, established on each calculation article or even on the whole, is inappropriate because it increases the degree of approximation and complicates the calculation. Furthermore, the modality of establishing the deviations does not subordinate the exceptions principle because they are obtained a priori and not as a difference between the standard expenses and the real expenses, at least for the direct expenses.

We want also to state our opinion about another issue, the scope of the expenses in the standard cost calculation. We consider that in the entities concrete conditions in our country, at the technical and the current general methodological possibilities, it is advisable to determine the standard cost at the level of the production cost. Indeed, it could be more useful if we could obtain the complete standard cost of the finished products, but this would lead, in our opinion, to inaccuracies and approximations, especially due to the fact that many sale expenses are made after the expiration of the account period when the product have been manufactured, and when we determine the production expenses, the profit and other economic indicators that characterise the productive activity. In addition, we must take into account that in this field, the selling expenses have a smaller weight in the structure of the production cost.

On the other hand, the integrated and complex nature of the entities from the chemical fertilizers industry generates a large amount of internal movement in the form of the transfer of semi-manufactured goods between the various cost centres (installations), usually, in the field of the technological process. The transfer of production by way of semi-manufactured goods from own production, inevitably provokes the transfer of costs, so that the correct evaluation of this intern circulation is very important to obtain representative standard costs. In this context, we consider that, for the evaluation of the transfer of semi-manufactured goods and the creation of the cost from a cost centre to another it is necessary to use the standard unitary cost of production, of the installation from which the semi-manufactured goods resulted. The producing installation of semi-manufactured

$$\begin{pmatrix} C_{11} & C_{12} & \dots & C_{1n} \\ C_{21} & C_{22} & \dots & C_{2n} \\ \dots & \dots & \dots & \dots \\ C_{m1} & C_{m2} & \dots & C_{mn} \end{pmatrix} \text{ or condensate } C = (C_{ij})$$

For this matrix the columns indicate the type of calculation article and the rows indicate the element of expenses. According to this conception, the same principle of systematization is also maintained for analytical accounts of indirect expenses: the column will indicate the articles of expenses and the rows indicate the different expenses on articles.

goods reimburses the standard cost of production for each calculation article in part, while the receiving installation incorporates the respective consumption in a distinct calculation article, named “semi-manufactured goods from own production”. In the same conception, all the others mutual intern consumptions: benefits of auxiliary sections, utilities, reparations etc are evaluated and reimbursed also to the standard cost of production. This evaluation system of intern circulation of production leads to the increase of efficiency, to the reducing of the workload required for works costing and to the increasing of the responsibility for incurred expenses.

In terms of structure, the standard costs method requires the performance of some works specific to the methodology of its application, in the following steps:

- Elaborating standard calculation on expenses places and on finished product (semi-manufactured products);
- Calculating, tracking, analysing and reporting deviations from standard costs;
- Organizing the expenses account due to the production process and to the costs calculation.

Data processing processes, characteristic to costs calculation, shall be presented such that they rationally take place in the computer. Also, it shall to realize a comprehensive integration of information, so that to ensure an increase of cost information power, and also a filtration and an aggregation of this information and the storing and retrieving of information shall to be rationally made.

To achieve these requirements the matrix computation is proved to be particularly suitable so that in the conditions of using electronic computers, the costs calculation could be organized by way of matrix computation. In this way it is possible not only an analytical presentation of values and quantities concerning the costs from the formal point of view but also becomes possible to accentuate the causal relations between the different structures of products, to establish the factors that influence the costs on causes of influence and on this occasion, to take them into account at the establishment of standard costs and at the control of activity through costs.

Matrix computation can be used with the same results both in the elaboration of standard calculation and in effective calculation. Regarding the latter, by using matrix computation are increased the informative properties of effective costs, determined without involving an additional workload.

A possibility used in this sense would be that to provide at the level of the costs centre, semi-manufactured goods or finished product, some information about the structure of costs on articles of calculation and elements of expenses. This information can be presented by way of matrices as follows:

where: $i = 1, 2, \dots, m$
 $j = 1, 2, \dots, n$

To delimitate the expenses at the level of each costs carrier on elements of expenses it can raise the objection regarding the impossibility to obtain information in this profile.

In our opinion the problem can be solved since the articles of direct calculation have homogeny content and for indirect expenses, already in their collection phase, it is carried out the delimitation on types of expenses.

The use of matrix computation in the processing of information concerning the costs and, on this basis, the knowledge, at the level of each costs centre and product, of the effective expenses in relation to the destination (articles of calculation) and their nature (elements of expenses), offer the possibility to analyse at this level the share of material expenses in the cost of production structure and from here, the possibility to determine the value added.

The above discussion concerning the use of matrix computation in the rationalization of the cycle of the processing the information regarding the cost doesn't exhaust the problem of its benefits.

It also can be used when analyze the deviations from standards and to the assessment of unfinished production.

4. CONCLUSIONS

In the conclusion of the issues discussed and taking into account the fact that the mastering of costs is not possible without the establishment of a “management of costs”, of a self-comprehensive system of internal operational management on the basis of standardized costs, we wish to precise our point of view on some problems which should be considered as directions for improvement of the costs calculation in the chemical fertilizers industry:

- establishing in advance, before to begin the period of inventory, usually, at the beginning of the year, some standard costs, which represent all maximum admissible expenses in order to obtain a certain production, recouped in: homogeneous types of expenditure (articles of calculation and its detailed report); costs centres (centres of responsibility); finished product or semi-manufactured goods (standard unit cost). In conditions of economic stability, the standard unit cost may be considered as the only calculation of unit cost of finished products (semi-manufactured goods), thus eliminating all the works after calculation typical for absorbent methods. In this view, the weigh centre of the current work is moving in the sphere of the as detailed tracking of expenses on article of

calculation and costs centres, leaving aside the finished product (semi-manufactured goods) which gave them occasion. If in certain periods, it is wished to finalize the effective calculation and the calculation on the unity of finished product (semi-manufactured goods), this is realized starting with the calculation on costs centres which don't remove the cost calculation on product. It follows therefore that the standard-cost method gives a new orientation to the evidence of production expenses and to the work of analysing the production costs, namely: the works of post-calculus and also the work of analysis with retrospective character pass on secondary plan;

- tracking and quantifying the deviations from the standard costs in preventive control phase, delimitating the place where they were produced, the way of expense and also the type, the sense and the cause of the deviation in the expense of which it is part. In the conditions of using the calculation electronic technology, the deviations can be tracked, at least at the level of direct expenses which are determined on the basis of specific consumptions, for each semi-manufactured goods or finished-product. In the view of the standard-cost method, the calculus, the tracking, the analysis and the reporting of deviations represent the centre of the activity of costs calculation. This means that it will seek to detect and correct everything that deviates from the default program, considering that the others phenomena and processes are always running in the desired range to ensure the goal, in other words, will go on the idea of rule by exception, as a concrete form for the implementation of the basic concepts of modern management of the enterprise. In our opinion, the information provided by evidence of deviations must be organized by the selection system (pyramidal) as in Figure 1, ie at the level of the sections and installations to detail the causes of deviations in order to take operational measures by their leadership and the management of the entity to be provided with summary information on the volume, structure, frequency, trends, the way of manifestation of deviations on longer time periods, the cost centre, etc.:

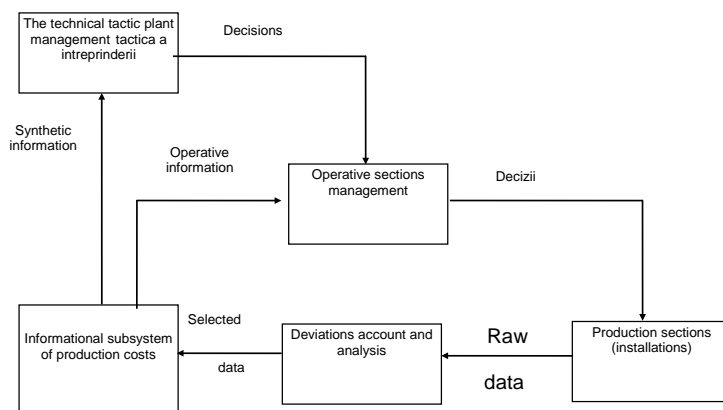


Figure 1. Scheme of informational flow regarding the deviations from the costs of production

- the structure of expenses and the adjustment of the calculation in order to meet the current requirements of increase of the costs informational potential, by elaborating some calculations based on the grouping of production expenses in direct expenses and indirect expenses, but also the grouping of them according to the relation with the volume of production, in fixed and variable expenses. Regarding the first grouping, it is envisaged the structure of expenses on articles of calculation specific to the entities from the chemical fertilizers industry.

According to the second grouping, the appreciation of the indirect expenses will be done only after a prior

confrontation of their level with the volume of productive activity, which involves the prior updating or “flexibility” of the indirect expenses budgets, in order to bring them to the state of perfect comparability in relation to the real volume of the activity.

Also, among other rules, the imputation of fixed production expenses on the cost is based on the necessity of using the normal capacity of production. In the case of the production which is inferior to the normal capacity, appears the “sub-activity”, frequent in the chemical fertilizers industry in the actual period, manifested by way of some closed sections or with limited production, installations which don't work etc., but

which can even generate their own expenses: preservation, maintenance, redemption etc. In addition, the sub-activity deforms the costs of other costs centres, by the distribution effect of fixed costs, so as in order to comply with the principle of “normality”, a part of these expenses is also distributed on the sub-activity, causing in the structure the sub-activity cost, which is to be directly reflected in the result of the exercise;

- improving the criteria of indirect expenses repartition through the development of the multi-criteria

method, which take into account their causal relation with the costs and carriers centres;

- because of the important volume of works which implies, the efficient application of standard-cost method in the practical activity of the entities from the chemical fertilizers industry can be realized only in the conditions of using the calculation electronic technology, which facilitates both the laborious activity of substantiation, and the activity which uses the standards of expenses.

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