

**RECIPROCAL ALLOCATION METHOD IN SERVICE DEPARTMENTS.
THE CASE OF A PRODUCTION ENTERPRISE**

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Abstract:

The main aim of this article is to indicate the role of reciprocal allocation method in the process of costs calculation. In the environment of nowadays companies, often taking very complex organisational forms, the existence of service departments becomes of great importance. Although, as far as management accounting processes are concerned, which lead to identifying the product cost, the service departments' costs come out to be of minor importance. This article means to prove that the service departments' costs and their reliable settlement are a desirable source of information about the products. This work consists of two parts. First of them features theoretical considerations and a critical analysis of subject literature. In the latter part, the service departments' costs calculation will be presented, basing on reciprocal services in a production enterprise from chemical industry.

Key words: *management accounting, cost calculation, management of production costs, service department*

INTRODUCTION

In the reality of modern economy, the operation of enterprises is strongly determined by the management processes. Management is a multi-area field including: planning, organisation, employment, leadership, as well as control [2]. The listed actions are meant to contribute to achieving the market success of the enterprise. Nevertheless, they cannot be performed without a sufficient set of information, as they are all actions basing on data provided to the management by the accounting system [5]. Bearing in mind the strong competition and rivalry to achieve competitive advantage, the information about costs becomes of strategic importance. In production enterprises the exact and reliable structure of products' costs is substantial important and leads to indicating actual profitability of given products' sales [8]. The process aiming to indicate the product cost is costs calculation, being a part of management accounting. For this article, the mostly scrutinised stage of calculations will be the settlement of service departments' costs. Although the service departments are rather common in production enterprises, the settlement of their costs is often simplified to direct allocation method, ignoring their reciprocal services. In the latter part of this paper the most important rules of product cost calculations shall be presented, as well as the characteristic of the department services. In the empirical section, an enterprise from chemical industry has been examined to present the departments services allocation, including reciprocal services. Basing on the comparison between the reciprocal and the commonly used direct allocation method, the significance

of reciprocal services in the service departments costs settlement shall be emphasised.

PRODUCT COST CALCULATION

The idea of cost calculation is inevitably bound with the cost accounting, being a substantial process in production enterprises. It is a procedure leading to indicating a unit cost of a single product [9]. Depending on the diversity of products, various models of product costs indication can be distinguished [1]. From the perspective of usability of the calculation processes data, reliable information considering the utter product cost is crucial for both control planning and decision making. An undeniable concern in this matter is fairness and reliability of assigning costs to given products. In traditional accounting, distinguishing between direct and indirect cost is the key to indicate unit cost. The Act of Accounting states that the unit cost consist of direct costs and a justifiable part of indirect costs [11]. The direct cost can be defined as the costs easily traceable to individual products or services. They vary in exact proportion to volume produced. On the contrary, in production enterprises, there exists a large number of costs, that by definition cannot be directly allocated to a final subject of cost calculation. Such costs are referred to as indirect costs. The Act of Accounting provides basic costs definitions, however does not indicate how to settle them [9]. Therefore, many models of assigning costs to produced goods have been created by business practise. This comes from the fact that costing is a necessity to undertake rational decisional processes. Ipso facto misusing of costing or implementing methods inadequate to produce goods may bring severe

consequences and lead to a decrease in company operation effectiveness. For the enterprise both underestimating and overestimating the production cost of a final product can be very dangerous. Thus, it seems to be of crucial importance to elaborate an optimal cost accounting system, adjusted to the needs of a given enterprise. Moreover, compiling inappropriate solutions for this matter might result in losses for the company. Additionally the data fetched from such miscalculations in no way could be of help to the decisional processes.

SERVICE DEPARTMENTS IN PRODUCTION ENTERPRISES

Service departments are isolated organisational units providing services to other parts of an enterprise. A factory's service departments classically consist of such activities as repair and maintenance, canteen, payroll, transportation, janitorial services, as well as research and development laboratories, data processing centres and many others [10]. The list of service departments an enterprise may include in its structures is in fact unlimited. It may depend on the market sector, size of the company and variety of offered goods and services. The operation of service departments may also be offered to other units from the outer neighbourhood of the company. Although, until recently, such behaviours were rather occasional. Nowadays, with swift development and growing popularity of outsourcing, service departments often come out to be an additional source of companies' income [6]. Nonetheless, service departments outsourcing will not be an area of interest in this article and only the classical approach to service departments shall be discussed in the latter part of this paper.

Service departments' costs are classified as indirect costs. This means that while contributing to the overall operation of the enterprise in an indirect way, there is no direct or obvious connection with product costs. As a result in the process of calculation, their costs are firstly appointed to department costs and then to total unit costs or period costs [7].

Bearing in mind the diverse range of service departments' fields of operation, various methods of their settlement can be defined. Among them, the most popular are:

- direct allocation method,
- step down allocation method,
- planned rates method,
- reciprocal allocation method [7].

The most basic and therefore the simplest costs apportionment method is the direct allocation method. Its main assumption is not to include the mutual services between service departments. In such case, these costs are directly appointed to department costs and subsequently to the final product. An undeniable advantage of this method is the high level of adopted simplifications, resulting in easiness of calculations. On the contrary, implementing this method may only be justifiable in the case, when the reciprocal services between service departments are negligible.

The step-down method is based on the assumption that all services between service departments are unidirectional. In order to properly apportion the costs, the service departments have to be sorted, starting from the unit, that provides the most services for the other service departments. In such case the calculation begins from this unit, ending on the last one from the sorted list. It should be noticed that on the subsequent stages of settlement, the cost incurred by a given unit are incremented by the services received from the previously settled units. Using this

method clearly leads to providing more accurate data regarding the product costs but its implementation is not always possible. It is a method suitable for smaller companies with mediocre number of service departments.

In the planned rates method it is assumed that the service departments' costs are settled with fixed rates. This solution is useful in the case of large number of service departments, however it requires correct apportionment of variances. These can be defined as the difference between the actual and planned costs.

The method considering all the mutual services between service department and basing on the actual costs is the system of equations method, also known as algebraic method or reciprocal allocation method. In order to apportion the service departments' costs, this method requires creating and solving a corresponding system of equations. This system includes in its construction both the basic costs incurred by the given unit as well as the costs of the services received from the other service departments. The service costs re-allocations reciprocate before finally ending up in production departments. Therefore the data obtained from this method brings important value to the production management process, as it provides an arguably more accurate result [2].

The methods listed above, are not the only available choices. In the business practise other methods might be used, as long as they are better suited to the needs of an enterprise.

APPORTIONMENT OF SERVICE DEPARTMENTS' COSTS IN A PRODUCTION ENTERPRISE - CASE STUDY

As it has been presented in the theoretical part, the service departments' costs have no direct influence on the product costs. This could be the reason for not paying enough attention to correct and scrupulous selection of method of their apportionment. Although the reciprocal allocation method is widely considered to be the most accurate, its usage is rather uncommon not only in Poland but also in the rest of the world [4].

The case study features an analysis of service department costs in a production enterprise from chemical industry. The financial consequences of inappropriate apportionment method selection shall be presented and compared.

The discussed company operates in chemical industry. It is a production unit, delivering professional cleaning products mainly to the countries of Central and Eastern Europe. Among its units, the most notable are a production hall with professional liquids bottling department, control laboratory centre and maintenance and service department. The forming of this last department was a consequence of implementing the ISO quality norms in the company. While the operation of the liquids bottling department is solely used by the enterprise, the control laboratory centre and maintenance and service department offer their services to other units from the industry. Basing on this information, Table 1 presents the service departments existing in the company collated with respective cost division keys.

In the mentioned enterprise, due to financial systems limitations, service departments have been settled using the direct allocation method, which meant that the reciprocal services between the departments have been omitted at all times. Selection of this method has been justified by relatively low costs of mutual services. A quarterly collation of service departments' cost, including the reciprocal services between them, has been presented in Table 2.

Table 1
Service departments in the production enterprise

Service department	Cost division key
liquids bottling department	the number of bottled liquids [l]
control laboratory centre	the number of hours worked by employees of the control laboratory centre [wh]
maintenance and service department	the number of square meters under maintenance [m ²]

Table 2
Activity of service departments in the production enterprise

1 st month	Service department unit	Liquids bottling department [l]	Control laboratory centre [wh]	Maintenance and service department [m ²]
	Recipients of services			
	Departments' costs	100000	2000	1500
	External customers	-	500	100
	Liquids bottling department	-	800	500
	Control laboratory centre	-	-	500
	Maintenance and service department	10000	50	-
2nd month	Departments' costs	150000	1900	1800
	External customers	-	100	200
	Liquids bottling department	-	500	600
	Control laboratory centre	2000	-	300
	Maintenance and service department	2000	600	-
3rd month	Departments' costs	150000	2200	1600
	External customers	-	500	100
	Liquids bottling department	-	200	300
	Control laboratory centre	1000	-	400
	Maintenance and service department	1000	200	-

Table 3
Costs of departments' services in the production enterprise [PLN]

Service department	Liquids bottling department	Control laboratory centre	Maintenance and service department
Reporting period costs			
1 st month	141900	268000	31500
2 nd month	201740	201500	43500
3 rd month	194560	210800	36000

As a result of the company's Data Protection Policies, certain alterations and obfuscations needed to be applied to the numbers from the table, hiding the actual values but still providing a fairly good insight on the trends observed in the enterprise.

The services listed in the Table 2 generated costs, which during the studied months were gathered on the "service departments' costs" account. Their amounts have been depicted in Table 3.

At the end of every reporting period, the costs of service departments were settled according to the rules of

direct allocation method, so failing to include the costs of mutual services. The effects of settlement using this method have been presented in Table 4.

The presented data indicates that all the base costs of service departments have been settled either on departments costs or to external customers as service costs. Reciprocal services have been fully omitted.

A contrary approach to dividing these costs has been presented in Table 5.

Table 4
Service departments' cost calculation without mutual services between service departments

1 st month	Service department	Costs to be apportioned	Targets of services	
			Departments costs	External customers
1 st month	Liquids bottling department	141900	141900	-
	Control laboratory centre	268000	214400	53600
	Maintenance and service department	31500	29531.25	1968.75
2 nd month	Liquids bottling department	201740	201740	-
	Control laboratory centre	201500	191425	10075
	Maintenance and service department	43500	39150	4350
3 rd month	Liquids bottling department	194560	194560	-
	Control laboratory centre	210800	171762.96	39037.04
	Maintenance and service department	36000	33882.35	2117.65

Table 5
Service departments' costs including reciprocal services

Service department	1 st month	2 nd month	3 rd month
Liquids bottling department	219142.00	256420.35	201270.32
Control laboratory centre	278690.00	223467.20	220718.10
Maintenance and service department	55559.50	90081.78	51563.98

It utilises the system of equation method. In this case the systems of equations, representing the mutual services between service departments, were the following:

1st month:

$$110000x = 141900 + 800y + 500z$$

$$3350y = 268000 + 500z$$

$$2600z = 31500 + 10000x + 50y$$

2nd month:

$$154000x = 201740 + 500y + 600z$$

$$3100y = 201500 + 2000x + 300z$$

$$2900z = 43500 + 2000x + 600z$$

3rd month:

$$152000x = 194560 + 200x + 300z$$

$$3100y = 210800 + 1000x + 400z$$

$$2400z = 36000 + 1000x = 200y$$

The following denotations have been used:

x – bottling cost per 1 litre of liquid in the bottling department,

y – cost of control laboratory centre per 1 working hour,

z – cost of maintenance and service department per 1 m² of floor surface.

Including the mutual services in the systems of equations leads to depicting the costs more realistically. Although the reciprocal services may seem negligible in the studied enterprise, their inclusion results in significant changes in the base costs of service departments, namely

increasing them. Table 5 presents the service departments' costs settled using the algebraic method.

An analysis of service departments' costs from the Table 5 clearly indicates the paramount importance of including the mutual services in settling the costs and calculating the eventual unit cost. The systems of equations method provides tools to the most complex settlements of costs, being therefore the optimal framework to be implemented in production enterprises. With the development and improvement of complex computer programs, a growing popularity of this method can be expected. This case study shall be summarised with an analysis of changes in costs resulting from including reciprocal services between service departments, as shown in Table 6.

Including reciprocal services in service departments' costs apportionment always leads to increasing their costs. In the studied enterprise the extent, to which the costs increased, was dependent on the amount of mutual services. The most significant changes have been noticed in the maintenance and service department. Although this department generated the smallest base costs in the company, it received a significant amount of services from the other two units. Failing to include them in the process of calculations might have negative influence on the production management process.

Table 6
Increase in service departments' costs in the case of including reciprocal services

Service department	1 st month	2 nd month	3 rd month
Liquids bottling department	+54%	+27%	+3%
Control laboratory centre	+4%	+11%	+5%
Maintenance and service department	+76%	+107%	+43%

CONCLUSIONS

In each manufacturing company, one of the most important issues, as far as the process of production management is concerned, is unit cost. Accounting process of cost calculation leads to establishment unit cost. Despite many costs do not have obvious links to individual product, they are still a part of the resources consumed in creating a product or service and should be reflected in the product cost. Examples of such costs are service departments like computing services, repair and maintenance, security, food services, and so forth. Their costs must be allocated to the production departments, which in turn will allocate them to the product. Although the linear algebraic model used to solve the reciprocal service departments' cost allocation problem appears to be widely recognised it is still not universally used by the accounting professionals. Results of analysis of studies performed in the article (Table 1-6) prove, that the linear algebra model is the most useful tool in terms of unit cost allocation and provides useful data for the manufacturing process.

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