Calculation Methods for Costs Optimization and Process Modeling in Health Care: A Preliminary View

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Abstract— Paper deals with the practical application of modern costing methods in terms of organizations providing health services to optimize their costs. Within the research the specifics of cost management in health organizations will be explored. The implementation of modern costing methods in selected health organizations will be carried out and based on this a methodology will be elaborated for their application and practical use, which will be of great importance for given organizations in optimizing costs. After introduction Activity based costing we can approach to identification of the fundamental elements of process management in a health organization with links to process performance measurement.

Keywords— Activity-based costing, variable costing, BPM, process modeling, healthcare management.

I. INTRODUCTION

One of the key factors of effective company management is ability of accurate estimation of the cost of products.

Product costing is an essential economic tool used to quantify the cost of individual interventions carried out. Traditional costing is based on the experience of manufacturing organizations, but their variations used are also adapted to other sectors and areas of application, such as provision of services. Application of cost calculation in health service is not so common, although it would be widely usable in particular for the purposes of determining the costs of individual activities and performances in comparison to incomes from medical establishment. This would be useful especially for the management to be informed about the cost volume and structure, related to the operations carried out.

The difficulty inherent in choosing a proper and accurate product costing method for manufacturing enterprises has been widely discussed by academics and practitioners [1,7]. The important limitation of traditional (absorption) costing methods had been also deeply discussed along with advantages of other costing method as Variable Costing or Activity-Based Costing (ABC) [8].

Non-manufacturing sector and the current complexity of cost structure and outputs of organizations lead to frequent preference for modern costing methods (Variable Costing Method and Activity-Based Costing and Management) over traditional absorption costing.

Application of modern costing methods would bring many benefits and additional information on cost of outputs, which is then usable to measure profitability (although this is not the main objective of providing health services), effectiveness and cost performance of provided interventions.

Application of the above modern costing methods entails a number of predictable benefits, especially the ability to quantify the actual costs of activities undertaken within the health organization, to identify the relationship between the costs and means of carrying out these activities, to identify capacity influences on the overall costs of the organization and in the assessment of legislative issues regarding the reimbursement of particular performances to also measure the “profitability” of provided operations. It is necessary to view profitability in this case as an identified discrepancy between the amount of reimbursement for a certain performance and the actual (full) cost after taking into account all overhead costs.

Application of modern methods of cost management, however, entails a number of issues related to the practical applicability of costing for the health organization environment, and its further practical usefulness for decision-making bodies and characteristics of specific information outputs of such methods. Some applications of modern costing methods in organizations providing health services have been already performed worldwide [4,5], but without general generalization.
II. LITERATURE REVIEW

A. Costing methods

Application of the costing methods in non-manufacturing sector or healthcare brings a lot of obstacles in comparison with traditional applications in manufacturing industries.

The basic efficiency of the operations performed can be generally measured by the quantity of output and inputs consumed, which can be quantified by the costs [1], in other words, if the activity is performed at the lowest possible unit cost [3]. Distinguishes between efficient and inefficient production and estimates the level of inefficiency by establishing the best practices in the sector as criteria for comparison.

Efficiency and costs measurement in the conditions of healthcare service companies are, despite these simple relations, restricted for several reasons. Firstly, the companies and institutions which provide the healthcare services usually work with a very complicated structure of customers, diagnoses, services and other cost objects. Secondly, the system of the payment for healthcare services, along with the ethical consequences of people’s health usually does not allow the easy estimation of revenues and consumed costs generated by individual customer. And thirdly, the government and legislative intervention in a non-competitive area usually causes the inability of management of healthcare companies and institutions to apply any progressive programs to reduce the costs or increase the effectiveness of existing operations.

The above mentioned problems related to the utilization of the costing methods in healthcare service management, lead very often to the situation, when no product costing method is practically used. The environment of the hospital management and system of the payment for healthcare service through the insurance systems causes the apparent unnecessary of the information about the accurate costs of the product [6].

While the method used for product costing purposes are usually not an object of the any regulations, companies or institutions could use any method of product costing and any tape of cost allocation technique. This fact causes a high variety of used costing methods [1,9,10].

Traditionally, two different product costing systems are defined, the traditional absorption costing and alternative variable costing [1]. These two major costing approaches differ from one another, by the degree of costs assigned to the cost driver. Many other methods of product costing are defined in traditional management accounting. Special category of product costing method is the Activity-Based Costing, which was designed in 1980’s and became more natural part of enterprise’s costing system in recent years.

Traditional costing techniques, based on the experiences from manufacturing industries, were used for the purposes of overhead cost allocation during the 20th century. These are based on simplified procedures using principles of averages. In recent decades, such conventional concepts have become obsolete due to two major phenomena. The first of these is ever increasing competition in the marketplace, the necessity to reduce costs and the effect of having more detailed information on company costs. Secondly, there has been a change in the cost structure of companies. In terms of the majority of overhead costs, traditional allocation concepts, based as they are on overhead absorption rates, can often provide incorrect information on product costs. Those shortages or limitations had been very closely described in the scientific publications [1,7]. The first criticism of traditional costing concept was published by Kaplan and Johnson in 1987 [8].

The logical solution of registered disadvantages of traditional absorption costing systems was to develop a costing method which would be able to incorporate and utilize cause-and-effect instead of widely applied arbitrary allocation principles into the company costing system [1, 7]. In situation, when the portion of overheads exceeds 50% of total company costs and the company is using single measures for allocation of overhead costs to the cost objects, the risk of an incorrect product or customer costs calculation becomes significant.

It was then, at the dawn of the 1980s that the Activity-Based Costing (ABC) method came about, being quickly adopted by enterprises of many and various types. The spread of ABC owed a significant debt to advances in computing and IT thereby permitting practical utilization of ABC principles.

Early applications in the industry sector [2,11] have been followed by many applications in the service [12], logistics [13], and also in healthcare [5]. Nevertheless the direct application of ABC in healthcare institutions is not a frequent case in the literature.

Petřík describes organizations with the most to gain from ABC implementation as:

- Those with a high frequency of different cost objects – this presumption is valid for either production companies, or for service or trading companies
- Those with a large portion of indirect and supporting costs
- Those with a great number of processes and activities [15].

All these three characteristics are simply suitable for healthcare institution. Based on these experiences we can forecast high level of suitability of Activity-Based Costing approach for management of healthcare institutions. ABC approach could bring many benefits for an organization. Most important are:

- better understanding of process and activity costs, enabling managers to make decisions in order to optimize the costs of an activity.
- correctly quantifying the costs of distinct production/service activities. As the production of individual products/serving an individual customers consists of different operations, the ABC system is able to precisely describe the manner in which a product/customer goes through the various operations, as well as accurately calculating the costs of those operations.

The reasons senior managers consider going ahead with implementing ABC could be discerned as the following [14].
BPM thus automates the company processes and is able to ensure the necessary flexibility for them. There exists an entire range of reasons for the introduction of process management; however, the practice of both productive and non-productive companies and organizations shows the following basic reasons deciding in favor of process management. These undoubtedly rank among them:

- the necessity of a reaction to basic changes in the company surroundings;
- the necessity of change in the company organizational architecture;
- assistance in exclusion of those processes which do not bring value for the customer;
- reasons for the necessity of integration (e.g. the connection of operations, the incorporation of the customer into the process of producer, the supplier to the process of producer);
- the intention of certifying the system of quality management according to ISO 9001 [18,19].

III. PROBLEM SOLUTIONS

Together with the emergence of ABC methodology, issues relating to its practical utilization and implementation have been presented by both academics and practitioners. Drury [1] defined the necessary steps to set up an ABC system as follows:

1. Identifying the major activities taking place in an organization;
2. Assigning costs to cost pools/cost centers for each activity;
3. Determining the cost driver for every activity;
4. Assigning the costs of activities to products according to their individual demands on activities.

It is obvious that the application of the ABC in healthcare institution will be specific especially in the first step of application, where the individual activities are defined. Despite the fact, that the healthcare institution provides the oppositely different activities and tasks, logically the system construction could be similar to the manufacturing organization.

Activities defined within the ABC system are classifiable as either primary or secondary (support) activities. Primary activities might relate to actions which the organization performs to satisfy external demands, while secondary refers to those performed to serve the needs of internal “customers”. This classification is essential for cost allocation procedures, as described in further. In healthcare organizations, we can expect the higher importance of support activities, which could consume also the higher portion of costs.

Activities form the basis of measurement of all relevant information in an ABC system. Several procedures defining activities may be used [14].

- Analysis of the organizational structure of an enterprise;
- Identifying the inputs and outputs of the process;
- Assigning the costs of activities to products according to their individual demands on activities.
• Analysis of the workplace;
• Analysis of personnel costs.

Cost allocation to defined activities might prove very complicated in practice and eventually take up an important amount of the implementation process time. The reason is that the structure of activities and structure of a company’s department usually clash somehow. The activity cost matrix could be invaluable for assigning company costs classified in company cost centers to activities. Very often it is necessary to define a resource cost driver in order to effectively allocate such costs. Resource cost drivers help to assign costs to a specific activity, when the cost in evidence is aggregated in general book entries. The following resource cost drivers were used in the case studies:

- Personnel workload – for allocating personnel costs to activities
- Square meters – for allocating rent, premises depreciation, heating, and indirect electricity to activities
- The quantity of machines, tools, etc.

Applying all three ensures that no activity is overlooked.

Second step in ABC application is the assigning costs to cost pools/cost centers for each activity. Assigning costs to activities represents the first stage of the allocation process within the ABC system. Firstly, not all company costs will be allotted to the activities defined. Company costs could be classified according to their nature under [1]:

- Direct traceable costs – those allocated directly to a cost object using the same principles as traditional costing methods
- Activity-traceable costs – those allocated to identified activities
- Non-traceable costs (or unallocated costs), which could be allocated to a cost object in proportion to other costs, or may be covered by a small increase in the target margin
- Estimation

Third step of the ABC application is the determining the cost driver for every activity [1]. Within this step of the application it is necessary to calculate the primary rates of individual activities. Following steps have to be done:

Calculating the primary rates of individual activities can be conducted in four steps:

1. Setting appropriate activity cost drivers for individual activities;
2. Determining the output measures of individual activities;
3. Calculating the primary rates of individual activities;
4. Assigning the costs of support activities to primary activities

Performing of this step of ABC application in healthcare institutions could have a lot of specifics. The setting the appropriate cost drivers may be questionable and the measuring the output rates could also be complicated.

Final step in ABC application is the assigning the costs of activities to products according to their individual demands on activities. I case of ABC implementation in healthcare institution this step could be crucial, because the management have to decide, what the final product is or cost object of the healthcare institution. Is it the patient as the customer or the type of diagnosis?

Final ABC system in healthcare institution could be described in following figure.

![Fig. 2 Outline of the ABC model in healthcare institution](image)

Because most of the key processes in organizations providing health care is not effectively managed (i.e. including the establishment of metrics and definition of process interface) the next step will be the process modelling in that ways [18]:

1. Identification of the processes
2. Description of the context of the processes
3. Establishing a map of the processes
4. Description of the processes (Fig.3)
   - Identification of the sequence of the events and functions (activities)
   - Division of the process into sub-processes
   - Detailed description of the functions
5. Controlling the consistency and legitimacy of the process model
   • Controlling of the rules for creating models (syntax)
   • General controlling of models and objects
   • Controlling of the relationships between models.

Fig. 3 Sample of a detailed description of the processes [16].

IV. CONCLUSION

As already mentioned, the application of modern costing methods in healthcare organizations is very topical. These modern methods, particularly represented by process calculations (Activity-Based Costing) offer a wide scope of information outputs for management decision-making not only on costs but performance and capacity management as well [2].

Health organizations, however, are increasingly facing the pressure to improve the effectiveness of outputs and cost savings. Although several applications of modern costing methods have already been successfully implemented in the world, the application of management and economic tools in the Czech environment is not so common and on the theoretical level is not prepared at all.

The benefits of this research can be viewed especially in the ability to use the results in specific health organizations, which can on the basis of expected project outcomes apply modern costing methods or their main principles. Thanks to the application of these methods, a positive impact on the efficiency of performance of organizations can be assumed. The fundamental prerequisite for the project success is the ability to present a comprehensive methodology for the application of modern costing methods in a health organization.

The description of relationships between costs and revenues is a basic prerequisite for studying the behavior of costs in organizations providing health services. These findings may be further elaborated into a special costing methodology for health organizations and definition of procedures for costs optimization and efficiency increase.

ACKNOWLEDGMENT

This paper is one of the research outputs of the project NT 12235-3/2011 “Application of modern calculation methods for optimization of costs in health care” registered at Internal grant agency of Ministry of Health Czech Republic (IGA MZ ČR).

REFERENCES