Activity-Based Costing in Public Administrations
A Business Process Modeling Approach

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ABSTRACT
The traditional way of budgeting in public administrations is input-oriented; however, this system does not meet actual methods of efficient budget controlling as a mapping of output parameters. Due to challenges, such as the need for cost reduction because of decreasing tax revenues, pressure for controlling mechanisms is rising. Furthermore, Europe Pan-European directives foster process harmonization and introduction of IT-supported and optimized business processes in the public sector. In this regard, activity-based costing can be a useful instrument for efficiency measurement of public administrations' output. Through the introduction of new public management and double-entry accounting public administrations, the opportunity to use cost-centered accounting mechanisms to assess process performance while evaluating their activities in a holistic concept is accomplished. Process modeling can be a useful instrument to help public administrations to capture relevant process knowledge and thus create the data basis for activity-based costing.

Keywords: Activity-Based Costing, Business Process Assessment, Domain Specific Process Modeling, E-Government, Public Administrations

INTRODUCTION
Actually, the Public Sector is facing many changes. Initiatives like the EU Service Directive (European Commission, 2006), or the EU e-Procurement Directive (European Commission, 2004) demands for increasing service delivery. Furthermore, the customers' attitude changes, he expects more and more transparency of public administrations processes (Janssen, 2005). At the same time the pressure for reducing the costs for daily work grows. Against the background of declining tax revenues, cities and municipalities in Europe in particular have to deal with improving and redesigning their work routines (Becker, Niehaves, Algermissen, Delfmann, & Falk, 2004; Gronlund, 2002). Therefore, the support of the business process through IT like specialized procedures and workflow management systems plays a crucial role. However, this also represents a further cost factor. The cost-benefit ration for those IT investments often remains opaque to the administrations, limiting the intent to invest.

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Through New Public Management (NPM) new possibilities of cost control for public administrations arise. With NPM, the way of accounting in public administrations, e.g., in Germany, changes from the classical fiscal accounting to double-entry accounting as known from the private sector (Hood, 1995). Based on this new accounting approach, administrations have the possibility to introduce an almost complete resource usage concept (Jackson & Lapsley, 2003). Elements like target agreements concerning products and a contract management with the employees are essential constituents of this reformation.

Activity-based costing is a useful instrument for public administrations. Public administrations, as an overhead intensive service sector, are suited particularly well in this case. NPM offers relevant data basis for activity-based costing. It allows for assessing administration processes from a cost perspective in different overhead areas (Brown, Myring, & Gard, 1999; Jackson & Lapsley, 2003). The obtained cost rates can be used for cost control as well as for comparing administrations and for comparing as-is and to-be costs.

Process models are an appropriate measure for supporting activity-based costing. Process models are used for transparency issues concerning the knowledge of activity flows and for documenting the often implicit process knowledge of the employees. Thus, process modeling provides a qualitative description of activities, providing in depth-understanding and thereby a starting point for the quantitative analysis with activity-based costing (Tornberg, Jämsen, & Parakno, 2002). However, with business process modeling public administrations face specific challenges because their highly diversified product portfolio often contains more than 1,000 processes (Algermissen, Delfmann, & Niehaves, 2005). Using generic modeling languages like event-driven process chains (Scheer, 2000) or BPMN (Object Management Group, 2008) often turns out to be very difficult due to the large amount of processes (Becker, Algermissen, & Falk, 2007). The modeling method PICTURE, which has exclusively been developed for the needs of public administrations, has proved to be adequate for this field of application. It has been used for modeling and analyzing more than 1,000 processes in public administrations successfully (Pfeiffer, 2008).

The contribution of this article is the combination of the domain-specific modeling method PICTURE and the concept of activity-based costing. This integration enables public administrations to model their processes fast and easily, to assess them from a cost perspective and based on this to carry out a process assessment and evaluation of reorganization activities.

In the following chapter explains the basic concepts of activity-based costing and its applicability to public administrations. Afterwards the PICTURE method is presented as a modeling method especially developed for public administrations. In the fourth chapter both concepts are compared, their connection is set up and illustrated using an example. This article concludes with a summary and an outlook to future research areas.

ACTIVITY-BASED COSTING IN PUBLIC ADMINISTRATIONS

The central idea of activity-based costing is to change the way how overhead costs are broken down on outputs like products or services. Instead of distributing the overhead as a fixed percentage of direct costs, activity-based costing assigns costs according to the resources used, e.g., personnel resources, for producing the outputs. The resource consumption by the outputs is measured through their usage of certain activities or processes. Activities are tasks performed by an organization’s employees...
consuming resources and in turn are creating the outputs. The frequency of execution for an activity is determined by the cost driver, an “event associated with an activity that results in the consumption of […] resources” (Babad & Balachandran, 1993), e.g., an order. To calculate the activity’s cost driver rate – the cost rate for a single execution of an activity – the total costs for caused by the activity are divided by the cost driver. The total costs of an activity result from the share of the activity to the overall capacity of the resources used by it. Sometimes, the factor allocation resources costs to activities are called resource drivers (Cokins, Stratton, & Hebling, 1993; Gupta & Galloway, 2003).

Due to these properties activity-based costing is especially suitable for application areas with a high overhead fraction. That is mainly the case in personnel intensive areas like the service sector. In service companies basically all benefit processes can be included in the activity-based costing. Activity-based costing is therefore a well suited and useful costing instrument for the service sector (Ruhl & Hartman, 1998). Public administrations mainly provide services, too. Therefore, personnel costs often are the dominating cost factor in this sector. At the same time, departments often offer multiple services at once in an administration and often several departments are involved in providing a service. Activity-based costing can help to better allocate the large amount of overhead costs to the services of the public administrations than simple measures like the number of employees of an organizational unit or their share of budget (Brown et al., 1999).

The execution of activity-based costing requires identification, structuring and recording of the relevant activities or processes. A method that has turned out to be very useful for recording, documenting and also analyzing processes is process modeling (Green & Rosemann, 2000; Shanks, Tansley, & Weber, 2003). Hence, it is not surprising that also in literature respective approaches to integrate the two instruments have been discussed (Tatsiopoulos & Panayioto, 2000; Tornberg et al., 2002). However, a more detailed examination of the conceptual fit between modeling approaches and activity-based costing is still missing.

**PICTURE METHOD**

PICTURE is a domain specific modeling method (Guizzardi, Pires, & Sinderen, 2002; Luoma, Kelly, & Tolvanen, 2004; van Deursen, Klint, & Visser, 2000) which has been developed specifically for public administrations. The target when developing the PICTURE method was on the one hand to represent preferably the complete process landscape of an administration with justifiable effort and on the other hand to create process models which can be used for further semi-automatic analysis. For a more profound introduction to PICTURE cf. (Becker, Bergener, Kleist, Pfeiffer, & Räckers, 2008; Becker, Pfeiffer, & Räckers, 2007). Like many other modeling approaches PICTURE differentiates several views on the modeling object for reducing complexity when modeling. PICTURE distinguishes four views:

**Process View**

The process view describes the operations of the administration in the form of single activities put together to processes. At the same time the process view integrates all other views by recording “who” carries out single activities, “with what” they are carried out and “what” is edited respectively produced. The central element of the PICTURE method and thus also of the process view are process building blocks. Each process building block represents a typical activity in the sequence of work of public administrations. This strictly defined language construct simplifies and quickens modeling because it refers to the known vocabulary of the domain. An overview of the building blocks is presented in Figure 1.

To describe the details of an activity execution in more detail and to record properties which are necessary for subsequent evaluations the PICTURE building blocks are specified in more detail by specific set of attributes for each
building block type. For example, for the building block Receive Document/Information attributes like Input Channels, Received Document or Used Information Systems and the Sending Organizational Unit are recorded. The attribute Input Channels is an example for an attribute which requires multiple entries which have to be weighted. In PICTURE this is presented by a percentage distribution. Another important attribute also with regard to supporting activity-based costing is the required processing time which can be found in many building blocks like, e.g., Enter data into IT.

At the next higher structural level building blocks are composed to sub processes. Thereby a sub process is understood as a sequence of activities (process building blocks) which are carried out within one organization unit by one administrative employee and which contribute to the performance of a task of the complete process. Sub processes contain attributes, too. Here it is for instance recorded how often the sub process is carried out per year (number of cases) and who is responsible for its execution.

Within sub processes the modeling of process building blocks is done strictly sequential. This is due to the reason that one sub process only comprises those activities which one single administrative employee carries out. Therefore, it is assumed that he can only do one task at a time. However, it is possible that for one sub process several alternative operational variants exist, e.g., due to a decision (acceptance respectively rejection). For representing such a situation PICTURE offers two different constructs. One the one hand, attributes can be used, like the above described attribute Input Channels, where different cases can be represented by entering percentages. On the other hand, it is possible to define sub process variants. Such a sub process variant describes the alternative execution of the sub process from start to finish.

Sub processes are composed to processes. A process is characterised by providing exactly one service to the customers of an administration. Examples for such processes are Moving an identity card or Extending the parking permit. In the simplest case a process consists

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of exactly one sub process; processes passing through several organisation units to deliver a service consist of more than one sub process.

Besides the differentiation regarding the refinement of the modelling levels to processes, sub processes, variants and finally process building blocks, aggregating processes to products is also possible by combining processes to groups or superior groups. These groups represent products, product groups etc. The procedure leads to a hierarchy of services which opens out into a comprehensive product catalogue. For example, the processes for applying for, extending and giving notice of the loss of a passport can be combined into the group passport affairs. A potential superior group for processes concerning identity cards would be pass documents.

**Organisation View**

In the organisation view the organisational structure of the administration is represented in a hierarchical composition of the different organisational units and positions. The organisation units are the basic elements of the organisation view. The organisational units are responsible for the execution of certain parts within the processes. That is why in PICTURE sub processes are assigned to organisational units.

Besides the organisational units, positions and administrative employees are also to be maintained in this view. This is of special importance regarding the determination of personnel costs. Different position types and according properties like cost rates and capacities are specified for the positions. This allows for recording the relevant costs for employees as they are assigned during the modelling with PICTURE to the respective position. This is relevant for a subsequent automated analysis. Besides the mere storage of cost rates it is also important to state here to which process building block attributes these cost rates will be assigned (i.e., specifying the resource drivers for the cost rates). In the field of personnel cost this are mainly time attributes like processing time.

**Business Object View**

The business object view contains information concerning the necessary input (e.g., applications) and the corresponding produced output or possible intermediate products (e.g., statements or notifications) of an administrative process. It does not matter from a modelling perspective whether the input was created within the administration or whether it was given from the outside. An internal input has to be the output of another sector and thus can be quantified. This can be internal order documents or information. An external input normally does not cause costs until it arrives. These costs are measured and operationalized via the process view.

**Resource View**

The resource view shows which work equipment is needed for providing an administrative service. That is, for example, software applications like MS Office or specialised procedures as well as hardware (printer, scanner) or judicial information like laws. The resource view contains element types for representing these non-organisational work supporters as well as sources and targets of the business objects. In their roles as work supporters resources can be compared to the already mentioned element types of the organisation view. In their roles as sources or targets of business objects they determine where business objects – especially documents and information – come from and where they are stored like, e.g., in specialised procedures. In the context of activity-based costing the resource modelling serves for adding cost types like printing or archiving costs to the activities in which they are used. Thus, a product-centred addition of the respective costs will be possible if the required cost rates are stored with the resources in the PICTURE method. Thereby the corresponding attributes from the method have to be assigned as drivers to the resources like, e.g., the attribute “printed pages” to a printer.
INTEGRATION OF ACTIVITY-BASED COSTING AND PICTURE

Comparison of Method Elements

To integrate activity-based costing and the PICTURE method, the different constructs of both instruments have to be compared and assigned to each other.

Activity-based costing is applied to allocate costs to outputs. In general these outputs could be for example products or services. In the context of public administrations as a information processing organisation, the suitable output are the administration’s services as they do normally not produce material goods. This corresponds to the concept of a product in PICTURE.

PICTURE uses different levels to structure the activities needed to deliver a service. The top level - the processes - encapsulates all activities needed to deliver a process while a sub-process depicts activities within a certain organizational unit. Process building blocks finally are the atomic level to describe activities in PICTURE. In contrast, activity-based costing does only have the concept of activities which are not further structured. The examples in the literature show activities on a quite high level of abstraction like “process orders” (Anderson & Kaplan, 2003) or “disbursing Materials” (Cooper & Kaplan, 1998). These examples seem to be similar to a sub-process in PICTURE, as activities in activity-based costing are used to distribute resources costs which are normally associated with single organisational units. However, the concepts of processes and process building blocks can be easily integrated in activity-based costing. Processes allow for an accumulation of the cost of several activities conducted while delivering a service, while the detailed level of process building can help to break down activities further and therefore makes it easier to capture the resources used by an activity through the attributes of the building blocks.

Cost drivers in activity-based costing denote the determining factors (e.g., amount of building applications) that are responsible for the execution frequency of a main process. Such inputs or outputs can be represented in PICTURE by means of the processed object view. The respective amount of process and sub-process executions per year is recorded in form of an attribute on the process level and sub-process level, respectively.

The resources, respectively the resource consumptions, determine which costs are produced by activities. The most important resource in this context is the labour utilisation. The resource labour is modelled with the aid of the organisation view. In this view it is possible to deposit the payment and the (annual) labour time of a certain position. On the basis of these data the minute-by-minute wage rate can be calculated. The other resources are recorded in the resource model. The allocation of resources to activities occurs by annotating the resources to the according building block.

Table 1 summarizes the above mentioned considerations in tabular form.

Activity-Based Costing with PICTURE – An Example

To conduct activity-based costing with PICTURE the relevant services and activities have to be identified in accordance to the activity-based costing approach. For this purpose the definition of a process in PICTURE, which is geared to the external services of the public administration, can provide assistance. In the presented example this is the process “Modification of an income tax card” which in turn consists of the sub process “Modify income tax card”.

The identified processes have to be modelled subsequently with the PICTURE method. Thereby the attributes which are relevant for the activity-based costing, especially the used resources and the personnel in charge, have to be recorded. The sub process “Modify income tax card” is depicted in Figure 2.

The respective partial cost rate can be calculated if the corresponding cost information is deposited in the organisation model and in the resource model. In the example of Figure
Table 1. Comparison of elements of activity-based-costing/PICTURE

<table>
<thead>
<tr>
<th>Activity-Based Costing</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>output</td>
<td>product</td>
</tr>
<tr>
<td>primary process</td>
<td>process</td>
</tr>
<tr>
<td>sub-process</td>
<td>sub-process</td>
</tr>
<tr>
<td>activity</td>
<td>process building block</td>
</tr>
<tr>
<td>cost driver</td>
<td>business object</td>
</tr>
<tr>
<td>resource</td>
<td>resource</td>
</tr>
<tr>
<td></td>
<td>position</td>
</tr>
</tbody>
</table>

The deposited cost rate of an employee of the Local Public Office amounts to 30€ per hour. The second activity, the inspection of the submitted documents, therefore results in labour costs of 5.00€. The first activity incorporates also the attribute values of the input channel to the calculation. The labour costs only occur if the application is submitted in person by a citizen. In case of a postal submission, the deposited cost rate for the used resource post room - incoming mail comes into operation. Hence, PICTURE does not only allow the ascertainment of costs for the resource labour, but also for arbitrary other resources. Another example is provided by the fourth activity and the annotated resource Printer. The costs can be calculated on the basis of the amount of printed pages (resource driver) and the stored cost rate.

The cost rate for the sub process can be calculated on the basis of the cost rates of the single activities. The costs incurred by the use of the software Meso form a special case in the presented example. Here, a cost rate per (sub) process execution is calculated, which is consequently incorporated in addition to the activity cost rates into the sub process cost rate. The product of this rate and the respective resource cost driver, in this case the amount of modification applications, results in the annual sub process costs. The sub process cost rates can be further aggregated to main process costs.

CONCLUSION AND OUTLOOK

Process reorganization and optimization through activity-based costing bears great potential for public administrations in Europe. Due to missing transparency, much potential of cost reduction and process optimization are not explored yet. Especially municipal administrations are not able to face the huge challenges forced by European Union or Federal States. So they are often not aware about the structure of their business processes including often more than 1,000 processes, depending of the size of the organization.

Activity-based costing is one proven concept measure the performance of newly created or reorganized processes. Furthermore, intra- and inter-municipal benchmarking can be applied and a comparison of as-is and to-be processes is possible. Process modelling has proven itself to be a useful tool to generate the data pool needed for activity-based costing. Particularly the application of modelling approach that is especially tailored to a certain domain leads to a quicker and easier acquisition and analysis of information. The possibility to capture processes and process-related information in an efficient way is especially important for the application of activity-based costing as the main criticism on this instrument are the enormous costs for interviewing and surveying people to gather the relevant information (Anderson & Kaplan, 2003).
The present article underlines how the domain-oriented modelling approach PICTURE and the concept of activity-based costing can be combined to support public administrations and give them an easy and simple instrument to face the challenge. The example shows that the information gained during the phase of modelling suffice to make consolidated statements about the process costs accounting for personnel costs as well as other types of resource consumption. We used PICTURE in a case study in a small city (Becker et al., 2008) and showed that process costs can be measured in a very efficient way and recommendations for process optimization can be given with the PICTURE approach. The example also indicates that the aggregation of weaknesses in the process landscape can lead to the identification of additional reorganiza-

**Figure 2. Exemplary process “Modify income tax card”**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Attribute</th>
<th>Organization</th>
<th>Business object</th>
<th>Resources</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive Document for modification of income tax card</td>
<td>Document</td>
<td>2 min</td>
<td>30h</td>
<td>Employee (LP0)</td>
<td>5 min x 30h x 90% + 0,50€/Mal x 10% = 2,20€</td>
</tr>
<tr>
<td>Inspection of the submitted documents</td>
<td>Duration</td>
<td>10 min</td>
<td>30h</td>
<td>Employee (LP0)</td>
<td>10 min x 30€/h = 5,00€</td>
</tr>
<tr>
<td>Create income tax card</td>
<td>Duration</td>
<td>2 min</td>
<td>30h</td>
<td>Employee (LP0)</td>
<td>2 min x 30€/h = 1,00€</td>
</tr>
<tr>
<td>Printing of income tax card</td>
<td>Quantity</td>
<td>2</td>
<td></td>
<td></td>
<td>2 min x 30h + 2p x 0,10€/p. = 1,20€</td>
</tr>
<tr>
<td>Issue of income tax card</td>
<td>Duration</td>
<td>5 min</td>
<td>30h</td>
<td>Employee (LP0)</td>
<td>5 min x 30h x 90% + 1,50€/Mal x 10% = 2,40€</td>
</tr>
<tr>
<td>Archive modification application</td>
<td>Duration</td>
<td>2 min</td>
<td>30h</td>
<td>Employee (LP0)</td>
<td>5 min x 30€/h = 2,50€</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub-process attribute</th>
<th>Organizational unit</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case p.a.</td>
<td>1000</td>
<td>Process cost rate: 14,40€ + 2€ = 16,40€</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Process costs p.a.: 16,40 € x 1000 = 1640€</td>
</tr>
</tbody>
</table>
tion potentials without cost items in the fore. Thus, PICTURE enables decision makers in deciding, e.g., on IT-investments or organisational changes. Based on that, further research activities should particularly concentrate on the development of a procedure model that standardizes the application of activity-based costing in the area of public administrations and on the empirical evaluation of activity-based costing with the use of the PICTURE method.

REFERENCES


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