Advanced Information Technologies for Management – AITM 2011

Information Systems in Business
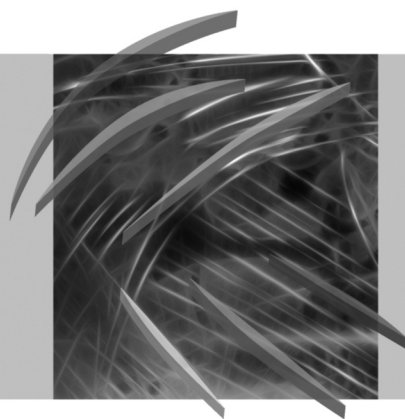
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Streszczenia

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PROCEDURE OF CREATING ACTIVITY-BASED COSTING SYSTEM FOR HIGHER EDUCATION INSTITUTIONS IN OROS MODELER ENVIRONMENT

Abstract: The article presents the procedure of building a computer-based costing system designed uniquely for university level education institutions. The concept of activity-based costing (ABC) has been adopted as the cost calculation method. The structure of the costing model for a hypothetic university has been elaborated and described in the paper. Significant attention has been paid to the implementation of the ABC model into the information technology environment. Thus, the most important steps of constructing the ABC system in the OROS Modeler environment have been described.

Keywords: Activity-Based Costing, ABC model, higher education, teaching costs.

1. Introduction

The analysis of costs of teaching and learning has been crucial for higher education institutions. This results from a high share of these costs in the total expenses of universities, an increasing competition between educational institutions on the Polish education services market, and the demographic changes. Moreover, latest legal alterations force Polish universities to count actual costs of educating and charge full-time weekend students (Higher Education Act of 2005) and those who enroll for their second study curriculum (Higher Education Act of 2011). Thus, reliable costing of education services has recently become a priority for Polish higher education institutions.

Generation of reliable information on costs of education services is highly possible thanks to activity-based costing [Acton, Cotton 1997; Krishnan 2006; Lukka, Granlund 2002; Tatikonda, Tatikonda 2001]. Efficiency of ABC in this area has also been noticed in Poland [Klaus, Kowalski 2007; Ossowski 2009].

ABC models are characterised by significantly greater complexity than traditional costing systems. Hence, for their building the use of specialised software is strongly recommended [Januszewski 2003]. The literature delivers only few examples of the process of constructing ABC systems in the IT environment. Moreover,

so far the author has not traced any example that would describe the procedure of designing an IT-system for institutions of higher education.

The aim of the article is to present the procedure of constructing a computer-aided system of activity-based costing for education of students.

2. The ABC-rooted model of higher education services costing

Every model of a costing system built upon the activity-based costing notion should consist of three modules: resources unit, activities unit, cost objects unit.

In relation to each of the mentioned modules the model of education services costing offers specific elements and solutions in the area of cost accounting. A general model of ABC developed for the purpose of costing of the education services which is limited to solely one undergraduate study curriculum is depicted on Figure 1.

When a university offers more than one study curriculum the education process should be redesigned in the activity module in order to subordinate teaching courses to various curricula. The same applies to the object module where groups of objects called "Regular Full-Time Students" and "Weekend Full-Time Students" should be divided into subgroups reflecting various study curricula. Alternatively, a study curriculum could be a head criterion, whereas both types of study (defined in the activity module) and student groups (defined in the object module) would be its members. And even more detailed division could be thought of when the university offers distinct specializations paths within the same curriculum. In this case students should be differentiated between specialization groups in the object module.

The resources unit of the model consists of:
– university teachers,
– educational infrastructure (classrooms, laboratories, etc.),
– materials required for the study processes,
– department administration (salaries, office stationary, phones, etc.),
– other common resources (e.g. library).

In the activity unit there are processes of teaching both regular and weekend students, and processes that are not directly linked to education itself, such as managing the university or servicing students. Every teaching/learning process consists of separate activities of delivering each course of the study curriculum in a prescribed form (e.g. lecture, class, laboratory class, project class, etc.). Ultimate cost objects are individual students who attend any major path on each semester.

Activities of servicing students in the time span of their study are differentiated with respect to three periods into [Szuwarzyński 2001]:
– the first semester, when recruitment costs are incurred;
– the particular year, when students are obliged to choose their major resulting in changes in types and sizes of student groups,
– the diploma year, when the number of courses students attend is lower but the time burden for teachers brought about by the diploma assessment is heavier.
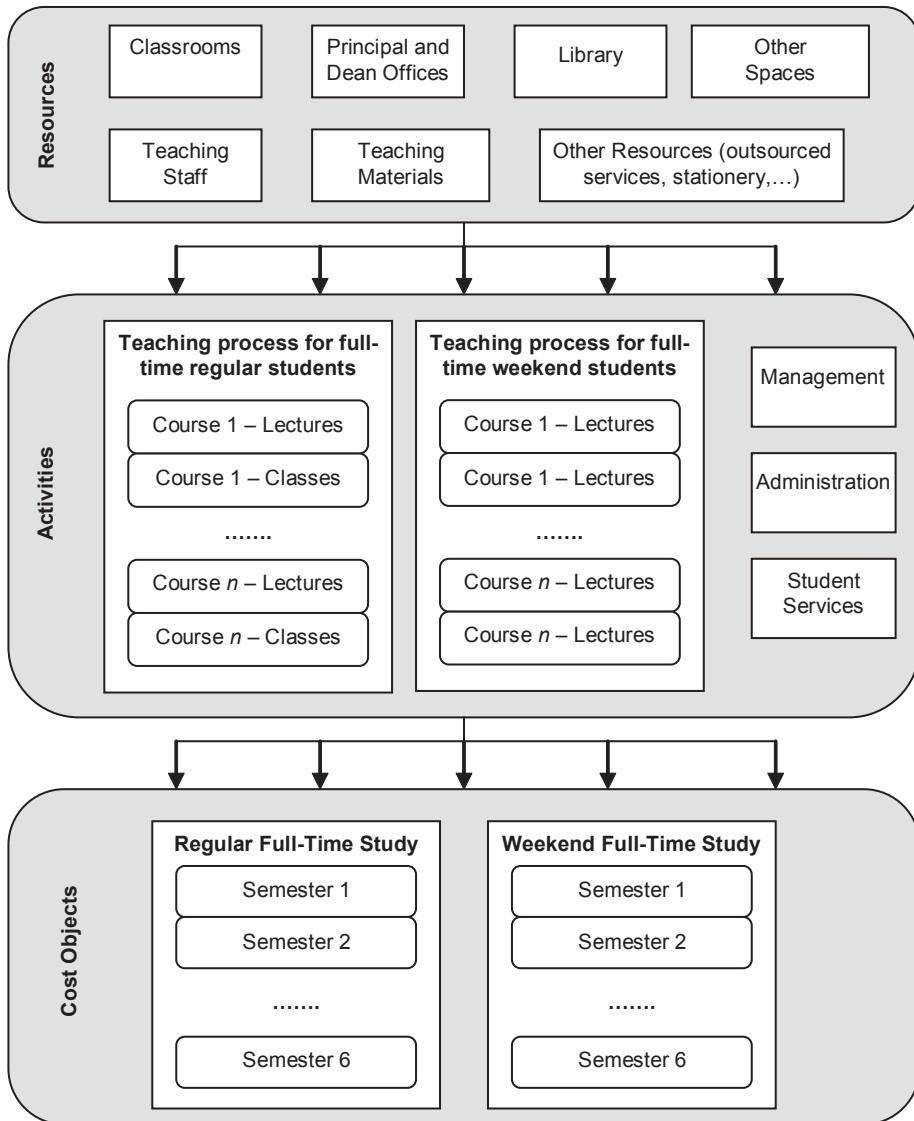
Figure 1. ABC-rooted structure of higher education services costing

Costs of resources that are consumed for delivering scheduled courses should be assigned with the use of resource drivers, such as teaching hours of teachers or hours of occupation of classrooms. Costs of particular courses are then assigned to related semesters of studies.

3. Assumptions and main steps of constructing the ABC costing system

Constructing the ABC system required the following steps:
1) setting up aims and elaborating assumptions to the costing model,
2) defining the model of the costing system with the adoption of ABC,
3) implementing the model in the IT environment,
4) preparing input data required for the costing procedures,
5) inputting data, calculating unit costs and interpreting the results.

The aim of the costing model was to obtain answers to the following questions concerning the full-time regular and full-time weekend curricula:
– how costly is a process of education performed for a study programme,
– what are costs of delivering particular courses,
– how costly it is to educate a group of students in each semester,
– how high is unit cost per student for every semester.

The following assumptions for the ABC model have been made:
– the ABC model has been embedded in a hypothetical university,
– university leads only one study curriculum for regular and weekend full-time undergraduate students called "Business Administration",
– studies last 3 years (6 semesters) and are possible in the regular or weekend way,
– management bodies of the university are the Principal, the Dean and the Chancellor,
– administration units are: Dean's Office, Finance and HR Department, Maintenance Department, Social Department, and the Library,
– university hires all offices (for the management and administration),
– the university rents all teaching rooms (three lecture theatres, one large and two smaller, three classrooms, one language laboratory, two computer laboratories, three laboratories and one gymnastic facility),
– teaching staff is: 8 professors, 30 PhDs, 24 MSc fellows,
– administration staff is 18 people in total,
– remuneration of tutors depends on teaching hours delivered and their position in the hierarchy.

The presented ABC model for costing education services consists of:
– 23 GL accounts for posting costs by nature,
– 16 types of resources in 6 groups (Teaching Staff, Principal and Dean Office, Finance and HR, Alumni Career and Marketing Centre, Library, and Teaching Rooms),
– 5 processes (including: 2 educational processes for both regular and weekend studies, as well as "Strategy" process, "Student Services" process and "Administration Activities" process),
– 12 cost objects (a particular cost object is each of 6 semesters during both regular and weekend curricula),

– 697 costs flow paths with over dozen of resource cost drivers and activity cost drivers.

Subsequent steps of the procedure of the ABC model implementation to the IT system will be presented in Section 4 of this text.

The preparation of input data necessitated in making detailed assumptions concerning the costs by nature. In particular, salaries for teaching, administrating and managing staff, rentals for infrastructure and amounts of other costs (e.g. office stationary, telecommunication, marketing and promotion) have been estimated. In order to apportion costs by nature to the university resources defined in the ABC model, it was crucial to estimate square meters of teaching and office areas, the number of computers and phones installed in every classroom or office room and to establish certain bases for natural costs apportionment, such as for example marketing, stationary, utilities or outsourced services, to the university resources.

As far as the assignment of resource costs to activities is concerned, it was necessary to assume the number of teaching hours for every single course, and the lecturers designated to deliver courses, the teaching rooms to be occupied for each course. Another crucial information that influences the number of hours realized in the form of tutorial classes or laboratory classes was the number of groups the students were divided into.

In the case of assigning activity costs of courses to cost objects the number of teaching hours of each course realized in each semester was needed. In order to allocate costs of other activities to cost objects, the number of students during each semester was required.

The final step of the entire project was to put the assumed data into the model, launch the costing procedure and interpret the outcomes.

4. Procedure of the model implementation in the OROS Modeler Environment

OROS Modeler was the IT environment upon which the model has been based. This tool is now part of *SAS Activity Based Management* software package developed by SAS Institute and is said to be one of most popular tools of the stand-alone type for ABC modelling [Miller 2000, p. 172].

The implementation of the model in the OROS Modeler was carried out in the following steps:
– defining GL cost accounts for costs by nature,
– defining a cost centre for each group of resources and a cost account for each item of resources,
– defining a cost centre for each process and a cost account for each activity,
– defining a cost centre for each group of cost objects and a cost account for each cost object,
– defining resource cost drivers and activity cost drivers,

– assigning costs by nature to resource cost accounts,
– defining cost flow paths from resource cost accounts to activity cost accounts,
– defining cost flow paths from activity cost accounts to cost object accounts.

Figures 2 and 3 present the structure of expenses posting accounts defined in the resources module, i.e. costs by nature (Figure 2) and resources (Figure 3).
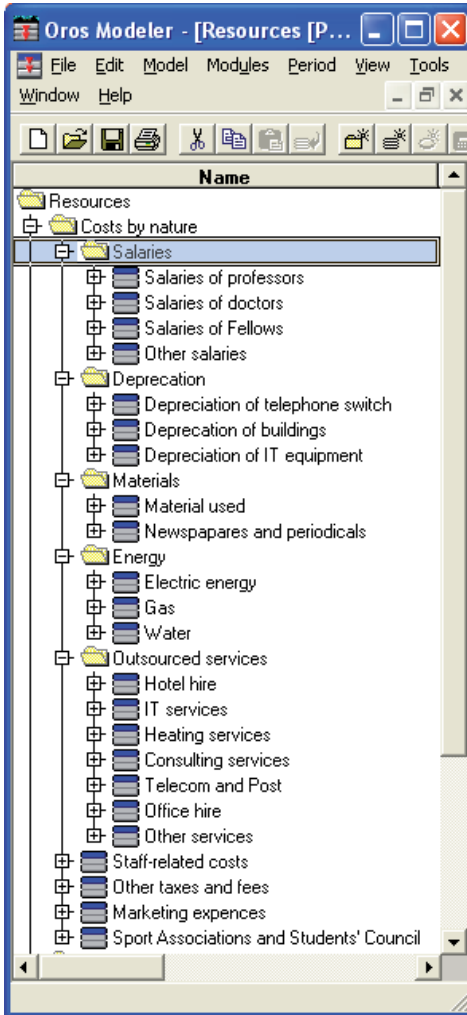
Figure 2. Structure of expenses accounts in the resources module – costs by nature
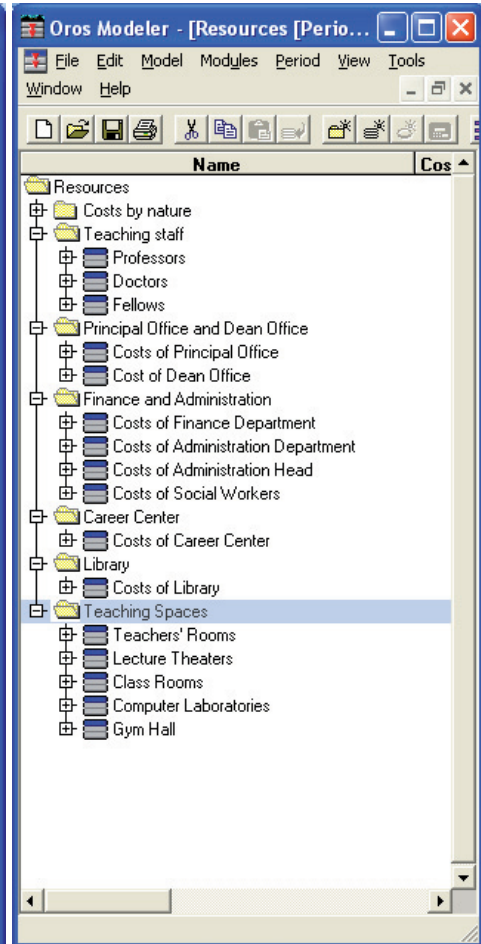
Figure 3. Structure of expenses accounts in the resources module – resources

The next two figures show respectively the structure of expenses posting accounts of didactical process (Figure 4) and the structure of expenses posting accounts of other processes (Figure 5), whereas the structure of expenses posting accounts in the cost objects module is depicted in Figure 6.
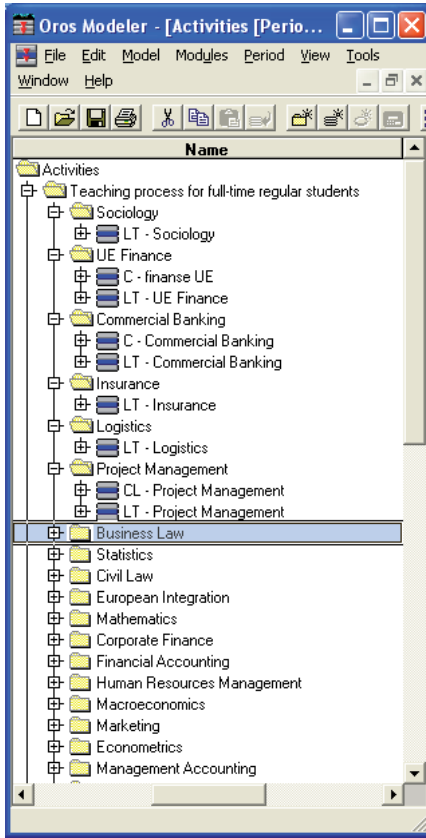
Figure 4. Structure of the activity module – didactical process (extract)
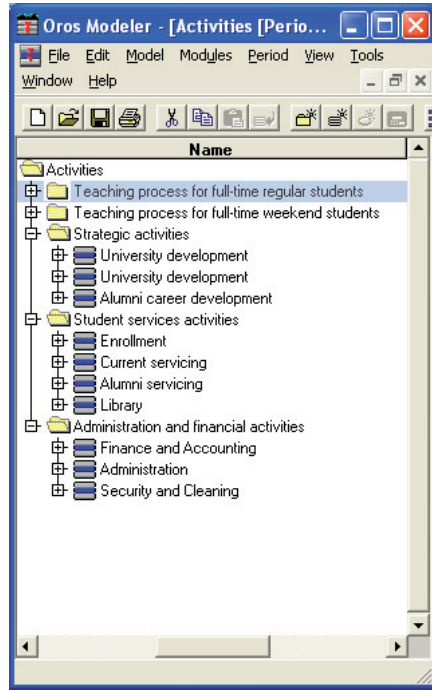
**Figure 5.** Structure of expenses accounts in the activity module – other processes
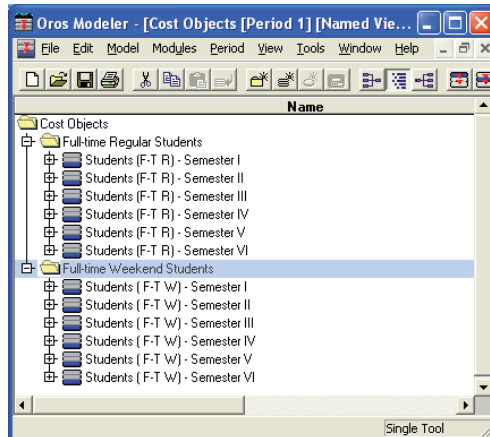

Figure 6. Structure of expenses accounts in the cost object module

In the next step, cost allocation paths with attached resource cost drivers and activity cost drivers have been defined. A cost allocation path shows how costs flow from resource cost accounts through activity cost accounts to the accounts of cost objects. The way cost drivers are defined is presented in Figure 7.
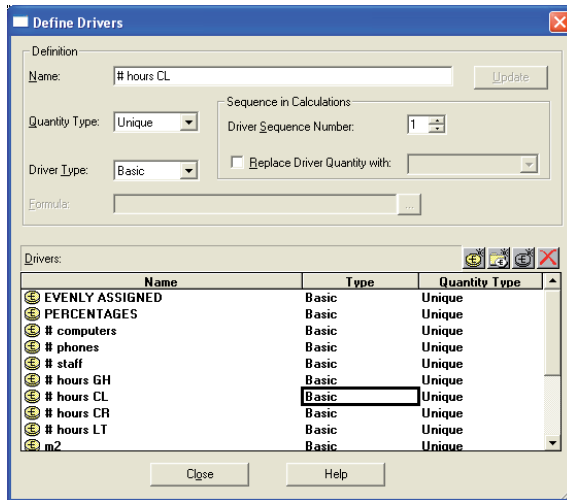
Figure 7. Defining cost drivers

There are some internal allocations paths in the resource module as well. They define how costs by nature are assigned to resources. Figure 8 depicts the case of assigning energy expenses with the use of "square meters" driver the various resources.
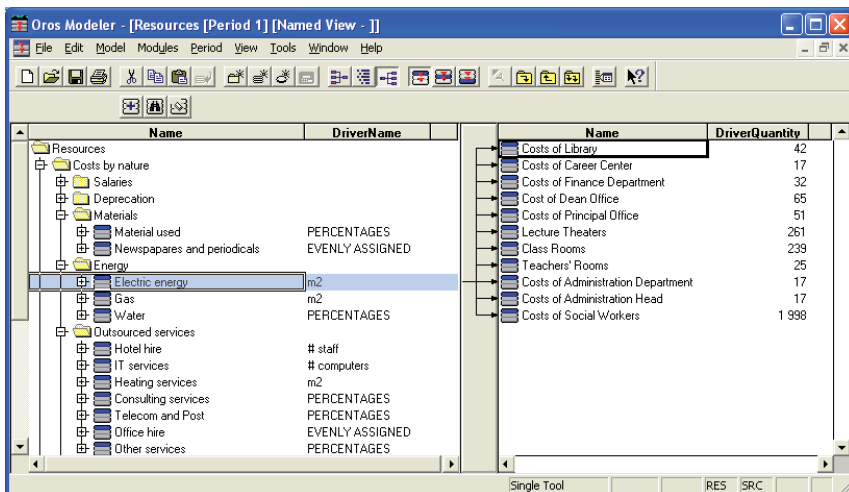
Figure 8. Allocation of energy expenses to resource accounts

Figures 9 and 10 show examples of expenses assignments respectively from resource accounts to activity accounts and from activity accounts to object accounts along with attached drivers.
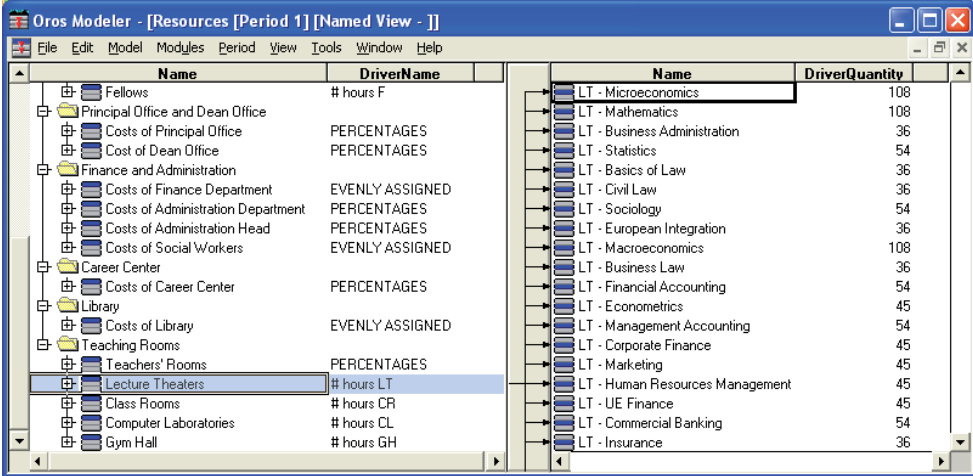
Figure 9. Allocation of resource account "lecture theaters" to activity accounts
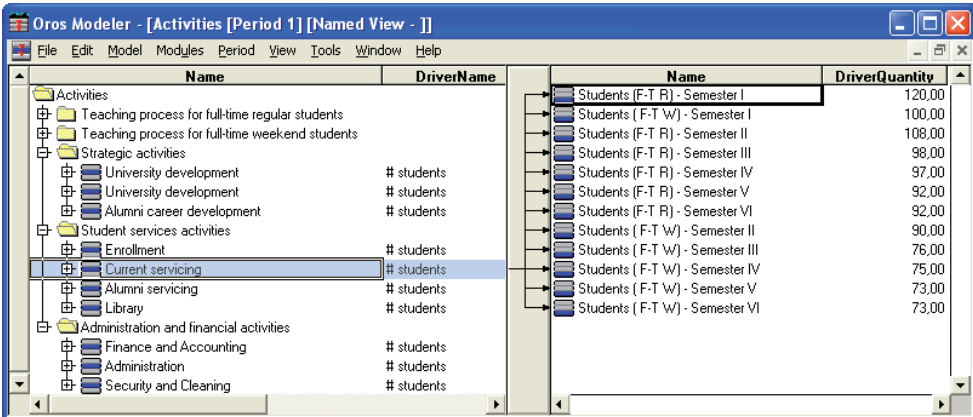
Figure 10. Allocation of cost of the "current servicing" activity to cost objects accounts

In the last step of the model implementation in the OROS Modeler environment the unit called "Education Unit Costs" was prepared. It was designed by adding two additional columns, i.e. "number of students" and "unit costs" to the "Cost Object" unit.

After the structure of the model had been designed, which means that cost centres and cost accounts for resources, activities and cost objects had been defined and

cost flow path had been depicted, the following data have been prepared and input to the computer:

– the amounts of natural costs which were estimated upon underlying assumptions,

– the values of resource cost drivers, i.e. cubic meters of teaching and office areas, percentages of apportionment of several natural costs to resources, number of telephones, computers and employees in particular organizational units, hours of usage of teaching rooms by particular courses, teaching hours for particular courses,

– the values of resource cost drivers, such as the number of teaching hours for particular courses during each semester which was required to allocate the costs of delivering courses to semesters, and the number of students in particular semesters which was necessary to allocate costs of other activities,

– the numbers necessary to calculate the unit student costs, i.e. the number of students in particular semesters of regular and weekend studies.

After having input the above-mentioned data, the calculation procedures have been launched. This resulted in obtaining the unit cost per student of both regular and weekend curricula. The outcomes of the costing procedure have been showed in Figure 11.

Name	Cost	# students	Unit Cost
Cost Objects	856 510,00		
Full-time Regular Students	529 319,46	607	872,03
Students (F-T R) - Semester I	87 757,97	120	731,32
Students (F-T R) - Semester II	97 919,81	108	906,66
Students (F-T R) - Semester III	77 595,16	98	791,79
Students (F-T R) - Semester IV	101 265,71	97	1 043,98
Students (F-T R) - Semester V	104 235,43	92	1 132,99
Students (F-T R) - Semester VI	60 545,38	92	658,10
Full-time Weekend Students	327 190,54	487	671,85
Students (F-T W) - Semester I	50 686,58	100	506,87
Students (F-T W) - Semester II	62 485,16	90	694,28
Students (F-T W) - Semester III	44 059,11	76	579,73
Students (F-T W) - Semester IV	58 617,87	75	781,57
Students (F-T W) - Semester V	69 211,51	73	948,10
Students (F-T W) - Semester VI	42 130,31	73	577,13

Figure 11. The teaching unit costs per student

The results show a significant difference between education cost of students of the regular and weekend types. The teaching process of regular students turned to be 62% higher than that of weekend ones (529,319 PLN for regular study compared to 327,191 PLN for the weekend one), the main reason being the limited number of teaching hours delivered to students of the weekend education. The difference is much lower if we take into account an average teaching cost per student per semester

which is 30% higher in the case of regular education (872 PLN to 672 PLN). This is mainly due to a higher number of weekend students than those of regular type.

5. Conclusions

As described above, the realization of the procedure of ABC system designing for the costing purposes with the use of dedicated software is relatively non-complicated. This advantage should be an important incentive for the implementers to fully exploit the functionalities of such tools. But one specific feature of activity-based costing for higher education institution is particularly worth emphasizing. The model structure is decisively more complex in the part which relates to allocating resource costs to activities and allocating GL accounts of natural costs to GL accounts of resources in comparison to the part which refers to allocating activity costs to cost objects. The latter step of the costing procedure requires only two activity cost drivers, i.e. the number of students for each semester and the number of hours for each course delivered in each semester when a particular course lasts more than a single semester. Costing models for merchandise and production enterprises are usually significantly more complex in both steps of the costing procedure (see for example: [Januszewski, Kujawski 2005].

In the author's opinion the costing methodology described above can be a basis for the pricing policy for a higher education institution. The adoption of ABC to costing purposes yields a unique opportunity to precisely calculate costs of teaching and gain knowledge about differences between study curricula which are possible to be significant.

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PROCEDURA TWORZENIA SYSTEMU RACHUNKU KOSZTÓW DZIAŁAŃ DLA UCZELNI WYŻSZEJ W ŚRODOWISKU OROS MODELER

Streszczenie: W artykule przedstawiono procedurę budowy komputerowo wspomaganego systemu kalkulacji kosztów kształcenia studentów. Jako metodę kalkulacji przyjęto rachunek kosztów działań (ABC). Zaprezentowano ogólną strukturę modelu kalkulacji kosztów kształcenia opracowaną dla hipotetycznej uczelni wyższej. Szczególną uwagę zwrócono na implementację opracowanego modelu ABC w środowisku informatycznym. Dokładnie przedstawiono najważniejsze kroki konstruowania systemu ABC w środowisku OROS Modeler.