

The Applicability of the Principles of Activity-Based Costing System in a Higher Education Institution

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Abstract: In view of the growing relevance of management accounting in the administration of universities, the recognition of the need for an effective costs assessment system (Jarrar, Smith and Dolley, 2007), and the profound changes that have been occurring in the structure of Portuguese universities, developing and implementing models that may actually be useful for the management of these institutions will be of major importance. The aim of this work is to present a costs assessment model, influenced by the activity-based costing (ABC) and applicable to higher education institutions. Therefore, based on the procedures used by the services of a faculty belonging to a large Portuguese university, we tried to create a model which allows the attribution of each department's expenditure to the various cost objects – courses, research projects, services. In this way, we tried to present a model which, without being too complex, has a level of detail sufficient enough to enable the production of reliable information and which can be applied in the context of higher education institutions.

Keywords: activity-based costing; management accounting

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1. Introduction

The challenges posed by the economic development of the 1980s led to new studies and further development in the area of cost accounting. According to Kaplan (1984), until then cost accounting was based on models created in the 1920s, developed for industries where direct costs represented a high fraction of costs. Today, with the growing importance of indirect costs, it is crucial to adequately include them in the full cost of products and to assign them to the products to which they really correspond. Kaplan argued that the development of cost control systems was not following the evolution of business's productive systems and the growing weight of indirect costs. It was in this context that the concept of activity-based costing (ABC) emerged, presented and divulged by Robin Cooper and Robert S. Kaplan.

The ABC was indeed a catalyst for management accounting progress and increased credibility. It allows, in principle, for a more exact costing of products and a finer operational performance evaluation, due to the importance given to activities and to its perspective on the organisation and management method.

Several studies called the attention to the fact that traditional cost accounting systems were not providing the essential information needed to support universities' managers decisions (Bourn, 1994). They argued for the implementation of an effective management accounting system in these organisations (Goddard and Ooi, 1998),

drew attention to the fact that management accounting was gaining importance in the administration of universities and that there was a growing need for an effective system of cost accounting, mainly due to the decrease in financial resources available to these institutions (Jarrar, Smith and Dolley, 2007). It becomes clear that universities need to adopt more sophisticated management models, in order to be able to plan, monitor and allocate the resources in a more precise way, i.e., a sophisticated cost accounting system as a solid management tool.

The majority of Portuguese companies still use traditional costing systems, with a low level of sophistication (Machado, 2007). Although we are not aware of studies that can prove this, we believe that the cost accounting systems adopted by Portuguese universities are similar to the ones used in the Portuguese businesses, particularly in what concerns sophistication. It is against this background that we prepared the present work, with the aim to develop a cost accounting system that uses the concepts of the ABC model and which higher education institutions can resort to. For this purpose we suggest a model which is not too complex and provides managers with truly reliable information about the costs of the various services provided by an institution, be it courses, (undergraduate degrees, master degrees, doctoral degrees), research projects or other.

2. Activity-based costing

As a consequence of the growing economic and market requirements of the last decades, especially since the early 1980s, companies were faced with a new reality, a new competitiveness paradigm. Companies, faced by this new reality which imposed stricter quality requirements and very short product life cycles, were forced to become more flexible, both in their production procedures and their product design. Simultaneously, indirect costs overweighed the so-called direct costs, a change which was naturally brought by technological development and growing requirements regarding competitiveness, marketing, research and development.

It is in this new economic context that Kaplan (1984) addresses the new challenges of the economy, raising the question of whether cost accounting was prepared for a much more competitive economic environment. In his paper, Kaplan theorises that until then cost accounting had been based on models developed decades ago, for industries with high direct costs, built for the mass production of standard products, with no major progress having been made since those times.

Thus is questioned whether the progress in the management and costs control systems was following the evolution of the productive systems. Johnson and Kaplan (1987) thought that the new economic and technological realities that companies were now facing contributed to both “new requirements and new opportunities” presented to management accounting systems.

This was the background for the development and dissemination of the activity-based costing system. Although many of the concepts in this model had existed for decades and had been applied in some large companies in the United States, it was only by the end of the 1980s that it emerged and gained popularity as a good model for management accounting, both amongst academics and entrepreneurs.

2.1. Characteristics of the model

ABC is a costing system which allows for a better visualisation of used resources, since it focuses on the analysis of the whole company's structure activities. The model's basic principle is a simple one, and stems from the assumption that resources are used during activities, which in turn are used by the items of cost.

Unlike the traditional systems, which focused on the principle that each product consumes a certain amount of resources (Cooper, 1998a), the main focus of the costing process in the ABC model is the company's activities which consume resources that can then be allocated to products. This means that, in the ABC system, the cost of a product is the sum of the costs of all the activities involved in the product's design, manufacture and commercialisation.

The costs are attributed to cost pools, and then ascribed to products through cost drivers. In other words, the

ABC model assigns indirect costs to products through a two level process: first, these costs are attributed to cost pools, only then are they allocated to products, based on the extent products use the activities.

2.2. Activities

Kaplan and Atkinson (1998), Kaplan and Cooper (1998) and Cooper and Kaplan (1991a) defined activities at four levels:

Unit-Level Activities:

Unit-level activities represent the activities necessary for a single product to be made or a single service to be performed. The amount of resources consumed by these activities is proportional to the quantities produced or performed.

Batch-Level Activities:

Batch-level activities are activities where a new product or service order is placed. They are independent of the number of units being produced, but the resources consumed are proportional to the number of, for example, order forms.

Product-Sustaining Activities and Customer-Sustaining Activities:

The product and customer sustaining activities represent the work performed by an organization that makes it possible for product or service production to occur and that allows the sale to a particular customer to take place. Naturally, the resources consumed during these activities are independent from the volume or the mix. They are, for example, maintenance activities, product specification updating, commercial research and backing, individual product/service technical support.

Facility-Sustaining Activities:

These are the company's support activities which are not related to products. Some researchers advocate resources consumed during facility-sustaining activities should not be allocated to products or services commercialised by the company. However, Kennedy and Afflec-Graves (2001) questioned the facility sustaining costs and their non-attribution to products. This level includes, for example, administrative and management, cleaning, maintenance and security activities.

2.3 Cost Drivers

The second stage of the ABC system attributes activity costs to the cost objects, through cost drivers which correlate the activities with those products and services. Cost drivers are used to identify the way activities are consumed by products/services. The cost driver is an event, associated to an activity, which results in resource consumption (Babad and Balachandran, 1993), a quantitative assessment of an activity's output (Kaplan and Atkinson, 1998). For each activity there should be an appropriate cost driver.

A model based on the ABC system can include three kinds of cost drivers: transaction drivers, duration drivers and intensity or direct charging drivers.

Transaction drivers are the number of setups, the number of order forms, etc. They are used when the units consume the same resources of the activity. It is the less costly driver but also the less accurate, since it assumes that the same quantity of resources is used every time an activity is performed.

Duration drivers represent the time that is necessary to perform an activity. They are, for example, the time needed to prepare an order; the time spent inspecting products; or the labour hours. These drivers are more accurate but make it more expensive to implement the system.

Nevertheless, these drivers are not always accurate nor the most suitable. For example, in the case of the cost per hour in processing a new order, the duration driver assumes that the hours spent introducing the new order have the same cost, ignoring the possible need for specialised personnel or more expensive equipment for some new orders. Thus, intensity or direct charging drivers are more suitable and, it is safe to say, more accurate than the previous ones.

In practice, the determination of the number of cost drivers is important for the system's design (Cooper, 1989; Babad and Balachandran, 1993). In fact, highly accurate attribution of indirect costs requires a great number of cost drivers. More precisely, the minimum number of cost drivers necessary for an ABC system depends greatly on the desired level of accuracy. Once define the minimum number of cost drivers for a specific system, the adequate cost drivers can then be selected.

3. Universities

The growing need for cost rationalisation and containment in the public sector in general is most certainly the reason for the inevitable sophistication of public sector accounting systems, namely of analytical accounting and internal control systems. Due to their importance as management tools, these systems (such as the ABC system and the Balanced Scorecard) will play an increasingly important role in the efficiency level of public sector institutions and in the modernisation of its management.

Higher education institutions will have to take on board this reality. This means having deep knowledge about the cost of each course, each discipline, each student, each research project, each service provided to external customers, and of any other services provided to the community; it also means knowing the ratio between profits and costs for each cost item in order to produce results.

Bourn (1994) argued that the traditional cost accounting systems were not able to provide accurate data about costs and performance control and assessment, with the consequence that essential information was not being

given to university managers in order for them to make decisions. Furthermore, Jarrar, Smith and Dolley (2007) called the attention to the fact that, in recent years, management accounting had gained relevance in university administration and that the need for an effective cost accounting system was a growing concern.

Cropper and Cook (2000) highlighted the need for universities to adopt more sophisticated management models so that it would be possible to plan, monitor and allocate resources in a more accurate fashion, i.e., a sophisticated management accounting system. However, designing, monitoring and maintenance such a model requires additional human and material efforts. According to Cropper and Cook, in order to address some of these challenges, English higher education funding bodies issued costing guidelines recommending a model which was an approximation of the activity-based management system. These guidelines included resource costs, activities, cost drivers and outputs. They also defined six key stages:

- 1 - Identify resources used (staff, consumables, equipment, etc.);
- 2 - Identify products (courses, research, working-papers, consultancy, etc.);
- 3 - Identify activities (teaching, research, admissions, library services, registration, etc.);
- 4 - Attribute used resources to activities;
- 5 - Assign activities to products through cost drivers (staff, students, space);
- 6 - Analyse and correlate results.

Broad and Crowther (2001) concluded that, in fact, universities did not adopt the ABC system but rather a hybrid system somewhere between traditional systems and the ABC system. Some general costs would be allocated based on activities and other costs would be attributed using more traditional techniques, such as labour hours. In principle, the ABC system is applicable to higher education institutions, but maybe not to all departments in a faculty. As will be shown throughout the next chapter, not always will it be possible to fully adopt this system. The specificity and the role of certain departments within the organisation make it difficult to implement the ABC system. However, the adoption of this system in other departments will undoubtedly allow for the information available to managers to be more reliable than that provided by traditional systems.

4. The ABC system applied to a higher education institution

At this stage, the aim is to propose an analytic accounting system which is at the same time founded on the activity-based costing model and adaptable to higher education institutions, more precisely to a social sciences faculty belonging to a large Portuguese university.

The work methodology was based on the principle that it was crucial to acquire in-depth knowledge about the

faculty that was the object of study. So, the first step was getting to know the faculty's cost items, its operating structure and its departments (specifically the role these have within the institution and what their cost structures are).

We were thus able to observe that the faculty has four governing bodies: the Representatives Council, the Executive Council, the Pedagogical Council and the Scientific Council.

The board is responsible for managing the entire structure of the faculty. The financial supervision is conducted by an external body.

The faculty under study also has a technical office, whose purpose is to provide secretarial services to the councils and support to the management bodies.

Several services and offices are under the control of the board: The IT Support Service, the Administrative Services, the Marketing and Communication Office, the Financial Services, the Maintenance and Auxiliary Services Office and the Students Assistance Office.

A higher education institution's cost items can be divided into four major groups: teaching (undergraduate degrees, postgraduate courses, master degrees, doctoral degrees), research (research projects), services provided to external customers (consultancy services to public institutes and courts, support in the development of projects in various areas, etc.) and to other institutions (such as museums, libraries, laboratories, sport entities, refectories).

In the next step, we will define the direct and indirect costs that a higher education institution may incur, and also a strategy for assigning these costs to the cost items.

4.1 Direct Costs

The most important resource for the majority of the higher education institutions, and more specifically in a "pen and paper" faculty of social sciences like the one we studied, is certainly the teaching body. The reason is it represents a considerable percentage of the total cost. We observed that, usually, these costs can be either direct costs (when the activity of the teachers is teaching) or indirect costs (when teachers perform other activities in the institution, such as board or council duties).

It seems that the teaching staff costs' distribution has to be based on staff time. Time spent teaching, time spent doing research and any other function must then be defined.

The time each teacher spends doing research or providing a service, assuming a specific research project or service, can in this way be directly attributed to the corresponding cost item. The time each teacher spends teaching can be attributed to each of the courses he/she teaches. Time spent with students individually and thesis supervision still needs to be accounted for.

4.2 Indirect Costs

In a higher education institution, indirect costs are the costs relative to the various councils, services, sections and offices.

At this point we tried to identify the activities each department performed and their cost structures. On that basis, we can determine a possible structure for the departments, given the characteristics of their activities, the cost drivers that can be used to allocate costs to cost items and the possible ways of collecting data.

IT Support Services:

This service is responsible for the setting up of all IT systems in the faculty, from communications to servers and all associated services available to other departments, teachers and students. This service's cost structure includes staff costs, purchase of replacement parts and consumables, purchase of tools, amortisation of equipment and costs ascribed to it by other sections.

We identified four activities that this service performs: Technical support, Computer equipment management, Application development and Printing support.

The service's cost attribution to the four activities can be based on the extent to which each one is consumed. More to the point, one can only assign resources to activities if one knows the resources (such as human resources, services, consumables) each activity consumes. In order to obtain these elements, one can resort to time-sheet records, for example. Those resources that are common to several activities may be allocated according to a logical criterion, based on the perception of the extent to which services are used in each one of the activities.

Technical support: this is the main activity of the service and consists of providing IT support to the whole institution. When it is the case of technical support provided to teachers, services or offices in the faculty, the cost thereof should be attributed to the requesting body. When it is the case of technical support provided to students, the cost should be assigned directly to the cost item, i.e., the course attended by the student.

Computer equipment management: this is mainly the repair of damaged equipment from the various services and offices, and other shared equipment. The cost should be assigned to the requesting department, except when the equipment being repaired is shared equipment. In this case, the costing should be addressed in the same way as are other shared facilities (building, surrounding areas, water and electricity).

Application development: in this activity, the service develops computer applications which are requested by a service or a teacher. Once again we are looking at a situation where costs are indirectly attributed to cost items via other cost pools.

Printing support: we think that it is possible, again using time-sheets, to register and consequently process the information relative to this activity.

Administrative Services:

The administrative services comprise four sections: Undergraduate student section, Postgraduate student section, Human resources section, Current administrative work and archive section.

Student sections perform various tasks related to student life, such as applications, enrolments, registrations and student follow-up throughout their academic pathway (issuing of grades, charging of school fees, issuing of extracts, general correspondence).

The human resources section is responsible for all administrative matters regarding the institution's staff.

The Current administrative work and archive section deals with processing (registering and forwarding) correspondence, keeping the administrative work archive up-to-date, etc.

The administrative service's cost structure includes staff costs, purchase of goods and services, amortisation of equipment in use in the service and costs ascribed to it by other sections. However, it is necessary to be able to allocate the costs to its four sections.

The Human resources section and the Current administrative work and archive section interact with all other services in the faculty, since they provide and receive material to and from them. They do not have direct contact with cost items. Thus, it seems that the section's costs should be allocated by the other services, sections and offices. An acceptable criterion for the allocation would be staff numbers in each of these other services.

The Undergraduate student section issues extracts, verifies the completion of student's studies, maintains personal file archives, dispatches requests, issues grades, manages students' change in subject area and students' transfers. Student application to higher education is made through national competition and registration is done electronically by the students themselves, so in this case the services are restricted to welcoming and supporting students throughout the course, as described above. It is possible to attribute this section's costs to the cost items (undergraduate courses) using the criterion of "number of students per course". In this particular case it seems that a more complex model (based on activities and drivers) would hardly lead to finer results.

In the Postgraduate student section service can be allocated to courses, i.e., each member of staff would be responsible for certain courses. In this situation it is possible to establish a single driver: "number of students". This means that this section's cost divided by the number of students enrolled in master and doctoral degrees equals the cost per student. The cost can subsequently be attributed to each of the courses using the number of enrolled students. This is the simplest

model for cost assignment. However, we acknowledge the fact that it might not be the most accurate and that, in situations where sections are organised in a different manner, a more complex model is required. We would then have to define activities and cost drivers. Activities could be Reply to requests (information requests, document requests), Event organisation, Providing support to visiting teachers, Application processing, Registration processing, etc. In this situation it is possible to resort to cost drivers such as Number of requests, Number of events, Number of visiting teachers, Number of applications, Number of registrations, etc.

Marketing and Communication Office:

This office is responsible for external communication and for promoting the faculty's image, namely through liaising with the media and other entities, and answering requests, whether scientific or not, from the public in general. It publicises the courses taught at the faculty, through brochures and advertisements, and scientific events such as publications and conferences. Furthermore, it supports the organisation of conferences, seminars, meetings, etc.

In this case, the cost structure includes staff costs, amortisation of equipment and purchase of goods and services, such as brochures and leaflets made in typographies, advertisements in the press and costs of other faculty services attributed to this office.

Therefore, we can account for three activities in this office:

- Communication – Brochures;
- Communication – Advertisements;
- Organisation of events – Conferences, Seminars, Meetings

As for the allocation of costs to activities, it can be done in two ways: costs which are related to specific activities (purchase of brochures, expenses with advertisements in the media) can be attributed to the corresponding activities. The remainder of the office's costs (staff, goods and services, amortisations), which are common to the three activities, can be assigned according to a logical criterion: the perception of the extent to which each one of them uses time and resources.

Finally, we propose the following attribution of activity costs to cost items (courses, research, services provided to external customers):

Communication – Brochures: Allocating this activity's cost to the cost items may be done directly. If an individual brochure is related to a specific cost item (course or other), the cost of the brochure will be allocated directly. However, if the brochure is not related to a particular cost item (for example, the promotion of meetings which do not directly concern a specific course or research project), its cost allocation requires more complexity. Costs could, for example, be attributed to the courses attended by participating students, or according

to the subject of the event, or still the type of audience at which it is targeted.

Communication – Advertisements: When an advertisement is related to a specific cost item, i.e., the advertisement refers to a course in particular, the cost allocation can be done directly. However, one advertisement may refer to several courses. This will have to be taken into account and the cost allocation will certainly require more complexity. One may, for example, consider the number of places in each course. When an advertisement is not related to the cost items but rather to the institution (advertisement for a competition, for a job position or managerial role, etc.), its cost must be allocated to the cost pools according to the subject of each particular advertisement, if possible, or according to the faculty's shared costs distribution.

Organisation of events: The allocation to the cost items can be similar to what was described for "Brochures". Thus, assuming that each event is related to a specific cost item, the organisation's costs will be allocated directly. If the event is not related to a particular cost item, costs could, for example, be attributed to the courses attended by participating students, or according to the subject of the event, or still the type of audience at which it is targeted.

Library:

Some library staff exclusively provides services to visitors. Other employees, although responsible for other tasks (conservation of library material, liaising with publishers, purchasing, etc.), also provide services to visitors.

The library's cost structure includes staff costs, equipment amortisation costs, costs of purchasing publications (books, magazines, etc.), costs with on-line newspapers subscriptions and data bases, costs of other faculty services attributed to the library, etc.

Services provided by the library are: loans/circulation services (book loan service to students and teachers), inter-library book loan service, purchasing service (monographs, e-books, data bases and newspapers), the library's website page management (news writing, page monitoring, main events announcements), customer service and user training service.

Four activities can be observed:

Loans: to teachers and students

Customer service: to library users

Training: for users

Inter-library loans: loans and loan requests

Allocating this section's costs to activities may be done using the data labour hours for each activity, i.e., the number of hours each employee spends performing one activity. This seems to present no problem regarding the activity Training, since it is possible to know how many hours are spent in this activity. It might not be as easy for

the other activities. In any case, we believe it is possible to estimate the time employees spend in each of the activities, for example by using time-sheets records.

In so far as cost drivers used for cost assignment are concerned, four different situations are presented:

Because the library has a computerised system that allows knowing how many books are lent each day, month, year, by student, teacher, researcher, and consequently by course or research project, the cost allocation of the activity Loan to cost items can be done based on this data. This means that, if we are taking students into consideration, the allocation will take in account the attended course; in the case of teachers the allocation will be indirect and resort to the functions each teacher performs in the school (teaching, research, board activities, etc.).

Relatively to the activity Training, the cost allocation can be done by keeping records of the students or teachers who attend the training sessions, and then follow the same procedure as for the activity described above.

The Customer service activity should be assigned to cost items based on library users. It would then be necessary to be able to know who consults books in the library. In this way, identifying the students and teachers who use the library's services allows the attribution of its costs to the cost items.

Finance Services:

The finance service encompasses five sections: Accounting, Treasury, Purchasing, Inventory and patrimony, and Finance management office.

In this case, the cost structure includes staff costs for the five sections, equipment amortisation, purchase of goods and services and costs of other faculty services attributed to this service.

The tasks usually performed by this type of service indicate that it is not possible to assign activities which will then allocate costs directly to cost items. This is an auxiliary cost pool. Thus, we can envisage two costing procedures.

The first one, certainly the simplest, resorts to direct allocation, where costs are attributed to cost items in a reasonable proportion: one portion to teaching, a second portion to research and a third portion to services provided to external customers, weights to be defined. Then, the cost attributed to teaching can be allocated to the courses based on the number of students enrolled in each course, the cost attributed to research can be allocated to ongoing research projects and, finally, the cost attributed to services provided to external customers can be allocated to the services provided.

The second one, more complex and which does not guarantee the provision of more accurate information, consists in defining the auxiliary activities that this service performs for the other services in the faculty.

This would be an indirect form of allocating the finance service's costs to cost items, via other services.

Maintenance and Auxiliary Services:

The aim of these services is to assure equipment and facilities maintenance, repair and safety, provide health and safety services, provide the necessary support for the smooth running of lessons and perform telephone operator duties.

The cost structure includes staff costs, equipment amortisation, costs with purchasing of goods and subcontracted services, and costs of other faculty services attributed to this service.

Once again these are services which do not have a direct connection to cost items. It seems to us, then, that allocating its costs can be done in the same manner as was proposed for the Finance services.

Student Assistance Office:

This office carries out responsibilities in the context of international mobility programs, student's academic and professional integration and psychological support. For that purpose, it is divided into two sections, one that promotes students' academic and professional integration and another that manages international mobility programs.

The cost structure encompasses staff costs (namely the psychologists that work in this office), amortisation of equipment and costs of other faculty services attributed to this office.

This office performs four different activities:

International mobility: liaising with other educational institutions, in the context of student exchange and cooperation protocols;

Academic integration: welcoming new students;

Professional integration: managing internships and career advice;

Psychological support: when requested by students.

Allocating costs to the various functions can be based on the proportion of time required by each one of them. This information would be available in time-sheet records.

Cost drivers, which assign costs to cost items, could be as follows:

- International mobility: dividing costs related to this function by the number of students in the programme; the course attended by faculty students in foreign institutions; the course attended in the faculty by students from other institutions;

- Academic integration: number of students per course;

- Professional integration: number of students who reply to job offers;

- Psychological support: the courses attended by the students who request this support.

5. Conclusion

In recent years, universities have been undertaking reforms, affecting both their structure and their management systems. The current tendency is to replace government control with self-management under government supervision. This means that higher education institutions now have the possibility to organise their structure in a way that is more consistent with their specificities, objectives and strategies, towards a model of a greater entrepreneurial inspiration. The need arises to address new concepts which were not as important some years ago, such as markets, customers and products.

This is the reason why it is crucial for these institutions to know in depth what their costs are, which in turn requires the restructuring of their costing models so that managers can take decisions based on objective, reliable and relevant information.

The aim of this work was to develop a cost accounting system that can be applied to higher education institutions. Here we present and discuss a model that allows the attribution of costs (teaching costs and other departmental costs) to cost items present in this kind of institution, such as teaching (undergraduate degrees, master degrees, doctoral degrees, postgraduate courses), research projects and services provided to external customers.

The traditional cost accounting systems do not provide university managers with reliable data about costs and their assignment to cost objects. Due to the decrease in financial resources available to these institutions, universities need to adopt more sophisticated management models and costing systems. This will produce information about costs and allow the identification of profitable and non-profitable courses. It is in this context that we here argue that it is possible to implement a complex model for determining costs, such as the ABC system or a hybrid system influenced by the latter, in the higher education environment.

The present work, by presenting a cost accounting system adaptable to "pen and paper" higher education institutions, argues for a hybrid model. A model similar to the ABC system is advisable for some departments, such as the IT Support Services, Marketing and Communication Office and the Library. The Finance Services and the Maintenance and Auxiliary Services have specific operational characteristics that make it difficult to implement the ABC system, so it would be advisable to use a system closer to the traditional costing models. For the other departments, the Administrative Services and the Student Assistance Office, it seems that both a system similar to the ABC and a traditional system would be applicable. Thus, we present in this work a hybrid model, with strong influence from the ABC system, which includes the concepts of activities and cost

drivers. However, we also recognise that in certain departments this system is not likely to work, the solution being to resort to a cost allocation system similar to the traditional models.

Without any intension of presenting a system adaptable to the majority of the Portuguese higher education institutions, an impossible task due to the specific operational characteristics of each establishment and

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