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# COST/STUDENT APPLICATION MODEL APPLIED TO THE REALITY OF BRAZILIAN PROFESSIONAL AND TECHNOLOGICAL EDUCATION

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## ABSTRACT

This study aimed to present a cost/student calculation model applied to the student body of the Brazilian federal education, science, and technology institutes. The method used was quasi-experimental. As a unit of analysis, the costs of an integrated medium level and superior technology and departmental analysis level understood each course as a different departmental unit. The data were collected together with the campus subunits, Rectory, and government databases, treated with descriptive statistical techniques, whose interpretation was made based on the theoretical arrangement related to activity-based costing. The results showed that the cost per student of the integrated high school course is similar to that determined by the ministry of education procedures but very different from the student's cost in the higher technology course. This model's contribution to the management of federal institutes is to enable a more accurate and precise costing mechanism.



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# INTRODUCTION

All types of organizations (and in this context, higher education institutions are inserted) must abandon the archaic management methods and adopt modern techniques and contemporary management models (Nascimento-e-Silva *et al.,* 2007; Silva *et al.,* 2019; Silva *et al.,*2019; Inácio and Nascimento-e-Silva, 2019; Nascimento-e-Silva *et al.,* 2020; Inácio, Nascimento-e-Silva and Melo, 2020a; Inácio, Nascimento -e- Silva and Melo, 2020b; Nascimento-e-Silva *et al.,* This modernization needs to show as much useful information as possible, so that decision making finds firm foundations on which to lean (Lopes & Rocha, 2010). In this sense, one of the tools used for this purpose is the costing system (Making, 2020; Al-Dhubaibi, 2021; Savić, Vasiljević, &Milojević, 2020). Modern costing systems aim to manage resources efficiently. It is through the analysis of information provided by these systems that administrators make their decisions. Analyzing how to allocate service department costs can directly impact company decisions; however, to extract this information's best use, it is necessary to formulate exact measurement functions

(Demski&Feltham, 1976). Costing is one of the most efficient ways to have information about the financial efforts spent on the manufacture, transformation, or commercialization of the products and services that the company works for. Also, it provides data that enable the correction of eventual distortions that may happen. It is through identifying the origin of such facts that management seeks solutions and corrections. For Mauad and Pamplona (2002), the costing system is nothing more than the cost appropriation method. Different types of costs are used to measure the real cost of a product: different types of accumulation techniques. Among the most used by companies are absorption costing, direct costing, standard costing, target costing, departmental costing, and activity-based costing. It is worth mentioning that the only one accepted by Brazilian accounting legislation and principles is absorption costing. However, nothing prevents companies from using other parallel systems for management purposes. The cost accumulation system is a system that processes, organizes, analyzes, and produces information for different management levels of companies (Leone, 1996; Greenberg and Wilner, 2015). Entity costs observe determined behaviors according to the parameters with which they relate. Costs arise in activities according to volume. Such volumes are measured by quantitative, physical parameters, called operational parameters (Leone, 1996). In the Brazilian scenario, two costing models are predominant, the one made by absorption, widely used because it is the only one that meets the fiscal requirements (Pinto, Silva and Freire, 2007), and the activity-based one, the focus of this study.

Absorption costing is characterized by the division of costs between direct and indirect, following the principle of accounting competence (Nowak *et al.,* 2019; Freitas *et al.,* 2019). Brazilian income tax legislation clearly states the absorption cost requirement, following article 290 of Decree no. 3,000. The division of costs characterizes this costing into three specific parts: which are direct labor, that employed directly in the production of the good or service; direct material, measured in the production of the good or service; and general manufacturing costs or indirect manufacturing costs, costs that do not participate directly in the manufacture of the good or service, such as the cost of cleaning the factory floor. The basic premise of absorption costing is to divide the costs of expenses by separating and classifying activities into productive and administrative activities. This way, it appropriates direct costs to products and services and prorates indirect costs through arbitrated methods. Expenses are taken directly to the results for the period in which they were incurred, decreasing its gross operating result. For Freitas et al. (2009), the main point of absorption costing is in the apportionment of indirect costs. It can make the result misleading due to the high burden of subjectivity. Absorption costing is the only one accepted by the tax authorities because this costing store costs in inventories. This fact increases the operating result, which results in more significant profit to be taxed by the government, generating a more significant collection of taxes and contributions. Hence the government's imposition about absorption costing. Despite not being accepted by the tax authorities, activity-based costing is an excellent weapon for companies. Its managerial use provides the necessary information for decision-making on the continuity of products and activities aimed at manufacturing (Hatim et al., 2020; Mehta and Bhojwani, 2020). Costa Filho (2002) defines activity costing as founded on the activities developed in the company. This cost is not that new. Some authors report its use by accountants in the 1800s (Wernke, 2005). However, it has become more used in recent decades due to providing more reliable management information, as shown by Khoury and Ancelevicz (2000).

Activity-based costing proposes to divide the organization into different types of activities. For this method, it is the activities that generate the costs. Thus, management is concerned with eliminating unnecessary activities in production. After that, it is necessary to demonstrate the results obtained by the processes (activities). Almeida *et al.* (2008) consider this technique a way of fragmenting the organization into activities. The main difference from the activity-based costing system to the others is indirect costs. While others often use mistaken methods to distribute indirect costs, activity-based allocates all costs to activities and only uses drivers to allocate activities to products or services. The allocation of expenses using activity costing is done in two stages: the first consists of allocating expenses to activities; the second is the allocation of activities to the product (Bezerra *et al.,* 2007). It is necessary to use spending drivers to allocate spending to activities (Zamrud and Abu, 2020; Zaini, Zheng and Abu, 2020; Raveendran *et al.,* 2020). The drivers are methods chosen according to the type of activity to accumulate expenses to activities. For Munaretto and Diedrich (2007, p. 74),"the drivers of resources (costs) are classified according to the characteristics of each company. They make it possible to assign monetary amounts of expenditure to activities". An example of this is the allocation of expenditure on electricity within a factory. You can choose several drivers for this, depending on the type of factory, such as the number of consumption points per activity and hours of operation of the machines. Choose the driver that is closest to real consumption.

In addition to spending drivers, there is also the direct allocation of costs to activities. This way is defined by Munaretto and Diedrich (2007, p. 75) when there are clear, direct, and objective identifications of the consumption of costs with a particular activity. It is an example of welding consumption, which is allocated directly to welding activity. After the expenses are distributed to the activities, it is possible to analyze which activities consume the most expenses and the reasons for that consumption. Then comes the direction of activities to products or services. In this procedure, activity drivers are used to triggering activities in the production of products or services. Activity drivers are the determinants of the occurrence of organizational processes (Taschner and Charifzadeh, 2020; Zhang, Mamazi and Isa, 2017). Only simple mathematical calculations are necessary to complete the process of calculating costs by activities. It is verified how much the products cost by dividing the accumulated value of the activities by the total produced through them. The allocation of expenses to activities reduces the distortions caused by arbitrariness in allocating indirect manufacturing costs. According to Azevedo *et al.* (2006), this arbitrariness is no longer accepted in the current market, as indirect manufacturing costs have increased due to the advent of new technology and techniques. That is why Brasil (2004) describes activity costing as the tool that contemplates changes in the cost structure arising from the technological evolution of fixed assets. This method states that activities are the cause of the cost and not the products or services. Products and services consume activities. Thus, it is possible to analyze whether an activity is being underutilized, generating unnecessary costs, because it is the activities that cause the costs (Khoury and Ancelevicz, 2000).

It is possible to state that activity costing is efficient in managing production. Itcan point out waste by identifying the most significant production idleness activities, causing unnecessary cost (López-Mejía, Gomez-Martinez and Marin-Hernandez, 2011). This costing allows companies to evaluate their production activities to eliminate those that add value to their products. For Cunha, Haussmann &Grieshaber (2009), this costing is beneficial because it improves the quality of cost information and allows its visualization from the inside of organizational activities related to costs. For Beuren and Roedel (2002, p. 8), this costing has the following purpose: "it is based on the analysis of the significant activities developed in the company, with a view to the more careful attribution of indirect expenses, its more effective control, and better support to the decision-making process."
The main negative point of the activity-based costing system is the high cost of implementation. As it is a robust tool that provides a lot of managerial information, the investment is substantial to be implemented, considering that in addition to the purchase of the necessary software, there is also the need to train employees. The second negative point concerns the employees' commitment. It is difficult for an employee to get out of his comfort zone and do new things. There is resistance from people to new methodologies. Another relevant factor, but not so harmful, is the error in the methodology of cost drivers. It occurs when many different activities are grouped, and few cost drivers are used. These errors can be divided into three types, according to Khoury and Ancelevicz (2000),

according to the nature of their causes: aggregation, specification, and measurement. The mapping of productive activities within the government (either federal, state, or municipal) would make activity costing a handy tool for decision making because it would eliminate activities that do not benefit society and encourage those who contribute the most to the community. The great challenge of implementing this funding is that activities in the public sector are very generic (Machado and Holanda, 2010). It must be said that to be implemented, we would have to train a large number of servers. In addition to very high expenditures on information technology, it would be necessary to develop a flexible system and accept each government agency's characteristics. The cost analysis in the public sector seeks only the control function. Through cost analysis, the public manager will find parameters to make decisions about the correct application of resources and assist in the preparation of annual budgets. Regarding the analysis and the relevant functions of costs, Martins (2003) states that they help in the control, decision making, control with data supply for the creation of operational parameters, decision, monitoring of the executed and comparison with the existing parameters to verify its performance (Alonso, 1999).

The manager will compare similar institutions and identify the differences between them with the knowledge of how the costs are formed in a given public service offered to the population. Analyzing the differences, you can know which one is being more efficient in applying public resources and making corrections and changes that seek better application. According to Alonso (1999, p. 40), "if the management models do not have information systems that assess present performance and point to future performance trends, then the reform is unlikely to be successful." It is also necessary to take into account the regional differences of each institution.As it is not possible, for example, to require that an institution located in the municipality of São Gabriel da Cachoeira, in the far interior of the Amazon region, spend the same amount on current expenses that a similar institution in São Paulo, a Brazilian megalopolis. It is known that inputs are more expensive in São Gabriel da Cachoeira because they are subject to a higher value of freight and insurance than in the capital of São Paulo. In this sense, this study aimed to present a costing model for students of two courses at Campus Manaus Zona Leste (CMZL) of the Federal Institute of Education, Science, and Technology of Amazonas (IFAM).

# MATERIALS AND METHODS

The research used the case study as a method. It is exploratory research that used accounting techniques to calculate costs, formulate, analyze, and explain the student's cost in two courses at the Campus Manaus Zona Leste of IFAM in 2014. There was a unit of analysis of administrative costs and operational aspects of these two courses to generate explanations about the cost/student of each course, configuring the level of departmental analysis, according to Nascimento-e-Silva (2012; 2020a; 2020b) and Silva (2020) guidelines In this study, the cost/student was defined using the activity costing method, proposing a calculation and analysis model. Because of the research problem, Yin (2001, p. 26) states that "this approach would also be an acceptable way to answer the questions of" how "and" why "but it would be different from the study carried out from a survey."It means that it is acceptable to classify the research as a case study despite having survey characteristics. In fact, in the case study, there is the possibility of an experiment. In the case of this work, the experiment was the proposal for a cost calculation model. The main reason for this research is to propose a cost/student calculation model applied to CMZL. Thus, it is classified as explanatory research, since it aims to clarify the determination of cost/student using costing methods and pointing out its main components. The research was carried out in three stages. The first was data collection. The second was the data analysis, with the separation and classification in groups. Subsequently, the activities that consume resources on the study campus were surveyed. After this analysis, the cost calculation model was presented. Excel software was also used to calculate costs and indices. The third stage was presenting the cost/student model, with due consideration about students' cost in the courses studied for the year 2014. The samples used were the number of students enrolled in the courses at Campus Manaus Zona Leste at IFAM in 2014 and the budgetary data on budget execution in the period studied through the Federal Government's Integrated Financial Administration System (SIAFI). The research was operationalized through data collection with the provincial offices of administration (PROAD), Teaching (PROEN), Personnel Department, Department of administration, and campus planning (DAP / CMZL) of the Federal Institute of Education, Science, and Technology from Amazonas. The data were extracted using the SIAFI data extractor and upon request when dealing with academic data. Personnel data were extracted from the Federal Government's Integrated Human Resources Management System (SIAPE) and the transparency portal. The collected data were treated with cost accounting techniques to separate the Manaus Zone Zone Zona Leste activities, being classified as middle or end activities. Financial data were treated with Excel software. Based on the classifications of activities, cost drivers have been implemented to determine all the expenses involved in the execution of activities allocate all expenses to activities. After determining all the expenses incurred in the activities, the activity drivers were implemented. For this treatment, basic cost knowledge, in addition to production management knowledge, was used to analyze the results obtained. Descriptive statistical methods validated the results. Data collection was carried out, and later the critique of this data. It allowed demonstrating that the government's cost value is not analytical enough for decision-making since such calculations should be simple since the data is censored.

# ANALYSIS AND DISCUSSION OF RESULTS

The activities were divided according to the sequence of operations to facilitate the application of the student cost calculation model on the campus of the researched institution. In the end, the general outline of the proposed model is presented.

***Resource Consuming Units:*** For ABC costing, one of the first steps to be defined is the definition of operational activities. As all entities have activities that consume resources, they must be classified into direct or indirect activities. There were numerous activities and also many sub-activities on the campus. Only the activities were taken into account to calculate costs, suppressing numerous sub-activities, as is the general coordination of human resources, which has two sub-activities; however, the main activity is human resources prevailed. There are seven direct activities in the organization chart; these activities are the courses' coordinations, which despite being a total of nine, can be summed up to seven coordinations. Subsequent evening courses have only one coordination.

Indirect activities amount to 30, of which 15 are allocated to the Department of Educational Development (DDE), 11 are linked to the Department of Administration and Planning (DAP), and 4 to the campus's General Directorate. As it is an educational institution, the final activities are allocated to the Department of Educational Development (DDE). Activities are sort of divided into other sectors. However, an activity is performed, which is not in the organization chart, which is the Rectory activity, which provides advisory services despite not being part of the organization chart. Through its Pro-Rectories, the Rectorate provides services for the execution of various activities, from academic to administrative. The Rectorate activities are activities considered indirect, and the consumption of resources from these activities must be taken into account in the formation of costs per student at CMZL. However, it cannot be done directly, as other campuses also consume activities of the Rectory.

***Number of Enrolled Students:*** In 2014, CMZL ended the school year with 797 students active in regular classroom courses, courses that

belong to the campus. Pronatec students are not included in this count, as they are extra enrollments and have their budget for carrying out their activities. Distance learning students are also not included, as this is another teaching modality. Checking the vacancies offered by Campus Manaus Zona Leste, it was found that 396 vacancies are offered annually for the entry of new students in the institution and that the total number of enrollments should be 984. Integrated courses have three enrollment cycles, as they correspond to high school; in subsequent courses, because they are modular for 12 or 18 months, there are enrollments for periods. In the case of CMZL, the subsequent courses have two to three periods, the only one with two periods being the Secretariat. The rest have three periods. For higher education courses, enrollment cycles depend on the number of periods the course has; in higher education in agroecology for seven periods or four years. In the veterinary course, there was only one cycle due to the course having started in 2014. It was possible to verify that the average number of canceled registrations was 19.00%. There were negative numbers in enrollments' evolution, relative to students who repeated their grades and therefore are outside the ideal enrollment cycle. For this reason, the student will not be able to repeat each failed subject more than once, under penalty of termination from the course. Inserted as active enrollments are also locking courses, which can be requested up to two consecutive times or interspersed, but you cannot ask for locking twice in the same discipline. In the course under study, Technology in Agroecology, 36 enrollments were canceled, corresponding to 32.14% of the total enrollments ideal for the course. In 2014, of the total of 76 enrollments that ended the school year, only seven students completed the course, out of the initial 81. Thus, only 69 students, or 85.19% had active enrollments, which is a sufficient number; however, if we analyze the exits, only 7 (8.64% of the total) must be speculated that not all active enrollments are attending or periodized. In an ideal situation, 28 students would be trained in the period; however, only 7 or 25% were formed. There was a loss of 75% of students during the course. In the year surveyed (2014), as it is clear that dismissal and dropouts are minorities, about 6%, it is deduced that a large part is paying for material that failed or locked the course.

***Allocation of Direct Costs in the Technology Course in Agroecology***

Most of the direct costs of entities that provide services are allocated to the payment of labor. In educational institutions, the main expense is the teacher's class time. It is one of the few expenses that can be allocated directly. As they have a mission to promote Technical and Technological education, the Federal Institutes of Education have a structure with high school and higher education, where teachers often teach classes at both levels. At CMZL, unlike federal universities, some professors teach at both the high and high levels. Hence, there is a small difficulty in directing spending on these teachers. Usually, at universities, professors are located in the departments of each course. At CMZL, teachers are assigned only to the Department of Educational Development (DDE), making it difficult to determine the costs directly consumed by campus courses. To obtain the value of class hours of teachers who taught in 2014 in the course under analysis, we had to create a spreadsheet with each teacher's schedules who taught discipline in the course. After feeding the spreadsheet, we obtained the total hours worked by each teacher. Then, we divide the amount of the expense with salary and social charges proportionally for each course. It is worth remembering that filling out this spreadsheet depended on the Department of Educational Development (DDE) information and its coordinators. Only these units have the timetable for each course. This fact was configured as a possible problem due to the lack of easily accessible public information. After filling the table with schedules, it was necessary to make one with the values because the values per course were allocated according to the class hours. A simple calculation divided: the total hours per course were divided by the total hours taught by each teacher; subsequently, the result was multiplied by the annual expenditure on salaries and social charges. Let us look at the calculation made for the allocation of teachers' class hours taught per course.

$$VAAC = \frac{CHC}{CHT} \times VGAD$$

Where:
VAAC: Amount allocated to the course
CHC: Workload taught by the teacher in the course
CHT: Total workload taught by the teacher
VGAD: Value of the annual expense with the teacher

Example: Professor 1, in Technology in Agroecology course, taught 4 hours in technology in agroecology and 12 hours in total. The annual expense with salary and social charges was R $ 98,386.88, therefore:
VAAC = 4 /12x 98.386,88
VAAC = 32.795,63

All expenses were allocated to him when the teacher teaches classes in a single Course. The values were allocated proportionally to the consumption of hours for each course. This calculation did not consider the hours dedicated to research and extension since there is no report on the activities. A supplementary report is required in federal institutes, indicating which course the research or extension project is linked to it. If the research and extension reports and the class hours of each teacher were aggregated, we would measure spending more precisely. We located the teachers who taught the class and verified who traveled during the period. Based on class hours, expenses were directed. Only expenses with teachers followed the division made by class hour. Technician expenses, as they are indirect expenses, were allocated to the activities related to them. As all teachers are assigned to the coordination, the amount calculated for the coordination was not apportioned as an indirect cost; as we have seen, we had to make the proportional division, according to each teacher's class hours, and allocate them as a direct cost. Daily expenses in the period were R $ 97,282.55. Of this expense, R $ 19,874.90 was used for the payment of daily fees to teachers who taught classes for the course under analysis, of which R $ 7,382.41 was directly allocated to Agroecology. Ticket expenses followed the same reasoning as daily rates, with direct consumption for the course amounting to R $ 6,246.53. The ticket price was slightly less than the daily rate. The explanation is that there are trips where the server only receives daily allowances since his travel is done in an official vehicle. Scholarship spending was the third largest expense in the other current expenses, corresponding to R $ 714,911.67 or 15.48% of the total costing resources destined to the campus. Although the cost of assistance is very relevant, there is no way to decrease it. This expense is intended to maintain students at school and defray transportation, food, and school supplies for students with low family income. For the technology in agroecology course, the annual expense for scholarships was R $ 68,805.00 and managed to contemplate 34 students enrolled in 2014. The expense was allocated to the course because of the names of the enrolled students provided by SISTEC. It was a scholarship like expense 339018.

***Allocation of Expenses to Activities:*** The expenses incurred by the campus were R$ 4,618,716.34. However, not all types of expenses should be allocated to activities. Take the case of the amount of R$ 18,887.61, like expense 339008. Verifying via the Federal Government's Financial Administration System (SIAFI 2014), this nature corresponds to the payment of funeral assistance to retired civil servants. Therefore, there is no way to allocate this expense, considering that retired employees are not full in any sector. Therefore, this expense was excluded from the calculation. The expense nature 339092 was also excluded from the cost calculation. This nature refers to expenses incurred in the previous year. Despite being paid in 2014, they occurred earlier. And by the principle of accounting competence, they should be excluded from the cost calculation. Natures 339036 and 339147 were also excluded. They used to pay external Pronatec teachers due to the lack of resources at the end of 2014. Spending was directed to each activity carried out within the CMZL. The first allocation was for salaries, daily allowances, student assistance, and tickets, allocated directly. After the allocation of direct costs, it was necessary to allocate the costs of activities. From this calculation, R $ 531,630.00 referring to student assistance were excluded. This expense must be allocated directly to each course, according to the students benefited. As the focus of the work is the Technology course in agroecology, a survey was made

only of the students of this course, which has many beneficiaries. In consultation with SIAFI, student assistance values targeted to specific sectors were identified, such as research and extension grants. These amounts were directed to the research and extension coordinators, as they are expenses related to projects carried out by these activities. For other expenses, drivers were used according to their nature. Spending drivers are criteria used to allocate spending to activities. In IFAM, the most usual is the number of students in each course, considering that the student is the product of teaching.Table 1 shows the amounts of CMZL indirect expenses allocated to activities. Included are expenses with per diem and passage of administrative-technical personnel allocated directly to the sectors (activities) according to capacity.

**Table 1: Activities with indirect amounts allocated**

| Activity | Amounts |
|---|---|
| EducationalDevelopmentDepartment | 68,705.59 |
| Veterinary medicine coordination | 65,520.12 |
| Forest tec coordination | 250,079.87 |
| Coordination tec agropecuaria | 138,680.90 |
| Higheragroecologycoordination | 259,715.52 |
| Tec agroecology / landscapingcoordination | 43,071.90 |
| SchoolRegSection | 66,632.68 |
| Library section | 249,677.18 |
| Leisuresportssection | 107,027.07 |
| Coordinationoffisheriesresources | 30,101.51 |
| Coordinationofeveningcourses | 54,716.97 |
| Researchcoordination | 67,911.50 |
| Extensioncoordination | 64,404.34 |
| General training coordination | 11,945.69 |
| School / communityintegrationcoordination | 17,368.39 |
| | - |
| Entrepreneurshipcoordination | 41,108.17 |
| General teachingcoordination | 1,282,143.59 |
| General productioncoordination | 86,255.03 |
| General coordination of assistance to students | 261,617.46 |
| Coordinationof animal production, | 259,938.31 |
| Educationalguidancesection | 18,621.82 |
| Secretaryofeveningcourses | 31,960.76 |
| | - |
| Administrationand Planning Department | 50,671.43 |
| Maintenanceandlogisticscoordination | 34,640.13 |
| Transportandsurveillance sector | 26,052.74 |
| Informationtechnologyindustry | 18,951.15 |
| Planning coordination | 11,672.21 |
| General coordination of human resources | 52,198.94 |
| General coordination of administration and finance | 56,194.21 |
| Protocol sector | 8,685.24 |
| Heritage sector | 51,045.49 |
| Warehouse sector | 41,189.26 |
| Purchasingandbidding sector | 45,421.07 |
| | - |
| ManagingDirector | 37,921.02 |
| Cabinet | 41,204.25 |
| Health care | 26,331.62 |
| Civil andenvironmentalengineering | 29,919.06 |
| Total | 4,009,302.20 |

Source: data collected by the authors.

The amount shown in table 1 includes the withdrawal of costs that can be allocated directly to each end activity. The total amount was R$ 4,618,716.34. From this, R$ 36,564.60 was withdrawn. From this difference, daily and tickets' value was removed, which was allocated to the General Teaching Coordination (CGE), as this value refers to teachers, and expenses with teachers should be distributed and allocated directly. The result of the previous subtractions was R$ 4,540,932.20. From this amount, the student assistance amount, directly allocated, was R$ 531,630.00. Therefore, the number of indirect expenses with activities was R$ 4,009,302.20. As with all campus activities, IFAM's Rectorate should also be allocated to Campi courses. For this, we separated them by activities and subsequently allocated them to each activity on IFAM's campuses.The pro-rectories and the rector's office were taken into account for the activities, considering that each of these sectors has a final activity according to its specificity. The drivers were framed to the activities according to the characteristic of the activity.Proad's director, for example, percentage of the executed budget is due to the Pro-rectory working on administrative matters that most often culminates in the execution of the budget. Therefore, the greater the budget execution by the campus, the greater the amount allocated to Proad. The other pro-rectors followed the same reasoning. As we can see, the amount of the Rectorate allocated to the CMZL courses was R$ 1,870,716.13 as an administrative activity.

***Allocation of Medium Activities:*** We divided the core activities into seven, identified as course coordinates. There are 11 courses on campus. However, there are only seven coordinations. The explanation is that coordinators are responsible for more than one course, as are the cases of agriculture and night courses (this responds alone for the courses of Secretariat, Computer technician and Maintenance and support in computer science EJA). The first step was to define the allocation of activities to the cost drivers.It was done for each activity. Even though there are 30 half activities, the drivers can be smaller since they can be used for more than one activity. The division was divided into two blocks, the administrative activities, and academic activities blocks. In the administrative activities block, the corresponding value was apportioned to the Rectory. Administrative activities have no connection with the student's education but are activities necessary for the campus's functioning. It is the case of the procurement and bidding sector, which, despite being extremely important for the institution's functioning, does not connect with the training of students. This activity provides the acquisition of materials and services used in classes by the teacher or the student. Academic activities are those that participate indirectly in the training of students. They are activities that are used by teachers and students for professional training. It is an example of the library used by teachers and students to carry out research. The expenses of administrative activities were allocated as shown in table 2. Then they were apportioned by the courses.

**Table 2: Total expenditure on administrative activities**

| Activity | Personal | Costing | Total |
|---|---|---|---|
| Administration and Planning Department | 375,641.07 | 50,671.43 | 426,312.50 |
| Maintenance and logistics coordination | 225,062.69 | 34,640.13 | 259,702.82 |
| Transport and surveillance sector | 100,665.87 | 26,052.74 | 126,718.60 |
| Information technology industry | 293,720.18 | 18,951.15 | 312,671.32 |
| Planning coordination | 71,727.77 | 11,672.21 | 83,399.98 |
| General coordination of human resources | 381,997.47 | 52,198.94 | 434,196.41 |
| General coordination of administration and finance | 317,351.47 | 56,194.21 | 373,545.68 |
| Protocol sector | 85,284.64 | 8,685.24 | 93,969.88 |
| Heritage sector | 106,217.75 | 51,045.49 | 157,263.24 |
| Warehouse sector | 169,715.47 | 41,189.26 | 210,904.73 |
| Purchasing and bidding sector | 241,289.42 | 45,421.07 | 286,710.49 |
| ManagingDirector | 310,430.29 | 37,921.02 | 348,351.30 |
| Cabinet | 249,367.59 | 41,204.25 | 290,571.84 |
| Health care | 278,300.52 | 26,331.62 | 304,632.14 |
| Civil environmental engineering | 184,233.27 | 29,919.06 | 214,152.33 |
| Total | 3,391,005.45 | 532,097.81 | 3,923,103.26 |

Source: data collected by the authors.

The direction of academic activities followed the same parameters as administrative activities, except drivers, as there are academic activities exclusive to courses at a particular time. An example is the case of animal production coordination, only during the day. There is

also the case of sectors that operate only at night. Then the values were apportioned by the courses. Table 3 shows the total values of academic activities.

**Table 3: Total spending on academic activities**

| Activity | Personal | Costing | Total |
|---|---|---|---|
| Educational Development Department | 345,171.63 | 68,705.59 | 413,877.22 |
| School Reg Section | 229,496.91 | 66,632.68 | 296,129.59 |
| Library section | 436,011.34 | 249,677.18 | 685,688.52 |
| Leisure sports section | 753,067.42 | 107,027.07 | 860,094.48 |
| Research coordination | 181,391.65 | 67,911.50 | 249,303.15 |
| Extension coordination | 146,155.63 | 64,404.34 | 210,559.97 |
| General training coordination | 155,844.47 | 11,945.69 | 167,790.16 |
| School / community integration coordination | 92,168.77 | 17,368.39 | 109,537.17 |
| Entrepreneurship coordination | 166,907.91 | 41,108.17 | 208,016.08 |
| General teaching coordination | 495,949.47 | 1,282,143.59 | 1,778,093.06 |
| General production coordination | 843,925.85 | 86,255.03 | 930,180.88 |
| General coordination of assistance to students | 364,206.75 | 261,617.46 | 625,824.21 |
| Animal production coordination | 159,871.71 | 259,938.31 | 419,810.02 |
| Educational guidance section | 138,676.10 | 18,621.82 | 157,297.92 |
| Secretary of evening courses | 54,184.69 | 31,960.76 | 86,145.44 |
| Total | 4,563,030.28 | 2,635,317.60 | 7,198,347.88 |

Source: data collected by the authors.

Following these principles, the cost per student was calculated. The student of the higher education course in agroecology cost CMZL the amount of R$ 42,426.00, according to the methodology for calculating ABC costs. The direct cost and indirect cost ratio was 58.93% and 41.07%, respectively, as shown in table 4, in nominal and percentage values.

**Table 4: Cost of the student of the Higher Course in Agroecology**

| Total Costs | 3,222,956.83 | 100% |
|---|---|---|
| Direct costs | 1,898,843.84 | 58.92% |
| Class hours Prof, | 1,816,409.91 | 56.36% |
| Daily and tickets | 13,628.93 | 0.42% |
| Financial assistance | 68,805.00 | 2.13% |
| Indirectcosts | 1,324,112.99 | 41.08% |
| Academicactivities | 771,628.33 | 23.94% |
| Administrativeactivities | 552,484.66 | 17.14% |
| Numberofstudentsenrolled | 76 | |
| Student cost | 42,407.33 | |

Source: data collected by the authors.

***Comparisons of Methods:*** After calculating the agroecology student's cost, we calculated the cost of the student in the integrated agricultural technical course. The calculation was necessary to compare the values and validate the method. The integrated agricultural technical course is of medium level and takes place during the day. There are two types of training in it, General training, which comprises high school training, and technical training. Table 5 shows how the hours of teachers who taught subjects in the courses were distributed.Table 6 was prepared based on table 5, and it shows the salary distribution according to each teacher's teaching hours for both courses. The daily expenses were R$ 6,536.85 for the course. The ticket price followed the same method and was R$ 5,428.09, as shown in table 8. The last direct expense was spent on student assistance grants. In the agricultural course, 141 students received scholarships, resulting in an amount of R $ 168,123.18 annually. After a survey of direct expenditures, a survey was made of indirect expenditures, calculated for and prorated for technical coordination in agriculture and livestock. The expenses with students of the subsequent course were separated, which were 52, and the integrated, which were 182. The separation was made by proportion: 22% of the indirect expenses were allocated to the subsequent course, and 78% to the integrated course. Thus, the student's annual cost of the technical course in integrated agriculture was R $ 30,099.85, as shown in table 9.

**Table 5: Class hours of teachers in the Agricultural Technician course**

| Teacher | Agriculture and Livestock Technician | Technology in Agroecology | Teacher | Agriculture and Livestock Technician | Technology in Agroecology |
|---|---|---|---|---|---|
| 1 | 4 | 4 | 20 | 4 | 2 |
| 2 | 12 | 4 | 21 | 4 | 2 |
| 3 | 4 | 6 | 22 | 6 | |
| 4 | 4 | 4 | 23 | 8 | |
| 5 | 8 | 6 | 24 | 6 | |
| 6 | 4 | 1 | 25 | 6 | |
| 7 | 8 | 2 | 26 | 6 | |
| 8 | 4 | 4 | 27 | 2 | |
| 9 | 4 | 4 | 28 | 6 | |
| 10 | 4 | | 29 | 8 | |
| 11 | 4 | | 30 | 6 | |
| 12 | 4 | | 31 | 6 | |
| 13 | 4 | | 32 | 8 | |
| 14 | 8 | | 33 | 7 | |
| 15 | 6 | | 34 | 4 | |
| 16 | 6 | | 35 | 4 | |
| 17 | 2 | | 36 | 6 | |
| 18 | 2 | | 37 | 4 | |
| 19 | 4 | | 38 | 6 | |

Source: data collected by the authors.

**Table 6: Allocation of costs of hours/classes of teachers of the courses analyzed**

| Teacher | Agriculture and Livestock Technician | Technology in Agroecology | Teacher | Agriculture and Livestock Technician | Technology in Agroecology |
|---|---|---|---|---|---|
| 1 | 32,795.63 | 32,795.63 | 20 | 61,499.75 | 30,749.87 |
| 2 | 155,688.39 | 51,896.13 | 21 | 36,278.33 | 18,139.17 |
| 3 | 51,432.55 | 77,148.83 | 22 | 21,699.13 | |
| 4 | 123,938.68 | 123,938.68 | 23 | 83,676.74 | |
| 5 | 53,220.88 | 39,915.66 | 24 | 33,083.83 | |
| 6 | 29,745.97 | 74,364.93 | 25 | 80,128.17 | |
| 7 | 62,003.95 | 15,500.99 | 26 | 46,734.55 | |
| 8 | 36,772.75 | 36,772.75 | 27 | 42,965.17 | |
| 9 | 116,684.41 | 116,684.41 | 28 | 37,717.50 | |
| 10 | 26,633.62 | | 29 | 80,017.14 | |
| 11 | 19,646.24 | | 30 | 29,469.37 | |
| 12 | 32,542.78 | | 31 | 64,649.19 | |
| 13 | 68,610.62 | | 32 | 48,417.95 | |
| 14 | 53,655.71 | | 33 | 50,889.08 | |
| 15 | 46,985.98 | | 34 | 53,384.77 | |
| 16 | 98,894.45 | | 35 | 36,896.65 | |
| 17 | 33,778.49 | | 36 | 43,266.62 | |
| 18 | 15,361.46 | | 37 | 59,776.75 | |
| 19 | 76,400.17 | | 38 | 81,839.88 | |
| | | | **Total** | **2,127,183.30** | **617,907.5** |

Source: data collected by the authors

Wages and daily costs were added to wages, as shown in table 7, always following the same apportionment method.

**Table 7: Expenses with daily rates of the courses analyzed**

| Teacher | Agriculture and Livestock Technician | Technology in Agroecology |
|---|---|---|
| 2 | 337.91 | 112.64 |
| 3 | 1,060.31 | 1,590.47 |
| 4 | 1,407.15 | 1,407.15 |
| 8 | 872.57 | 872.57 |
| 12 | 112.10 | - |
| 21 | 735.14 | 367.57 |
| 24 | 398.25 | - |
| 31 | 486.75 | - |
| 33 | 905.42 | - |
| 36 | 221.25 | - |
| **Total** | **6,536.85** | **4,350.40** |

Source: data collected by the authors,

As can be seen, the variation in the value of the courses was 40.89%. Comparing the agricultural student's valuesabout agroecology, the calculation of this variation was made as follows, as shown in table 10. In general, the cost of the student at Campus Manaus Zona Leste is high. However, as it is an agricultural unit, this is a somewhat reasonable cost, as the structure to maintain courses of this type needs to be reliable and robust. Also, personnel and social charges are very high.

**Table 8: Expenses with passages of the analyzed courses**

| Teacher | Agriculture and Livestock Technician | Technology in Agroecology |
|---|---|---|
| 2 | 125,45 | 41,82 |
| 3 | 906,88 | 1,360,32 |
| 4 | 1,289,47 | 1,289,47 |
| 7 | 1,103,67 | 1,103,67 |
| 8 | 397,62 | - |
| 12 | 815,00 | 407,50 |
| 14 | 495,00 | - |
| 20 | 295,00 | - |
| **Total** | **5,428,09** | **4202,78** |

Source: data collected by the authors.

**Table 9: Cost of the student of the integrated technical course in agriculture and livestock**

| | | |
|---|---|---|
| **Total Costs** | **5,478,173.58** | **100%** |
| **Direct costs** | **2,307,271.44** | **42.12%** |
| Teachers' class hours | 2,127,183.30 | 38.83% |
| Daily and tickets | 11,964.95 | 0.22% |
| Financial assistance | 168,123.18 | 3.07% |
| **Indirectcosts** | **3,170,902.15** | **57.88%** |
| Academicactivities | 1,847,846.78 | 33.73% |
| Administrativeactivities | 1,323,055.37 | 24.15% |
| Numberofstudentsenrolled | 182 | |
| Studentcost | 30,099.5 | |

Source: data collected by the authors,

**Table 10: Variation between the analyzed courses**

| Courses | Values |
|---|---|
| Agroecology | 42,407.33 |
| Agriculture | 30,099.85 |
| Variation | ((Course1 - Course2)/Course2)*100 |
| Variation: | 40.89 |

Source: elaboratedby the authors.

***Comparison of costs calculated with the federal government calculation:*** After calculating the costs using the activity-based method, a survey was made of the Federal Government's method, called current expenditure per student. The calculation proposed by the Brazilian Ministry of Education for the current cost of students is made using the formula: C = ( TF) / M, according to Morgan (2004, p, 62), being

C = Student cost
T = Total resources of the Brazilian treasury destined to federal institutions
F = Investments - Precatories - Inactive / Pensioners
M = Total students enrolled

Because the calculation is simple, the statement can be calculated as follows:

T = 4,618,716.34 (current expenses) + 17,561,412.29 (personnel expenses) + 1,870,716.13 (portion of the rectory)
F = 0
M = 797

Thus, according to the calculation proposed by the Brazilian Ministry of Education, the value of current expenditure per student at CMZL was R $ 30,176.72. Table 11 shows that the value of current expenditure on students is very similar to the value of expenditure found for the technical course in integrated agriculture and livestock.

**Table 11: Currentexpenditure x costcomparison**

| Course | Values |
|---|---|
| Agriculture: | 30,099.85 |
| Currentexpenditure: | 30,176.72 |
| Variation: | ((Course1 - currentexpenditure) / currentexpenditure) * 100 |
| Variation: | -0.25% |

Source: Elaborated by the authors.

The technical course cost in agriculture was 0.25% less than the current expenditure on students in 2014. Concerning the higher technology course in agroecology, the values were far, as shown in table 12.

**Table 12: Current expenditure x Cost of agroecology student**

| Course | Values |
|---|---|
| Agriculture: | 42,407.33 |
| Currentexpenditure: | 30,176.72 |
| Variation: | ((Course1 - Course2)/Course2)*100 |
| Variation: | 40.53% |

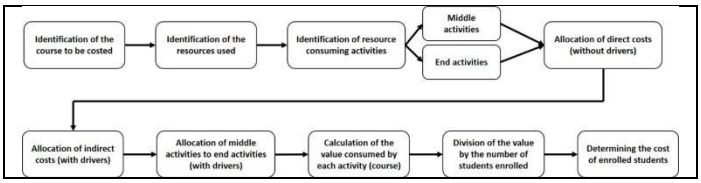
Source: Elaborated by the authors,

Because of these comparisons and the findings of this study, it is speculated that the Higher Technology Course in Agroecology is above the cost standard of Campus Manaus Zona Leste. However, it is essential to remember that the numbers of students enrolled in distance learning were not taken into account, as teachers who teach classes in this type of activity receive separate remuneration (in the form of scholarships).

## Summary of the model presented

The model constructed and presented in this study calculates the cost/student at the Campus Manaus Zona Leste side of the Federal Institute of Education, Science and Technology of Amazonas, Brazil, and can be summarized as shown in figure 1.

**Figure 1: Flowchart of the cost calculation of the proposed model**




Source: Elaborated by the authors,

The calculation of costs proposed in this model takes place in 9 steps, the first being the identification of the course to be funded, that is, the object's choice. The second step is the separation of the resources used, surveying the period's values. The third step is identifying resource-consuming activities; this step is essential for determining costs since we will know where to allocate resources from it. The allocation of direct costs is the fourth step. This step in the IFAM Campus Manaus Zona Leste case is the allocation of costs with teachers, scholarships, per diems, and teacher tickets, which can efficiently be allocated without the need for guidance. The fifth step is allocating expenses incurred for the school's operation, that is, indirect costs; these costs need drivers to be allocated to activities. It is at this stage that you can manage how much each activity consumes resources. The sixth step is allocating activities through the final activities; this stage is where we focus the costs on each course; in this stage, we can verify how much a course consumes resources. The seventh step is to find the amount spent on the course studied; this step is an extension of the previous one since previously you already found the amounts per course. The penultimate step is the coordination (course) value by the total number of students enrolled in the period studied. The last stage is the result of the previous one; in this stage, there is the cost of the product itself, that is, how much does a student enroll in a specific course cost.

## CONCLUSION AND RECOMMENDATIONS

This study presented a model for calculating students' costs in integrated and higher technology courses at the Manaus Campus Zona Leste of the Federal Institute of Amazonas. It was found that the federal government has a cost calculation system. However, this system does not have a degree of detail at the course level as required by Brazilian Federal Institutes and Universities. Thirty-seven

activities were identified; of these,seven were considered core activities, and 30 middle activities. The activities classified as purposes are the course coordinators, and their costs have not been distributed among other activities. The other activities were classified as means, and their costs were distributed among the main activities.
It was found that the agroecology course has a cost/student well above that determined by the methodology proposed by the Ministry of Education. The highest cost is related to teachers' teaching hours, which accounted for 56.36% of the total cost of the course. The student's cost of the integrated technical course in Agriculture was lower than the current expenditure, with students calculated according to the methodology of the Ministry of Education. In this course, the values with teachers were lower than the costs of the activities.

In the integrated technical course in Agriculture, the direct costs of teaching hours for teachers were less than the value of indirect costs. It is explained by the direct cost methodology, in which the higher the production, the smaller the portion of fixed costs allocated to each product. In teaching, the expenditure on teachers was estimated by class and was the same if the class has 1 or 30 students. The indirect costs were higher because the direct costs were lower, the number of students. As the "number of students" expense driver was widely used to allocate activities, the course absorbed the most costs due to the more significant number of students. Current expenditure is the average cost of students. As the Agriculture course was below the value and the agroecology course was above, it was found that there is a balance in spending. It is recommended that in future studies, there is a comparison between institutions with similar characteristics so that operational parameters can be adopted regarding the number of employees, expenses incurred, and the number of students. After surveying these parameters, methods can be proposed to calculate efficiency, efficacy, and effectiveness in entities with identical characteristics.

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