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Study of Management and Performance Indicators in the Evaluation of the Expansion of the Brazilian Federal Technical Teaching of the Northeast Region between 2012 and 2016

Marília Cristyne Souto Galvão Barros Matsumoto [α], Sheila Andréa Silva de Albuquerque [σ], Luciana Peixoto Santa Rita [ρ] & Ibsen Mateus Bittencourt Santana Pinto [ω]

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I. Introduction

The Brazilian Federal Constitution (CF/88) establishes education as "a right of all and a duty of the State and of the family, fostered and encouraged with the collaboration of society, aiming at the full development of the person, his preparation for the exercise of citizenship and their qualification for work "(Brazil, 1988). The Brazilian State is therefore responsible for ensuring access to education for all citizens through public educational policies, as well as for its monitoring and control. These educational public policies are subject to the appreciation of the legislature and to social control, because they are endowed with public resources.

The increasing demands for a formation that contemplated science, technology and work, as well as intellectual and instrumental activities, culminated in the creation of the Federal Institutes of Education, Science and Technology through Law 11.892, published on 12/29/2008. At the time, the policy of expansion of the technical-technological network of education was due to the perception that it, in universal terms, and in Brazil in particular, is increasingly important as a strategic element for the construction of citizenship and for a better insertion of young people and workers in contemporary society, full of great transformations and markedly technological (BRASIL, 2004). Since then, the number of existing units has quadrupled and their budget has increased exponentially, in order to pay for new investments and the hiring and qualification of technical-administrative servants and teachers.

Despite the dedication to promote improvements in the quality of education offered by the Federal Institutes - which can be observed in the performance of Federal Network students in national and international knowledge exams, such as the International Student Assessment Program (PISA) and the National Examination of Middle School (ENEM) - as well as, through the gradual advances in their indicators that demonstrate greater investment in the permanence and success of the students, an initial research in the data annually divulged by the National Institute of Studies and Educational Research Anísio Teixeira (Inep) indicate that the rate of disapproval and abandonment of students still remains significant. However, as Souza et al. (2016: 23)

> these vulnerabilities do not diminish the merit of the expansion policy of the FIs regarding the democratization of access to PE and higher education, especially if we consider the social advance that this represents for cities in the interior of Brazil, whose population had difficulties of access to courses of professional and/or superior quality and public training.

In order to assess the level of management of federal educational institutions, the Federal Audit Office (TCU) has established a series of quality and management indicators calculated using specific formulas. One of these indicators is the Academic Efficiency Rate of Graduates (EAC), which aims to

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measure the ability to achieve success among students who complete the courses in these institutions. This indicator lists all students who successfully completed their course in the period (completed or completed), regardless of the time of their entry; and all those who somehow finished their course, regardless of success or not, that is, seeks to examine whether students have completed without having escaped, disconnected or transferred.

Based on these findings, the question that is sought to answer in this article is: there is a relationship between government investments, with the establishment of the public policy of expanding federal public education, in the Federal Institutes of the Northeast Region between 2012 and 2016, and academic efficiency ? Therefore, the objective of the study is to analyze the correlation between the EAC and the management indicators established by the TCU. Because the research universe comprises 39 federal institutes, a non-probabilistic sample was chosen from 11 federal institutes, all located in the Brazilian Northeast Region.

In this research, the same methodology was used by Inep when analyzing institutes in the same region in order to minimize the social and cultural impacts that could interfere with educational indicators, given that they attribute statistical value to the quality of education, not only to the students' performance, but also to the economic and social context in which schools are inserted. The federal institutes located in the Brazilian Northeast Region were chosen because they are located in the region with the largest number of institutes. The specific objectives will be to analyze the context of the evolution of public policies aimed at professional and technological education in Brazil over time and to highlight the importance of these policies for brazilian society, as well as to evaluate if the students' results Federal Network, measures by the EAC are related to the management indicators.

II. Public Policy

The CF/88 provides for several rights protected to citizens through governmental actions, such as social rights of security, housing, education and health, and it is up to the State to guarantee a minimum of dignity to every citizen (PALADINO, 2008). However, the resources available to the state are limited, so the systematization of how these resources will be applied in the search for a conscious collective goal is what can be defined as public policy.

Public policy, as defined by Souza (2006: 20), is "a field of knowledge that seeks at the same time to" put the government into action "and / or analyze this action (independent variable) and, when necessary, propose changes in the course or course of these actions (dependent variable), "however, as important as discussing a definition is to examine the repercussions of these governmental actions on society.

Resende (2017:4) indicates that "the perception of a social problem as a political problem, and its discursive construction as such, is a prime factor for considering the relevance of facing this problem", in this sense, the author refers "one of the stages of the public policy cycle that, according to Araújo and Gazzola (2017: 28)" involves: agenda formation, policy formulation, decision-making, policy implementation, monitoring and evaluation, feedback, feedback and learning".

The initial phase of forming the agenda begins with the decision of what is a priority for the public power. The formulation phase refers to the presentation of solutions or alternatives and consolidation of objectives. In the decision-making process, alternatives are evaluated and the resources, deadlines and course of action are defined. In the implementation the resources are allocated, the responsibilities are delegated and the action plans are individualized. The other stages are subsequent to the practice of public policy and refer to the analysis of actors' performance, the use of resources, adequacy of objectives and actions and the results themselves and to the satisfaction level of the beneficiaries (ARAÚJO and GAZZOLA, 2017).

In Brazil, the expansion of professional and technological education is part of the public agenda, which foresees the presence of the State in the consolidation of educational policies, assuming education as a right and affirmation of a corporate project that corroborates emancipatory social inclusion (MINISTRY OF EDUCATION, 2010).

III. Public Policies in Federal Education - the Expansion of the Federal Network of Professional, Scientific and Technological Education

The institution of public educational policies, as state action in social relations, is understood as a social public policy, which according to Höfling (2001: 31) are those "aimed at the redistribution of social benefits aimed at reducing structural inequalities produced socioeconomic development". In this sense, it is worth analyzing the expansion of the Federal Public Network of Technical-Technological Education that occurred from the first decade of the 21st century, under the aegis of what was proposed at the time and its reach in a decade.

The perspective of public policy in the creation of the Brazilian Federal Institutes in 2008 significantly enlarges this concept, that is, it is not enough to guarantee that it is public because it is linked to the budget and resources of public origin, it is essential, above all, (social, economic, geographic, cultural, etc.);

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and, on the other hand, in other obligatory items, such as commitment to the social whole, as founding of equality in diversity. and to be articulated with other policies (of work and income, of sectoral, environmental, social and even educational development) in order to provoke impacts in this universe (Ministry of Education, 2010).

According to information available on the website of the Ministry of Education (MEC), from 1909 to 2002, 140 technical schools were built in the country. However, between 2003 and 2016, with the public policy of expansion of federal education, the MEC completed the construction of more than 500 new units. If, quantitatively, the expansion increased access, taking education to cities where investments in education were meager, the indications of the purposes and characteristics in the law creating the institutes in 2010, established parameters of quality to them in order to promote education of social, public and free quality, based on the principle of inseparability between teaching, research and extension, in order to train citizens who are critical to the world of work and contribute to sustainable development.

Considering the importance of government actions in the quest to improve the quality of Brazilian education and social development, and the important values involved, it was necessary to establish performance indicators that express the degree of achievement of goals and objectives settled down.

IV. Performance Indicators as an Instrument of Evaluation of the Public Policy of Expansion of the Federal Network of Professional, Scientific and Technological Education

Performance indicators are tools that provide information essential to the decision-making process and should be objectively measurable, presented in an accessible language, and serve different decision-making hierarchies. For Petri (2005, p.39), managers should "look for ways to measure and evaluate efficiency, effectiveness, effectiveness, quality, productivity, innovation, profitability and other characteristics." Therefore, the indicators are used as qualified or quantified parameters that serve to detail the extent to which the objectives of a project have been achieved. Indicators are marks or flags that seek to express and demonstrate reality in a way that can be observed and obtained more concrete data to improve the evaluation of the institution (COELHO, 2009).

The identification of the results of an institution's actions, through performance measures, constitutes the axis of communication with society, which makes the indicators fundamental elements for the entire cycle of public policy management (MPOG, 2010). In this perspective, public institutions need to develop managerial processes that aid in the evaluation of their performance, counting on the performance indicators, which are instruments capable of providing important information for the decision-making process.

In public institutions, the actions of managers should be based on the public interest, since the use of public resources should be carried out, prioritizing transparency. Thus, public administrators must provide society with qualitative and quantitative information on their actions, providing the exercise of control over public resources; this mechanism was established in CF /88, in guaranteeing citizens' right to demand ethics, integrity, transparency and accountability, as well as to participate directly in the choice of public policies to be implemented (OLIVEIRA and PISA, 2015). However, according to Soligo (2012) measuring indicators in the social sciences is a more difficult task than in the exact sciences, since much of what we intend to measure are intangible concepts. Kloot and Martin (2000) also point out that organizational performance would be better measured if performance indicators evaluated, in addition to the financial aspect, other dimensions such as customer satisfaction, internal business processes, innovation and learning.

In this sense, the TCU indicators raised in this article aim at the establishment of academic indicators that express the improvement of the efficiency and effectiveness of federal institutions of professional education, specifically, an analysis of the relationship between student performance and investments in Federal Institutions.

V. TCU Indicators for the Evaluation of the Federal Institutes of Education, Science and Technology

The TCU is an external control body of the Brazilian federal government that assists the National Congress to monitor the budgetary and financial execution of the country, contributing to the improvement of Public Administration for the benefit of society. This monitoring is usually performed through audits that result in judgments with information, evaluations and determinations.

Judgment nº 2.267/2005 - TCU - Plenary, resulting from the audit carried out in the Professional Education Program - PROEP, by the Secretariat of Professional and Technological Education - Setec/ MEC and the Federal Institutions of Technological Education - IFETS, the need to integrate 11 (eleven) indicators into the accounts of educational institutions. (RU), Student / Student Relations (RCM), Academic Efficiency Index of Concluintes (EAC), School Flow Retention Index (RFE) (GCD), Percentage of Personnel Expenditures (GCP),

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Percentage of Expenditures with Other Costs (GOC) and
Percentage of Investment Expenditures (ICG).

Table 1: Description of the indicators established by the TCU to evaluate the Brazilian Federal Education Institutions

Indicator	Reference	Formula for calculation
Ratio of Vacant Candidate (RCV) measures the consonance between the supply of vacancies in relation to the demand of the public.	**Subscribers** For all enrollment cycles with the start date included in the Analysis Period, search the total number of participants for the selection process (s). **Entry Fees** For all enrollment cycles beginning at the beginning of the cycle within the review period, seek the vacancies offered.	RCV = Subscribers / Vacancies for Entry
Ratio of Matched Ticket Entries (RIM) measures the renewal capacity of the student body.	**Ingressants** All new registrations made in the reference months of the analysis interval. **Enrollments** Attended All registrations that have been in Progress for at least one day in the period analyzed.	RIM = (Incurred / Tuition Attended) x 100
List of Graduates by Matriculation Attended (RCM) measures the ability to achieve school success.	**Graduates** All registrations that have changed status to Completed or Completed in the reference months of the analysis interval. **Enrollments** Attended All registrations that have been in Progress for at least one day in the period analyzed.	RCM = (Completed / Enrollments) x 100
Graduate Academic Efficiency (EAC) measures the ability to achieve success among students who complete.	**Graduates** All enrollments that have changed status to Completed or Completed in the reference months of the analysis interval. **Completed** All registrations that have changed status to Completed, Completed, Dispatched, Disconnected or Transferred External in the reference months of the analysis interval.	EAC = (Graduated / Completed) x 100
School Flow Retention (RFE) measures the ratio of students who do not complete their courses within the expected period.	**Retained All** registrations that remain In Progress after the End of Cycle Enrollment Forecast. **Enrollments Attended** All registrations that have been in Progress for at least one day in the period analyzed.	RFE = (Retained / Enrolled) x 100
Students' Ratio for Integral Time Teachers (RAD) measures the capacity of attendance by the teaching workforce.	**Enrollments Attended** All registrations that have been in Progress for at least one day in the period analyzed. Teachers For all effective or temporary teachers, consider as 1.0 (one) if you are hired under a 40-hour or Exclusive Dedication regime; and as 0.5 (medium) if it is contracted in a regime of 20 hours.	RAD = Registered/ Teachers
Teacher Titration (TCD) measures the refresher rate of the faculty.	Numerator Sum of all effective or temporary teachers of the Institution, weighted by their titration: Graduation (G): Weight 1 Perfection (A): Weight 2 Specialization (E): Weight 3 Master (M): Weight 4 Doctorate (D): Weight 5 Denominator Sum of all the institution's teachers, regardless of their degree and work regime	TCD=Gx1+Ax2+Ex3+Mx4+Dx5/G+A+E+M+D
Current Expense per Student	**GASTOT** Total Expenditure of the	GCA = (GasT / Matriculation

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(GCA) measures the average cost of each student of the Institution.	Institution, deducting inactive personnel and pensioners, expenses with investments and action 20RW Support for Professional and Technological Training. **Enrollments Attended** All registrations that have been in Progress for at least one day in the period analyzed.	Attended) x 100
Personnel Expenditures (GCP) measures staff costs in relation to the Institution's total expenses.	**GASPES** Personnel Expenses **TOTGAS** Total Institution's Expenses .	GCP= (GASPES/TOTGAS) $x100$
Expenses with Other Costs (Excluding Benefits and Pasep) (GOC) measures the expenses with other costs in relation to the total expenses of the Institution.	**GASOUC** Total Expenditures with Other Institutions' Costs, deducting benefits and Pasep. **TOTGAS** Total Institution's Expenses	GOC= (GASOUC/ TOTGAS) x 100
Investment Expenditures (GCI) measures the investment expenditures in relation to the total expenses of the Institution.	**GASINV** Investment Expenses **TOTGAS** Total Institution's Expenses	GCI=(GASINV/TOTGAS) x 100

Source: TCU, 2011.

The document elaborated by the TCU highlighted the advisability of implementing corrective measures in the professional and technological education system, including the development of management indicators for the Brazilian federal institutions of education, and stated that the definition of these indicators should allow a evaluation of the effectiveness and effectiveness of public professional education policies.

Minister Benjamin Zymler "stressed the advisability of implementing corrective measures in the system of professional and technological education, among which the development of management indicators for the Ifets" and Minister Valmir Campelo "also stated that the definition of indicators will allow better evaluation of the effectiveness and effectiveness of vocational education policies implemented by Technological Education Institutions "(BRASIL, 2005).

Judgment No. 2,267 / 2005 - TCU - Plenary emphasized the need to seek data collection for the production of indicators, electronically, for all the institutions of the network and to encourage the collection of socioeconomic data of all students for the calculation of the per capita income indicator of the students enrolled. Judgment no. 2.508 / 2011 - TCU - 1ª Câmara, draws attention to the need to seek the evaluation of the institution as a whole, no longer through case studies, since federal institutes had already been created and Setec/MEC would need to monitor the efficiency and effectiveness of program actions.

To standardize the generation of the indicators, Setec/MEC, since fiscal year 2012, centralized data extraction and the construction of tables with the indicators, which are sent to the Brazilian Federal Network Institutions. In this way, indicator reports are generated in a standardized and automated way, by centralized extraction in the MEC - from raw data of the SISTEC, SIAPE and SIAFI systems, official registration systems, people management and financial movement systems - and later, validated with the institutions themselves.

VI. Academic Efficiency Rate

The indicator of Academic Efficiency (EAC), established in Judgment no. 2.267 / 2005-TCU / Plenary, measures the ability to achieve success among students who complete. The proposed calculation was to calculate this indicator by the ratio of all students who completed their course in the period, regardless of the time of their entry; and all those who "should complete" in this period.

In order to adapt to the methodology of the National Information System of Vocational and Technological Education - SISTEC - based on the concept of enrollment cycle, this indicator became the relationship between all the students who successfully completed their course in the period, regardless of the time of their entry; and all those who, somehow, have finished their course, regardless of success or not.

Regarding the calculation methodology, all the registrations that had status change to Completed or Completed in the reference months of the analysis interval are considered for the records of the finalists. Regarding the registrations of the finalized, all the registrations that had a status change were considered for Completed, Integrated, Skipped, Disconnected or Transferred External in the reference months of the analysis interval.

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This indicator, specifically, is of great relevance because it expresses the result of all the investment in the federal network of education. It is the culmination of the work done, because if the student successfully completes, all the resources spent on him will return to society in the form of a fully formed citizen.

VII. Methodology

In order to reach the objective of this study, that is, to analyze the correlation between the Academic Efficiency Indicators (EAC) and the management indicators established by the TCU, the methodology adopted in this article was developed in two parts. Initially, a quantitative research was carried out regarding the analysis of numerical data on the management indicators that the TCU determined, while the other is qualitative in nature because it analyzes the aspects related to these indicators.

Preliminarily, an exploratory bibliographical research was developed in order to understand the reason for the existence of the Federal Institutes of Education, Science and Technology as a product of a public policy, as well as the reasons that led the TCU to establish certain indicators for the evaluation of these institutions.

Secondly, a descriptive research was carried out with analysis of secondary data obtained directly from the annual management reports published by the federal institutions of education, science and technology of the Northeast region of Brazil. The choice to analyze institutes in the same region was intended to minimize the social and cultural impacts that could interfere with the indicators, using the same methodology adopted by INEP when analyzing regionally.

In a universe of 39 institutions distributed across all regions of the country, most of them are contained in the Northeast region, and this was the first reason for the non-probabilistic choice of the sample. The second reason is because the region where the work was developed. Regarding the period, we opted to analyze the years from 2012 to 2016, a period in which the expansion, which was the object of this study, was already in full implementation, as well as, the indicators had already been adopted by all institutions in their management reports in a standardized manner and in accordance with Judgment nº 2.508 / 2011 - TCU - 1st Chamber.

The indicators of the following institutions were analyzed: Federal Institute of Alagoas (Ifal), Federal Institute of Bahia (IFBA), Federal Institute of Bahia (IFBaiano), Federal Institute of Ceará (IFCE), Federal Institute of Pernambuco (IFPE), Federal Institute of Pernambuco (IFS), Federal Institute of Piauí (IFPI), Federal Institute of Rio Grande do Norte (IFRN)) and Federal Institute of Sergipe (IFS).

The data were entered into statistical data processing software to analyze the relationship between the EAC rate and the other indicators, in order to find some influence of the increase in student efficiency expenditures.

VIII. Analysis of Results

Taking into account the data provided by the management reports of the selected institutions as a sample, in the analyzed period from 2012 to 2016, it was possible to compare the Current Expenditures per Pupil (GCA) in a historical series.



Source: Prepared by the authors

Graph 1: Current expenditure per student of the institutions analyzed in the period from 2012 to 2016

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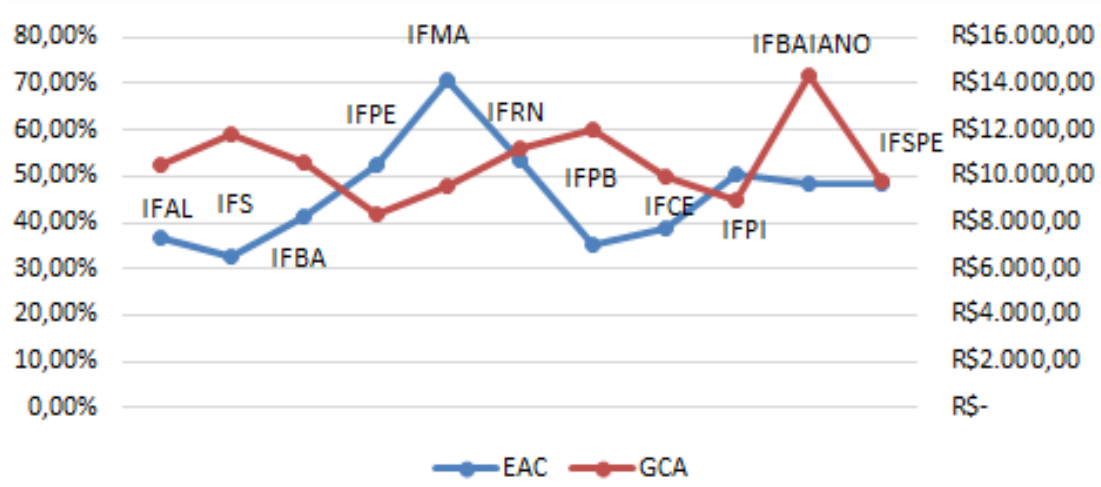
Analyzing Graph 1, it is possible to understand that, besides having undergone several augmentative or diminutive variations, it is clear that there is no standardization of the values spent per student in the institutions. While IFPE, for example, spent an average of R$ 8,382.29 per student on average, IF Baiano spent an average of R$ 14,392.59 per student. This discrepancy, however, is not reflected in the EAC rate.



Source: Prepared by the authors

Graph 2: Relationship between the mean values of GCA and CAE of the institutions analyzed in the period between 2012 and 2016

According to Chart 2, the mean of the highest EAC in the period - IFMA - does not correspond to the highest GCA average, which is the IFBaiano. The average EAC of the latter, inclusive, does not reach even 50%.

By establishing relationships among all the indicators, it was possible to see that even the average school flow retention index does not interfere with the EAC.



Source: Prepared by the authors

Graph 3: Relationship between the mean and the retention, EAC, SPC of the institutions analyzed in the period between 2012 and 2016

As the EAC measures the ability to achieve success among the final pupils, a possible relationship would be that the greater the retention of the school flow - which refers to the students who locked up the course or were disapproved - the lower the EAC should be. However, analyzing the data available in the management reports, this does not happen and the indexes behave independently.

In general, in the analyzed period, despite the investments and dedication to the expansion, there is maintenance of the EAC of the researched institutions. According to the data presented in graph 4, in 2014 there was a better performance of the EAC, however, in 2015, there was an involution, being the worst mean EAC of the period analyzed.

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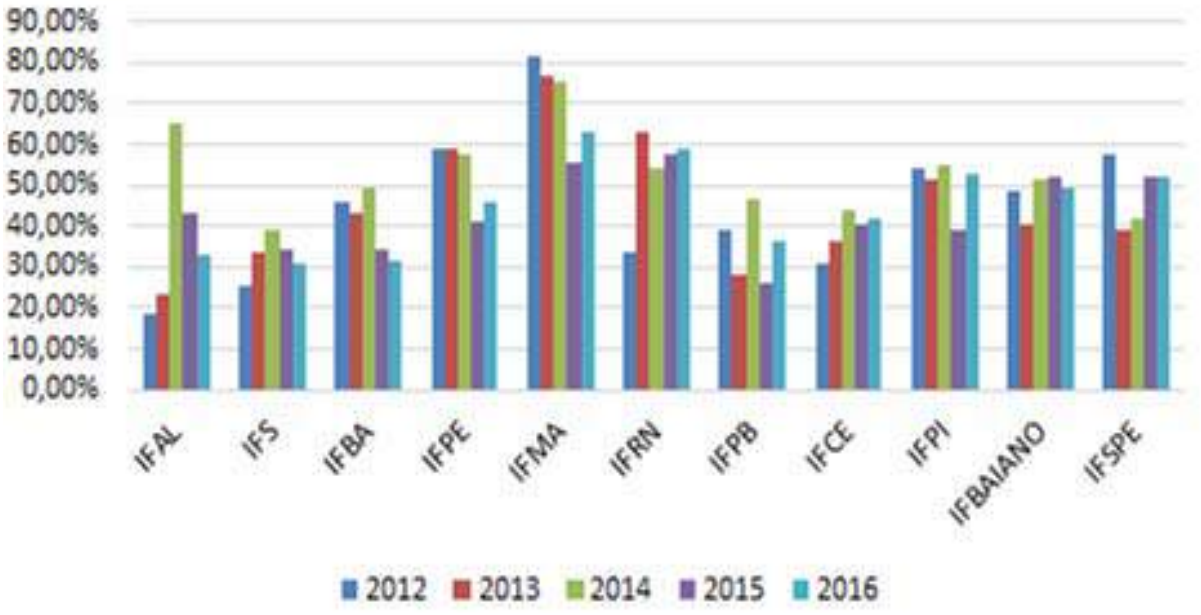

Source: Prepared by the authors

Graph 4: Evolution of the CAE per institution in the period between 2012 and 2016 in the analyzed institutions

It is also worth mentioning that, although initially it is not possible to establish a direct relationship between management indicators, such as those related to student spending, investments, personnel and other expenses and the EAC, it is important to analyze the evolution of these indicators as a whole. other information and data which have not been established by judgment and are not the subject of this study.

Thus, in order to analyze the correlation between the Academic Efficiency Indicator (EAC) and the management indicators established by the Brazilian Court of Audit, we conclude that there is no correlation between efficiency of the students of the IFEs analyzed and the other management indicators proposed by the TCU. One possibility for this result is that the Court of Auditors was concerned with developing formulas to measure institutional performance, however, it overlooked socioeconomic and cultural aspects of the students. And, according to Silva et al. (2017) "measuring results is not as simple as measuring monetary values".

The public policy of expansion of professional and technical education in Brazil found, in this first decade of existence, several historical challenges to establish itself in certain regions. The Northeast region, analyzed in this article, is the one with the highest poverty index in Brazil, where 43.5% of the population falls into this situation (IBGE, 2017). Still, according to the Social Indicators Synthesis 2017 (IBGE, 2017), all the major regions of the country experienced an increase in the percentage of young people who did not study and were not employed between 2014 and 2016, but only in the Northeast Region, the increase was greater than the observed nationally. The culture of tolerance to out-of-school youth to occupy informal and seasonal jobs, as pointed out in IBGE research, has the power to interfere deeply in the result of the indicators proposed by the TCU.

The federal institutions of professional, technical and technological education, with the possibility of bringing excellence in teaching, research and extension impacting this region, fulfill the role of structured intersectorial public policy to reduce social inequalities through a developmental education. However, for this to happen, the results need to be analyzed more realistically, considering the various aspects that influence indicators.

IX. Final Considerations

This research proposes to analyze if there is a relationship between the increase of Brazilian government spending after the establishment of the public policy of expansion of federal public education in the Federal Institutes of the Northeast Region between 2012 and 2016, which has its execution measured by indicators of management established in Judgment 2,267/2005 - TCU/Plenary and the academic efficiency, measured by indicator indicated in the same document. For this, the evolution of public policies aimed at professional and technological education over time in Brazil was systematized, showing the importance of these policies for society.

After this analysis, from the information made available in the management reports of the institutions, the efficiency of the students was evaluated, measured

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by the EAC relating to the financial management of the institution, measured by TCU indicators. The results show that the indicators are not related to each other, either presenting as directly or sometimes inversely proportional. One of the possible causes for this phenomenon is due to the socio cultural aspects neglected in the establishment of the indicators by the TCU that did not even consider the regional particularities where each institution is located and the public that attends.

Considering the Federal Institutes of Education, Science and Technology as a successful public policy to reach regions of Brazil, which were previously not on the map of education, goes beyond analyzing relations between students' completion and the amounts spent for it. Without daring to minimize the importance of monitoring the results of public institutions in order to assess their efficiency and effectiveness and, therefore, to exercise the monitoring and control that are vital in the public policy cycle, it should be pointed out that EAC can not be the only direct measure of student performance.

Especially after the expansion, the Federal network has achieved outstanding results in several national and international examinations, being always among the institutions best placed in the Enem ranking, and exceeding, in the Program for International Student Assessment (Pisa) - International Program of Evaluation (PISA, 2016), as well as the excellent performance in Olympiads of knowledge and in scientific research and initiation.

Thus, it should be emphasized that this article analyzed the academic efficiency of the institutions established as a sample, only in relation to a limited set of indicators, those established by the TCU, since they are adopted by all. The choice of the scope, it is worth mentioning, was due to the scarcity of scientific production that deals with this topic, as well as the relevance in discussing if the resources are being used in an effective way and if the indicators adopted to follow them do so with reliability, as an instrument for the evaluation of public policy.

In time, it is suggested as a topic of future research a new research whose focus is the approach of socioeconomic and cultural aspects that impact on the result of the EAC.

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