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# Technical efficiency of IF Sudeste MG campuses: an analysis of 2025 indicators

*Eficiência técnica dos campus do IF Sudeste MG: uma análise dos indicadores de 2025*

*Eficiencia técnica de los campus del IF Sudeste MG: un análisis de los indicadores de 2025*

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**Abstract:**
Given the expansion of the Federal Network of Professional, Scientific and Technological Education (RFEPCT) and the ongoing struggle to obtain funding for its activities, it is essential that the allocation and management of these resources be guided by several evaluation criteria. Since the National System for the Evaluation of Professional and Technological Education (SINAEPT) is still at an early stage, additional criteria must be developed beyond those already used by the government and based on data from the Nilo Peçanha Platform (PNP). This study aimed to conduct a Technical Efficiency Analysis comparing the campuses of IF Sudeste MG through an output-oriented Data Envelopment Analysis (DEA-BCC). The main results indicated that the Juiz de Fora, Manhuaçu, Rio Pomba and São João del Rei campuses operate on the efficiency frontier, whereas the Barbacena, Muriaé and Santos Dumont campuses still need to expand their course offerings and/or improve the indicators that comprise the Academic Efficiency Index (IEA).

**Keywords:** IF Sudeste MG; Technical Efficiency Analysis; Professional and Technological Education; Budget Management.

**Resumo:**
Diante da expansão da Rede Federal de Educação Profissional, Científica e Tecnológica (RFEPCT), e das constantes lutas para a obtenção de recursos financiadores de suas atividades, é de suma importância que o direcionamento e a gestão destes recursos ocorram sob a influência de diversos critérios de avaliação. Uma vez que o Sistema Nacional de Avaliação da Educação Profissional e Tecnológica (SINAEPT) ainda se encontra em estágio embrionário, faz-se necessária a elaboração de critérios adicionais aos já utilizados pelo governo e que são baseados em dados da Plataforma Nilo Peçanha (PNP). O presente trabalho objetivou a elaboração de uma Análise de Eficiência Técnica comparando os campus do IF Sudeste MG, por meio de uma Análise Envoltória de Dados (DEA-BCC) orientada para os outputs. Os principais resultados indicaram que os Campus Juiz de Fora, Manhuaçu, Rio Pomba e São João del Rei estão operando na fronteira eficiente, ao passo que os Campus Barbacena, Muriaé e Santos Dumont ainda precisam ampliar a oferta de cursos e/ou aprimorar indicadores que compõem o Índice de Eficiência Acadêmica (IEA).

**Palavras-chave:** IF Sudeste MG; Análise de Eficiência Técnica; Educação Profissional e Tecnológica; Gestão Orçamentária.

**Resumen:**
Ante la expansión de la Red Federal de Educación Profesional, Científica y Tecnológica (RFEPCT) y las constantes luchas por obtener recursos para financiar sus actividades, es de suma importancia que la asignación y la gestión de dichos recursos se orienten mediante diversos criterios de evaluación. Dado que el Sistema Nacional de Evaluación de la Educación Profesional y Tecnológica (SINAEPT) todavía se encuentra en una etapa inicial, es necesario elaborar criterios adicionales a los que ya utiliza el Gobierno y que se basan en datos de la Plataforma Nilo Peçanha (PNP). Este trabajo tuvo como objetivo realizar un Análisis de Eficiencia Técnica comparando los campus del IF Sudeste MG mediante un Análisis

Envolvente de Datos (DEA-BCC) orientado a los outputs. Los principales resultados indicaron que los campus Juiz de Fora, Manhuaçu, Rio Pomba y São João del Rei operan en la frontera eficiente, mientras que los campus Barbacena, Muriaé y Santos Dumont aún necesitan ampliar la oferta de cursos y/o mejorar los indicadores que componen el Índice de Eficiencia Académica (IEA).

**Palabras clave:** IF Sudeste MG; Análisis de Eficiencia Técnica; Educación Profesional y Tecnológica; Gestión Presupuestaria.

## 1 Introduction

The Federal Network of Professional, Scientific and Technological Education (RFEPCT) was created by Law No. 11,892 (2008) with the aim, among other objectives, of developing professional and technological education as an instrument for consolidating and strengthening local productive, social and cultural arrangements. Silva and Terra (2013) point out that, in this context, the creation and expansion of the RFEPCT prioritized the establishment of Federal Institutes in inland areas, democratizing access to education and fostering regional development.

In 2026, the Federal Network reached its ‘coming of age’ and currently comprised 754 units linked to 39 Federal Institutes (IFs), two Federal Centers for Technological Education (CEFETs) and 22 Technical Schools affiliated with federal universities, in addition to the Federal Technological University of Paraná (UFTPR) and Colégio Pedro II (Ministry of Education - MEC, 2026b).

One of these Federal Institutes is the Federal Institute of Education, Science and Technology of Southeastern Minas Gerais - IF Sudeste MG. Created in December 2008, IF Sudeste MG originated from the integration of the Federal Agrotechnical School of Barbacena, the Federal Center for Technological Education of Rio Pomba and the University Technical College of Juiz de Fora (IF Sudeste MG, 2026). IF Sudeste MG currently comprises 10 campuses located in Zona da Mata Mineira and Campo das Vertentes, offering more than 15,000 places in 209 courses, according to data from the Nilo Peçanha Platform - PNP (2026).

Although they fall under the same administrative structure, the IF Sudeste MG campuses have different circumstances. For example, of the three campuses that gave rise to the institute, two are predominantly agricultural - Rio Pomba and Barbacena - whereas the Juiz de Fora campus is recognized for its technological and industrial emphasis. Different contexts therefore lead to equally different ways of structuring and using financial resources, so the level of technical efficiency may vary significantly among them.

Therefore, this study aims to assess the technical efficiency of the IF Sudeste MG campuses for the year 2025. Recent research, such as Moro et al. (2026), analyzed the technical

efficiency of Federal Institutes between 2018 and 2023. However, because those studies used only data from the Nilo Peçanha Platform - PNP, their analyses were not disaggregated to the campus level, since the financial data provided by the PNP are aggregated only by institute. This study is thus justified by its specific delimitation of the research object, allowing greater disaggregation of the data analyzed.

## 2 Theoretical framework

### 2.1 National policy for professional and technological education (PNEPT): objectives and forms of performance evaluation

The RFEPCT was established on the foundation of comprehensive and polytechnical human education through an educational process that connects technical, scientific, cultural, ethical and political factors (Vieira, J. A.; Pasqualli; Vieira, 2026). According to Barbosa et al. (2025), the Federal Institutes stand out precisely because they offer integrated education combining secondary school and technical courses, enabling comprehensive education in terms of knowledge and experience.

Before the RFEPCT was created in 2008, there were only 104 federal institutions responsible for implementing technological education policies. After eighteen years and a substantial expansion in the number of such institutions - 754 to date - there is an undeniable need to analyze the policies governing the Federal Network from several perspectives. Sobrinho (2019) emphasizes that, given the political and economic effort involved - billions in public investment - critical analyses of the efficiency, efficacy and effectiveness of the public policies concerned are unavoidable.

Regarding organizational design, Fernandes (2009) notes that the multicampus structure of the IFs - interdependent units connected to a Rector's Office - creates challenges and requires specific management procedures in both organizational and financial terms.

The objectives of the Federal Network are currently guided by the National Policy for Professional and Technological Education - PNEPT - established by Decree No. 12,603 (2025), as follows:

I. Coordinate the provision of professional and technological education, in compliance with the goals of the National Education Plan (PNE);
II. Promote actions aimed at expanding institutions and the provision of professional and technological education, taking regional needs into account;

III. Promote policies that improve the quality of professional and technological education, considering its alignment with the demands of society and the world of work;
IV. Encourage the active participation of the world of work in the provision of professional and technological education, with a view to the social and productive inclusion of graduates;
V. Implement affirmative actions and public policies that promote access, retention and successful completion in professional and technological education, encouraging inclusion and reducing inequalities;
VI. Guide professional and technological education policies according to the socioeconomic challenges of the world of work, considering its constant process of transformation;
VII. Develop knowledge and practices capable of promoting social impact and transformation;
VIII. Promote extension, research, innovation, cultural production and sports activities within professional and technological education;
IX. Promote the initial and continuing education of professional and technological education practitioners; and
X. Implement mechanisms for evaluating and monitoring public policies aimed at professional and technological education.

Like any public policy, the PNEPT requires indicators to monitor and evaluate efficacy and efficiency. Accordingly, Decree No. 12,603 (2025) established the National System for the Evaluation of Professional and Technological Education - SINAEPT. Regulated by MEC Ordinance No. 524 (2026a), SINAEPT comprises six evaluation dimensions, as follows:

I. Analysis of the institutional conditions of provision, comprising:
    a) the didactic and pedagogical organization of courses;
    b) the teaching and technical staff; and
    c) the infrastructure and other resources available to ensure the adequacy and quality of provision;
II. Analysis of statistics on provision, student progression and educational performance, focusing on retention and course completion;
III. Diagnostic evaluation of the knowledge, competencies and practical skills developed in professional and technological education courses;
IV. The connection between professional and technological education provision and the demands of the world of work, considering its adherence to local, regional and national social, economic and productive contexts; and
V. Monitoring graduates' entry into the world of work and continuation of their studies.

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However, because it is still a recent system, SINAPET only has preliminary results from a ‘pilot project’ carried out between 2024 and 2025 (Anísio Teixeira National Institute for Educational Studies and Research - INEP, 2025).

Given SINAEPT's still incipient implementation, RFEPCT performance evaluation continues to be based on indicators provided by the Nilo Peçanha Platform - PNP - which, according to Pacheco (2012), only exacerbates the existing differences among Federal Network units and subunits.

Among the aforementioned indicators are the number of enrollments and equivalent enrollments, the in-person student-to-teacher ratio and the academic efficiency index. According to the PNP (2026), the academic efficiency index measures the percentage of students who successfully completed their course within the expected period or by the last day of the year following the end of the course cycle, plus a projected percentage of retained students who may complete the course.

It should be noted that this academic efficiency index uses the concept of simple enrollment rather than equivalent enrollment, which may cause severe distortions when different courses and units or subunits are compared. This is because equivalent enrollment adjusts the number of enrollments according to the Workload Equalization Factor and the Course Effort Factor[1], with the aim of reducing the numerical disparity caused by course-specific qualitative adjustments.

Finally, it is important to note that, to date, there is no indication that SINAEPT will evaluate data related to the financial resources allocated to Federal Network units. Therefore, it is not yet possible to determine whether SINAEPT will be adequate enough to become the definitive instrument for evaluating the efficiency and efficacy of the PNEPT. In this regard, the absence of financial efficiency indicators may compromise this evaluation system because

> The financial dimension, which is a fundamental component of management, is most often overlooked when promises and plans are formulated. For this very reason, a large body of good intentions fades as the everyday work of management progresses (Vieira, S. L., 2007, p. 59).

[1]While the Workload Equalization Factor indicates the ratio between a course's minimum workload and the standard workload of 800 hours per year, the Course Effort Factor adjusts enrollments for courses that, because of the specific nature of their activities, require a lower student-to-teacher ratio (PNP, 2026).

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### 2.1.1 Funding of the federal professional and technological education network: the budget allocation matrix and its indicators

Although it is linked to basic education, the RFEPCT is not funded by the Fund for the Maintenance and Development of Basic Education and the Appreciation of Education Professionals (Fundeb), which requires a series of annual struggles for resources during preparation of the Federal Government Budget (Pacheco, 2012).

In addition to the aforementioned problem concerning the scarcity of resources available to the Federal Network, there are two other highly complex questions that have been debated for years without consensus:

- How should resources be distributed among RFEPCT units?
- Once resources reach each RFEPCT unit, how should they be distributed among its subunits?

To increase transparency in answering the first question and guide the process of answering the second, the National Council of RFEPCT Institutions - CONIF - published a Guide to the Analysis and Interpretation of RFEPCT Budget Matrix Indicators (2025).

The Budget Allocation Matrix, established by MEC Ordinance No. 646 (2022), uses data from the Nilo Peçanha Platform as a parameter. Under this matrix, the budget, after deducting the amount allocated to student assistance, is distributed as follows:

- ‘Operations’ block (80% of the budget): maintenance and development of the institution's overall activities;
- ‘Rector's Office’ block (10% of the budget): maintenance and development of the activities of the central management unit;
- ‘Quality/Efficiency’ block (10% of the budget): activities carried out by the institutions, measured using indicators available on the PNP;

The aforementioned blocks are evaluated according to the behavior of the following indicators provided by the PNP: total enrollments, academic efficiency (IEA), in-person student-to-teacher ratio (RAPP), statutory targets for Technical Courses, Teacher Education and Youth and Adult Education (IAML), and per capita Family Income (RFP) (MEC, 2022).

The budget matrix has been widely criticized for failing to adequately consider the specific characteristics of each IF and campus. One criticism, for example, concerns the absence of criteria distinguishing older units from newly built ones, since the latter require fewer maintenance resources. In addition, units offering agricultural courses, although they receive a budget ‘bonus’ for doing so, often have maintenance and operating costs that exceed that

'bonus.' These and other shortcomings in the current budget allocation reinforce and aggravate the differences among units already noted by Pacheco (2012).

Accordingly, this study seeks to contribute to the discussion on how to evaluate the Federal Network's performance more fairly, with a specific focus on the campuses of IF Sudeste MG.

## 3 Data collection and processing

This is a quantitative, applied and documentary study whose object of interest was the units of IF Sudeste MG. At the time of the research, the institute comprised 10 campuses. However, since the collected data refer to 2025, some of these campuses - Bom Sucesso, Cataguases and Ubá - were still regarded as 'Advanced Campuses' and therefore had several indicators, including financial indicators, linked to the institution's Rector's Office. Consequently, only the Barbacena, Juiz de Fora, Manhuaçu, Muriaé, Rio Pomba, Santos Dumont and São João del Rei campuses were included in the efficiency analysis.

To analyze the technical efficiency of the aforementioned campuses, the data shown in Table 1, referring to 2025, were collected.

Table 1 - Data collected and their respective sources.

| Variable | Source |
|---|---|
| Current Expenditure (DC) | Internal IF Sudeste MG documents |
| Number of Courses Offered (CUR) | Nilo Peçanha Platform - PNP |
| Academic Efficiency Index (IEA) | Nilo Peçanha Platform - PNP |

Source: prepared by the author.

It should be noted that current expenditure data were collected from internal IF Sudeste MG documents because the Nilo Peçanha Platform does not present this information disaggregated by campus.

The data were processed through Data Envelopment Analysis - DEA - using the output-oriented BCC model and the free SIAD software. According to Colin (2019), DEA can be used to assess the relative efficiency of one unit in relation to others, allowing less efficient units to benchmark the practices of more efficient units.

According to Barbosa and Fuchigami (2018), efficiency in the DEA model is measured by dividing virtual output, the sum of the products of outputs and their respective weights, by virtual input, the sum of the products of inputs and their respective weights. Efficiency can therefore be increased either by maximizing outputs or by minimizing inputs. In this study, the efficiency analysis of educational institutions, which prioritize maximizing results, required the selection of an output-oriented BCC model, which assumes variable returns to scale.

The BCC model was developed by Banker, Charnes and Cooper (1984) to estimate the technical and scale efficiency of Decision-Making Units - DMUs - as a replacement for the original CCR model when DMUs operate at different production scales. This is the case in the present study because IF Sudeste MG comprises campuses of very different sizes and scales. Thus, the output-oriented BCC model was organized with Current Expenditure (DC) as the input, while Number of Courses (CUR) and Academic Efficiency Index (IEA) were defined as outputs.

It should be noted that, despite the availability of several additional data points, only these variables were selected because of the operational limitations of the data-processing method. According to Dyson et al. (2001), because DEA allows freedom in determining input and output weights, indiscriminately increasing the number of variables significantly reduces discrimination among DMUs. To minimize this problem, the authors recommend that the combined number of inputs and outputs not exceed 50% of the number of DMUs in the analysis. Therefore, for the seven DMUs in this study, one input and two outputs were used.

## 4 Results and discussion

The data used in the Data Envelopment Analysis - DEA - for the seven IF Sudeste MG campuses supported the choice of the output-oriented BCC method. As Table 2 shows, there are significant differences in operating scale among the DMUs, requiring an efficiency analysis that considers the specific scale of each unit.

Table 2 - Data analyzed for the IF Sudeste MG campuses for 2025.

| Campus | Current Expenditure (DC) | Number of Courses Offered (CUR) | Academic Efficiency Index (IEA) |
|---|---|---|---|
| Barbacena | R$ 10.548.473,00 | 28 | 60,12% |
| Juiz de Fora | R$ 8.702.678,11 | 33 | 68,96% |
| Manhuaçu | R$ 1.355.459,37 | 8 | 25,00% |
| Muriaé | R$ 3.781.865,33 | 19 | 55,56% |

| Campus | Current Expenditure (DC) | Number of Courses Offered (CUR) | Academic Efficiency Index (IEA) |
|---|---|---|---|
| Rio Pomba | R$ 10.006.814,94 | 41 | 53,80% |
| Santos Dumont | R$ 2.377.011,82 | 19 | 47,02% |
| São João del Rei | R$ 2.985.116,03 | 26 | 74,04% |

Source: adapted from internal IF documents and the Nilo Peçanha Platform (2026).

The Barbacena, Juiz de Fora and Rio Pomba campuses are the largest and oldest campuses of IF Sudeste MG, which partially explains the greater allocation of resources to these units. Furthermore, the predominantly agricultural structures of the Barbacena and Rio Pomba campuses naturally require more operating and maintenance resources.

The results of the technical efficiency analysis shown in Table 3 indicate that four IF Sudeste MG units operate on the efficiency frontier: Juiz de Fora, Manhuaçu, Rio Pomba and São João del Rei.

Table 3 - Technical efficiency analysis of the IF Sudeste MG campuses.

| Campus | Technical Efficiency |
|---|---|
| Barbacena | 86,58% |
| Juiz de Fora | 100,00% |
| Manhuaçu | 100,00% |
| Muriaé | 75,04% |
| Rio Pomba | 100,00% |
| Santos Dumont | 98,53% |
| São João del Rei | 100,00% |

Source: research data.

When examining the above results, it is important to highlight aspects that are not necessarily revealed by the figures. For example, the Manhuaçu Campus was on the efficiency frontier despite having an Academic Efficiency Index far below those of the other units. This result is explained by the significantly smaller amount of resources received, which affected the weight assigned to the analysis's sole input. Another consideration that goes beyond the figures concerns indicators not included in the analysis but which could influence efficiency if considered, such as the Verticalization Index, in which the Rio Pomba campus stands out, or the Student-to-Teacher Ratio (RAP). In the latter case, Manhuaçu would stand out for its low RAP because it is still expanding, whereas São João del Rei would stand out for an excessively high ratio owing to its extensive provision of distance-learning courses.

The output-oriented DEA-BCC analysis performed using SIAD also enables benchmark and target analyses. According to Barbosa and Fuchigami (2018), benchmarks allow less efficient units to identify which efficient units' practices should be observed and replicated. Target analysis can also indicate which indicators must improve for these DMUs to reach the efficiency frontier. Accordingly, Table 4 presents the results of the benchmark and target analyses.

Table 4 - Benchmarking and target analysis.

| Campus seeking efficiency | Main campus to be observed | Target Number of Courses Offered (CUR) | Academic Efficiency Target (IEA) |
|---|---|---|---|
| Barbacena | Juiz de Fora | 32 | 69,44% |
| Muriaé | São João del Rei | 26 | 74,04% |
| Santos Dumont | São João del Rei | 19 (unchanged) | 55,74% |

Source: research data.

The data in Table 4 show that, assuming the available resources remain unchanged, the Barbacena and Muriaé campuses need not only to expand their course offerings but also to improve the Academic Efficiency Index (IEA), whereas the Santos Dumont Campus only needs to improve its IEA. In these cases, the management of each unit should conduct an in-depth analysis of every subindicator comprising the IEA to identify potential constraints and seek solutions.

Finally, it should be noted that an output-oriented DEA-BCC analysis would be unlikely to place all units on the efficiency frontier because it is a comparative analysis among DMUs. With this in mind, the campuses analyzed - especially those still expanding courses, places and staff, such as Manhuaçu - generally displayed good indicators, so no major adjustments are required to further improve the quality of services provided by IF Sudeste MG and its units.

This study aimed to provide evidence to guide the next steps in the distributive and administrative policies of IF Sudeste MG managers. It recommends that future analyses be replicated not only to verify how these indicators evolve over time, but also to include the new units that became independent of the Rector's Office between 2025 and 2026: Cataguases, Bom Sucesso and Ubá.

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