IMPACTO CIENTÍFICO EDITORA

CONTRIBUTION OF THE ECONOMIC ENGINEERING DISCIPLINE IN THE PROFESSIONAL CAREER OF CIVIL ENGINEERING GRADUATES AT THE IFPB PATOS CAMPUS

CONTRIBUIÇÃO DA DISCIPLINA DE ENGENHARIA ECONÔMICA NA TRAJETÓRIA PROFISSIONAL DOS EGRESSOS DO CURSO DE ENGENHARIA CIVIL DO CAMPUS PATOS DO IFPB

CONTRIBUCIÓN DE LA DISCIPLINA DE INGENIERÍA ECONÓMICA EN LA CARRERA PROFESIONAL DE LOS GRADUADOS DE INGENIERÍA CIVIL EN EL CAMPUS PATOS DEL IFPB

https://doi.org/10.56238/edimpacto2025.063-013

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ABSTRACT

The discipline of Economic Engineering plays an important role in the professional training of civil engineers, developing economic and financial knowledge and skills essential for their careers. In this sense, this study aimed to analyze the perception of Civil Engineering graduates at the Patos Campus of the Federal Institute of Paraíba (IFPB) regarding the contribution of this discipline to their professional practice. The results indicated that content such as financial mathematics, project analysis, and capital markets are widely applied, while amortization methods, depreciation theory, and decision-making techniques are more limited, which may be conditioned by the type of position or the availability of technological resources. The interviewees also proposed greater practical context, focusing on budgets, bidding processes, and investments directly related to civil construction. The conclusion is that Economic Engineering contributes significantly to the training of civil engineers with strategic vision and management skills, meeting the demands of a dynamic, competitive, and

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multifunctional market. It is suggested that the syllabus remain comprehensive, but undergo continuous updates and practical application of the content.

Keywords: Economic Engineering. Professional Training. Civil Engineering. Job Market.

RESUMO

A disciplina de Engenharia Econômica desempenha um importante papel na formação profissional de engenheiros civis, desenvolvendo conhecimentos e habilidades econômico-financeiras essenciais para o exercício da carreira. Nesta direção, este estudo teve como objetivo analisar a percepção dos egressos do curso de Engenharia Civil do Campus Patos do Instituto Federal da Paraíba (IFPB) quanto à contribuição dessa disciplina para sua prática profissional. Os resultados indicaram que conteúdos como matemática financeira, análise de projetos e mercado de capitais são amplamente aplicados, enquanto métodos de amortização, teoria da depreciação e técnicas de tomada de decisão apresentam uso mais restrito, que pode estar condicionado ao tipo de cargo ou disponibilidade de recursos tecnológicos. Os entrevistados também propuseram maior contextualização prática, com foco em orçamentos, licitações e investimentos diretamente relacionados à construção civil. Conclui-se que a Engenharia Econômica contribui demasiadamente para a formação de engenheiros civis com visão estratégica e capacidade de gestão, atendendo às demandas de um mercado dinâmico, competitivo e multifuncional. Sugere-se que a ementa se mantenha abrangente, mas que passe por contínuas atualizações e aplicações práticas dos conteúdos.

Palavras-chave: Engenharia Econômica. Formação Profissional. Engenharia Civil. Mercado de Trabalho.

RESUMEN

La Ingeniería Económica desempeña un papel importante en la formación profesional de los ingenieros civiles, desarrollando conocimientos y habilidades económicas y financieras esenciales para sus carreras. En este sentido, este estudio tuvo como objetivo analizar la percepción de los graduados de Ingeniería Civil del Campus Patos del Instituto Federal de Paraíba (IFPB) sobre la contribución de esta disciplina a su práctica profesional. Los resultados indicaron que contenidos como matemáticas financieras, análisis de proyectos y mercado de capitales se aplican ampliamente, mientras que los métodos de amortización, la teoría de la depreciación y las técnicas de toma de decisiones son más limitados, lo que puede estar condicionado por el tipo de puesto o la disponibilidad de recursos tecnológicos. Los entrevistados también propusieron un mayor contexto práctico, centrándose en presupuestos, procesos de licitación e inversiones directamente relacionadas con la construcción civil. La conclusión es que la Ingeniería Económica contribuye significativamente a la formación de ingenieros civiles con visión estratégica y habilidades de gestión, atendiendo las demandas de un mercado dinámico, competitivo y multifuncional. Se sugiere que el programa de estudios sea integral, pero que se actualice continuamente y aplique el contenido en la práctica.

Palabras clave: Ingeniería Económica. Formación Profesional. Ingeniería Civil. Mercado Laboral.

1 INTRODUCTION

The academic training of a civil engineer covers, in addition to technical and specific content in the area, the development of skills and abilities related to economic decision-making and investment evaluation. In this scenario, according to Oliveira *et al*. (2025), the discipline of Economic Engineering stands out as an essential tool to help students improve their skills, deal with economic feasibility, cost management, and strategic planning.

In addition, according to Park (2016), economic engineering provides engineers with *insights* for more rational and efficient decisions, especially in budget-constrained environments, taking into account a list of criteria to be weighed, such as: time value of money, risk and return analysis, cash flow diagram analysis, financial cycle analysis, among other aspects considered relevant in the civil construction sector.

In this sense, the presence of the discipline in the curriculum of civil engineering courses is justified, as pointed out by Blank and Tarquin (2009), by the crucial role that these professionals play in investment decisions. They act not only as designers and executors of works, but also as direct collaborators in management, needing concise opinions that consider economic and technical factors, such as budget, costs, and standards.

The academic literature paves the way for the importance of economic engineering in the training of professionals (Oliveira *et al*., 2025; Davi *et al*., 2025; Medeiros *et al*., 2024), but there is a gap in the understanding of how these financial concepts and techniques are, in fact, applied in the daily lives of professionals already in the labor market, particularly in the context of a market that requires flexibility and multifunctionality (Monte and Marinho, 2025). That said, the present research is guided by a central question: a) what are the perceptions of the graduates of the civil engineering course at the Patos Campus of the Federal Institute of Paraíba (IFPB) about the contribution of economic engineering to their professional training?. This study is justified both because it offers future directions to professors in the area and to managers, in order to adjust the methodologies adopted in the discipline to the real needs of the civil engineering market. This seeks to optimize the teaching-learning process.

2 THEORETICAL FRAMEWORK

2.1 ECONOMIC ENGINEERING FOR CIVIL ENGINEERING

Economic engineering has as its object of study the financial sector, encompassing topics such as investments, decision-making based on the triad: risk, return and sacrifice of

liquidity, evaluation of investment options, among other aspects directly linked to the capital of a particular individual or legal entity. Due to its broad scope, this area works as a tool for systematizing and quantifying monetary elements, such as projected cash flows, capital costs, and interest rates to measure return, and non-monetary elements, such as an organization's reputation, market risks, and political scenarios (Oliveira *et al*, 2025).

For a company, the requirement for thorough and detailed analysis of quantitative and qualitative aspects enables the optimization of the use of available resources, enabling technical managers to make strategically designed decisions for possible scenarios that may be obstacles to corporate growth. In this context, economic engineering can be precisely defined as a technique that provides robust metrics in the financial sphere, grounding intelligent and optimized choices that idealize long-term business success and sustainability (Nogueira, 2013).

In addition to its encompassing and versatile presence, economic engineering occupies a prominent position as it is considered an area of great relevance in civil engineering courses, being included in the curriculum, most of the time, as a mandatory subject for the training of students. Financial education, due to its essential character, promotes the development of critical thinking of its respective students in the monetary field, giving them more than just instructions on how to use their money, but also awareness of the importance of their financial decisions through their daily lives, recognizing the existence of the interdependence of economic knowledge and social activity (Rocha, 2025; Medeiros *et al*., 2024).

Blank and Tarquin (2009) emphasize that its presence in the career of civil engineers is not merely by chance and justify their thesis by reporting that professionals "play an important role in investment decisions, based on their analyses, syntheses and efforts in the project" in which they are involved. In this way, it is possible to understand that such a specialized individual is not only a designer and executor of works, but also a direct collaborator in their management, because for large projects or with a higher level of complexity, acceptable and concise opinions are necessary, taking into account the economic and technical factors present in them, such as the estimated budget, costs, quality of materials and respect for technical standards of construction and environmental sustainability.

2.2 CURRENT LABOR MARKET

The current job market for civil engineers presents significant difficulties for professionals who want to work actively in the area. This reality has multiple reasons, one of which is the high demand of companies and organizations in relation to candidates. For current applications, it is essential that the candidates' resumes present not only the academic background and technical knowledge of their respective area, but also elements that make them stand out from their competitors. This dynamic of high demand, however, did not arise suddenly or randomly. Monte and Marinho (2025) point out that the transformation of the market is a direct reflection of the socioeconomic changes driven by the *Toyotism*, a production model that, in the 1970s, became an example of industrial efficiency and established a new standard of organizational work practices. Due to the impacts caused by this production model, the authors mention that, in the current context, "the worker has to have the competence to be flexible, multifunctional and with the ability to adapt to new areas and situations".

Garcia *et al* (2025), through the report *European Year of Skills: Skills Shortages, Recruitment and Retention Strategies in Small and Medium-sized Enterprises,* prepared by the European Commission in 2023 to analyze data related to the academic qualification of workers and the importance of this competence for success in the European labor market, and its percentage data, confirms the point defended by the authors, presenting the significance of accuracy in being able to perform diversified functions within a company. This means that current professionals need to have the ability to develop complementary skills, such as complex problem solving, advanced critical thinking and effective communication, flexibility and adaptability to recent technologies and work methodologies, among other differentials, especially if they are required outside the national territory.

In this perspective, Oliveira *et al* (2025) argues that:

> "Financial education is crucial for the formation of skills that go beyond technical knowledge, helping to make assertive decisions in the job market and in personal life. In a context of increased access to credit and demands for financial planning, knowing how to manage resources has become an essential skill."

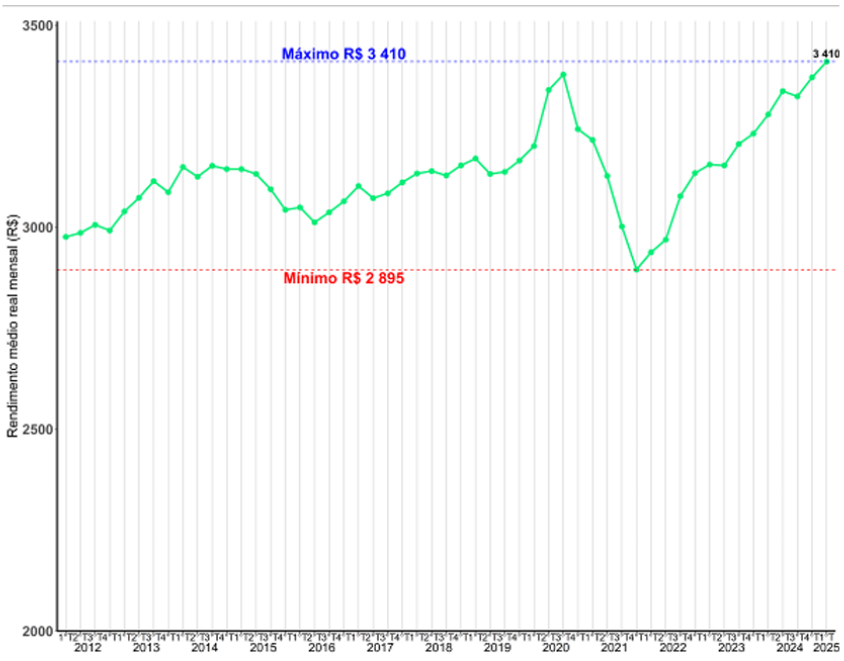
2.3 REALITY OF STUDENTS AFTER GRADUATION IN BRAZIL

University education, within the Brazilian labor market, has become an object of idealization for those who seek to show an adequate and qualified curriculum in it, standing out from the

competition. Silva (2025) presents, through his thesis elaborated in a case study of three private universities of civil engineering in São Paulo, that the graduate students gained greater employment relevance because they had an undergraduate degree. According to some of the interviewees by the author, the curriculum of their respective universities served as a positive factor for them to have a certain prominence in the job market, alleging specific points such as "access to technical knowledge through extracurricular courses", "disciplines linked to the realization of real case projects" and case studies that managed to bring together the content of the disciplines in a single project. In the thesis, the author also mentions that the interviewees had a salary range that was above three minimum wages, something that, according to data obtained by the Brazilian Institute of GeoFigurey and Statistics (IBGE), exceeds the estimated value of R$ 3410 of average monthly income from all jobs in the first quarter of 2025.

Figure 1

Figure of Average real earnings usually received by persons aged 14 years and over, employed in all jobs - Brazil - 2012 to 2025 - (in R$)



Source: IBGE (2025).

2.4 ALUMNI AND IMPACT EVALUATION OF ACADEMIC TRAINING

In the current scenario of higher education, the evaluation of the impact of academic training on professional careers has been gaining more and more significance. This practice

aims to understand the extent to which the topics covered during graduation contribute effectively to the job market and to the development of the professional. According to Tahim (2011), this measurement is not a current concern, but has become a theme on the rise, taking into account the constant search for the quality of all processes, such as the academic one. Thus, by analyzing this influence, it is possible to verify and verify improvements in this process that help students to exercise the profession.

In the scenario of undergraduate courses in Civil Engineering, the discipline addressed in this study is constantly associated with strategic training, focused on decision-making, critical and financially based thinking. Qualifying the absorption of graduates in relation to the contribution of Economic Engineering allows us to think about its practical application and about the training of engineers in question to deal with daily problems of their training. Taking this into account, Pimenta and Anastasiou (2014) argue that: "The university needs to train critical professionals who are prepared to face complex situations in the world of work"; Thus, when reflecting on the contribution of the discipline to education, one can observe the need for its adequate insertion.

3 METHODOLOGY

The research has an exploratory character, as it seeks to assimilate and understand facts, seeking answers to the indicated questions (Losch *et al*., 2023), aiming to unveil and analyze the contribution of the economic engineering subject present in the course curriculum. With a descriptive analysis, seeking to explain a series of events or factors or the relationship of a certain number of variables in a sample (Gil, 1999). The study began with biblioFigureic research on the subject of economic engineering and the contents studied in it.

At the same time, a questionnaire was prepared based on the subjects foreseen in the course syllabus, relating to the possible applications in the career of civil engineers. This questionnaire was prepared to carry out the field research with open and closed questions, described in Chart 1, through *Google Forms,* where it was applied to a sample of 61.54% of the graduates of the civil engineering course at the *IFPB Patos Campus, which corresponds to 8 respondents.*

Subsequently, a qualitative-quantitative analysis was carried out, associating the qualitative study with the quantitative, enhancing the verification of these aspects, as it says (Schneider et al., 2017) "Qualitative research can be supported by quantitative research and

vice versa, enabling a structural analysis of the phenomenon with quantitative methods and a procedural analysis through qualitative methods.", which was carried out based on the data obtained through the field study, which analyzed them thoroughly, with the objective of understanding the impact of economic engineering on the professional life of people graduated in the civil engineering course.

Table 1

Questions asked in the questionnaire

QUESTION	AUTHORS	ALTERNATIVES
1. Age	Elaborated by the authors themselves	Open-ended question
2. Year of completion of the course	Elaborated by the authors themselves	Open-ended question
3. Time working in civil engineering	Elaborated by the authors themselves	Open-ended question
4. Financial Mathematics and the Time Variable (simple and compound interest)	Elaborated by the authors themselves	Little, partially, quite a lot
5. Amortization Methods	Elaborated by the authors themselves	Little, partially, quite a lot
6. Decision-making methods (Payback, NPV and VFL, IRT and TRIM)	Elaborated by the authors themselves	Little, partially, quite a lot
7. Renovation and Replacement of Equipment Depreciation theory.	Elaborated by the authors themselves	Little, partially, quite a lot
8. Project Analysis (analysis of ratios, risk and uncertainty)	Elaborated by the authors themselves	Little, partially, quite a lot
9. Capital Markets (leverage, working capital, cost of capital)	Elaborated by the authors themselves	Little, partially, quite a lot
10. In which contexts did you use this knowledge the most?	Elaborated by the authors themselves	Planning and budgeting of works, Feasibility assessment of enterprises, Management of companies or own businesses,

		Participation in bids, Public tenders, others
11. What content do you believe should be more in-depth or updated?	Elaborated by the authors themselves	Open-ended question
12. Is there any content that was not covered and that you consider important to include in the course?	Elaborated by the authors themselves	Open-ended question

Source: Authors (2025).

4 RESULTS AND DISCUSSIONS

The analysis of the answers obtained through the questionnaire applied to 61.54% of graduates of the Civil Engineering course at the IFPB's Patos Campus, allowed to identify how much the contents covered in the discipline of Economic Engineering are used in the daily life of civil engineers, as well as the perceptions about its applicability and suggestions for improvements.

Some data were collected to outline the profile of the graduates, explained in Table 2, among them, the age group, in which most are between 23 and 25 years old; the year of completion of the course, most of it ended in 2025; and the time of work in civil engineering, with half of the sample from 0 to 6 months, and the rest being from 6 months to approximately 1 year, making juvenile properties notorious to graduates of the course and at the beginning of their careers. This data is relevant, as little experience can influence the frequency and perception of the application of the contents.

Table 2

Profile of Graduates

DATA	ANSWERS	FREQUENCY
	23	1
	24	2
	25	2
	26	1
Age	28	1

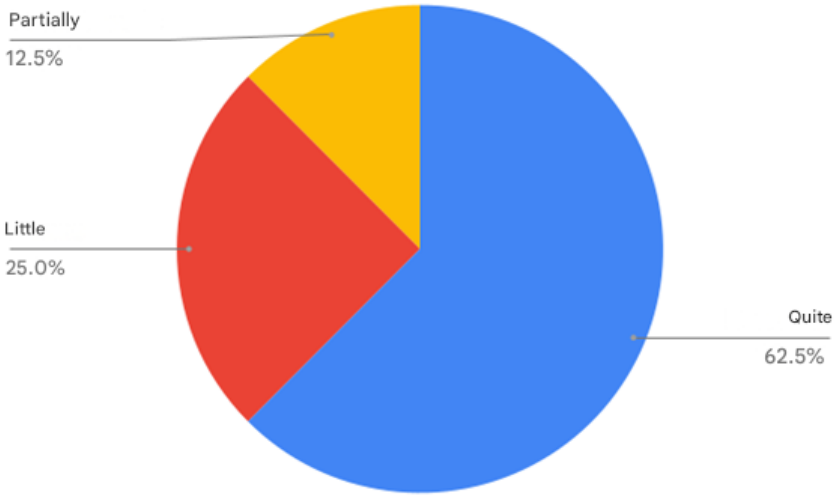
	37	1
Year of completion	2024	3
	2025	5
Time working in civil engineering	0	1
	1 month	1
	4 months	1
	6 months	1
	8 months	1
	1 year	3

Source: Authors (2025).

With regard to the use of Financial Mathematics and the time variable (simple and compound interest), it was observed that the majority of the participants 62.5% stated that they used these concepts a lot in their professional performance, while 25% stated that they used them little and 12.5% partially. Therefore, these results indicate that these contents are significantly applied in the work routine, collaborating in the analysis of the value of money in time.

Figure 2

Use financial mathematics and time variable

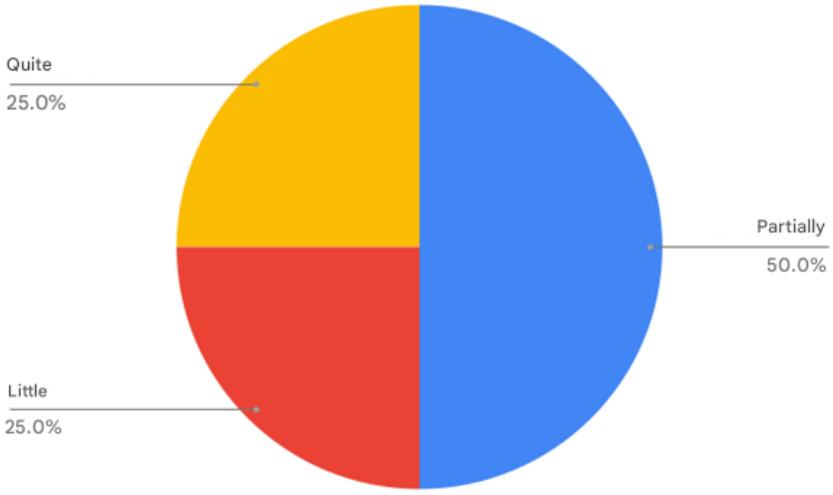


Source: Authors (2025).

As for the amortization methods, the perception was more balanced: 50% of the graduates stated that they use it partially, 25% little and 25% a lot. This scenario suggests that its practical application may be linked to specific circumstances, such as in the case of financing and credit operations, not encompassing all the profiles of professionals.

Figure 3

Using amortization methods

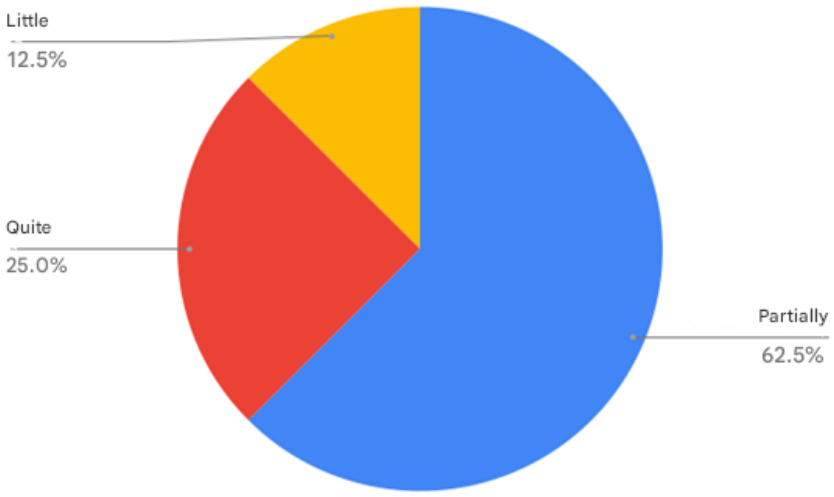


Source: Authors (2025).

In the application of decision-making methods (Payback, NPV, VFL, TRI and TRIM), 62.5% of the respondents stated that they use it partially, 25% a lot and 12.5% little. In this sense, the predominance of the category partially indicates that the perfect use of these methods is limited, some of the possibilities of this limitation are: the complexity of the calculations, absence of specialized software in the work environment or little direct demand for this type of analysis in certain positions.

Figure 4

Use of decision-making methods

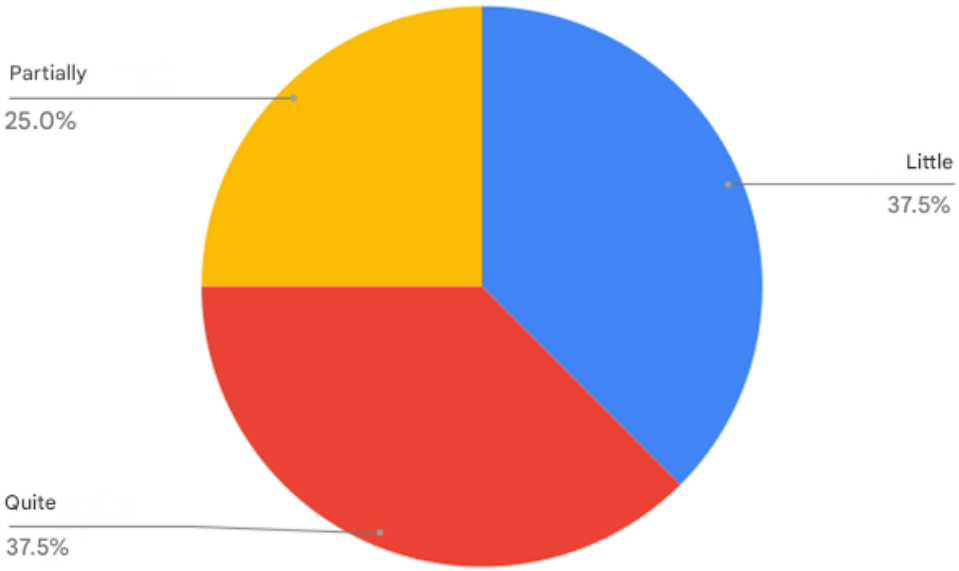


Source: Authors (2025).

In the item renewal and replacement of equipment, including the depreciation theory, the balanced distribution was: 37.5% use little, 37.5% a lot and 25% partially. This may be associated with the plurality of fields of activity in the area studied, given that not all professionals work directly with equipment.

Figure 5

Use of Equipment Renewal and Replacement Depreciation Theory

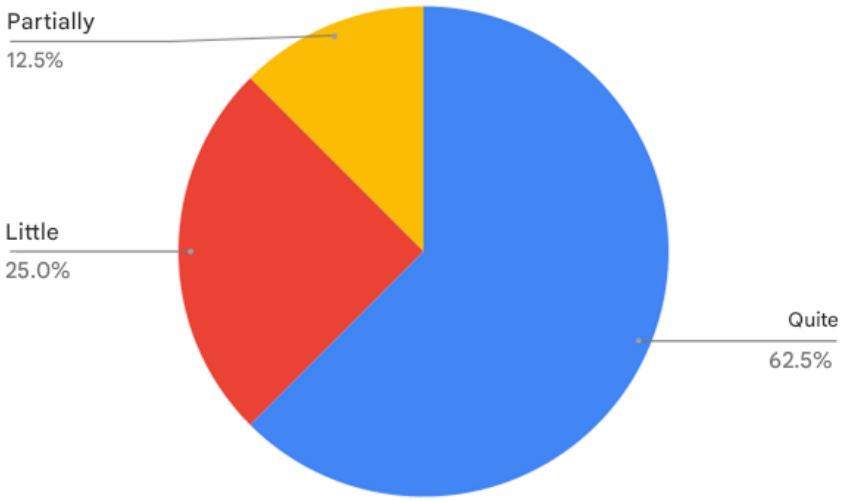


Source: Authors (2025).

The analysis of projects, which involves the evaluation of indexes, risks and uncertainties, presented results similar to those of Financial Mathematics: 62.5% use it a lot, 25% little and 12.5% partially. These numbers reinforce the significance of this content, especially in functions that are linked to planning and managing works, which decision-making needs to consider technical and economic variables at the same time.

Figure 6

Using Design Analysis

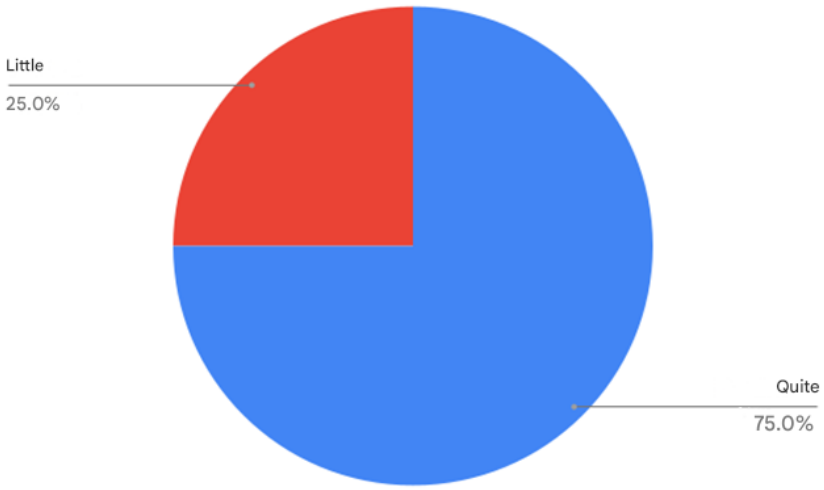


Source: Authors (2025).

On the topic of capital markets (leverage, working capital and cost of capital), 75% of the participants stated that they use it a lot and 25% a little, with no answers to partially. This data highlights that the understanding of business operations and financial flows is too applicable on the part of graduates.

Figure 7

Use of the capital market



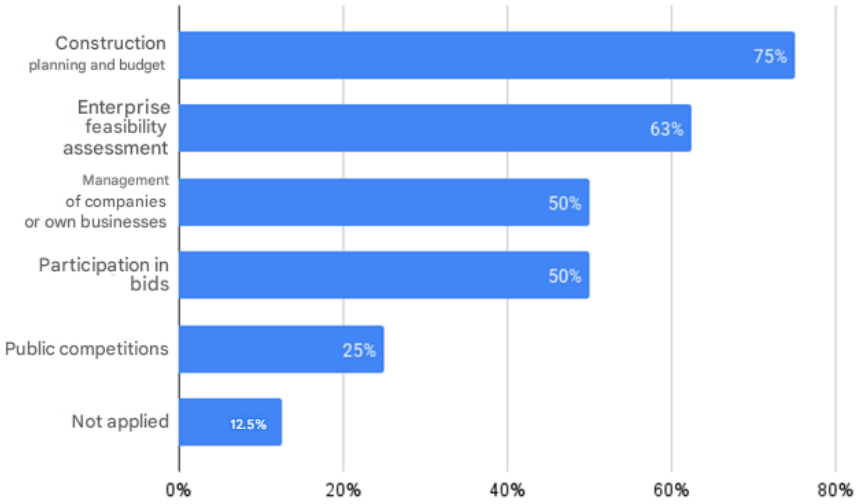
Source: Authors (2025).

In summary, the most used contents are: Financial mathematics and the time variable (simple and compound interest), as well as analysis of projects involving the evaluation of indexes, risks and uncertainties, as well as capital markets. The topic related to the renewal and replacement of equipment, including the theory of depreciation, is widely used by some, although not all. On the other hand, the topics on amortization methods, decision-making methods are used partially.

Regarding the contexts of application of the knowledge of the discipline, the answers indicated as the main uses: planning and budgeting of works with 75%, feasibility assessment of enterprises with 62.5%, management of companies or own businesses with 50% and participation in bids with 50%. Also, 25% mentioned the use in public exams, while only 12.5% said they had not applied the knowledge. These variables demonstrate that Economic Engineering contributes broadly to different sectors in which an engineer can apply his knowledge.

Figure 8

Most used contexts



Source: Authors (2025).

In addition, open questions were also asked to the interviewees. Regarding the question of which contents the graduates believe should be deepened or updated in the discipline, it was suggested from amortization methods, working capital and cost of capital, to risk analysis, projects and decision making. The need for the discipline to bring these themes to the practice of civil engineering was also mentioned, not only presenting the theory of the subjects, but how it is applied in the daily life of the civil construction professional. Depreciation theory and bidding processes, of paramount importance in the administrative scope of the profession, were also mentioned.

Finally, with regard to any suggestion of content that was not addressed in the course and that is considered necessary to be dealt with in it, the majority answered that they did not consider it necessary, because the course syllabus is already very complete. However, it was proposed to include bidding and more practical examples of investment and budgeting.

5 CONCLUSION

The study allowed us to understand how the knowledge of economic engineering contributes to the work practices of civil engineers. In it, it was evidenced that the discipline of Economic Engineering plays a fundamental role in the training of civil engineers from the IFPB's Patos Campus, contributing significantly to professional performance in different contexts of civil construction. The results obtained through the field research indicated that

contents such as project analysis and capital markets have high practical applicability, reinforcing the relevance of skills aimed at resource management, investment evaluation and technical decision-making based on economic and financial criteria. Such knowledge is essential to deal with the difficulties present in the field of civil construction, as it helps in making more assertive decisions.

At the same time, it was also observed that topics such as amortization methods, advanced decision-making and depreciation theory, despite being considered important, are applied in a partial or restricted way, often due to the specificities of the position occupied or the absence of adequate technological resources. In addition, the open responses revealed that there is a need to intensify and/or update some issues in the matter such as: amortization methods, working capital and cost of capital, risk analysis, projects and decision making. It was also suggested to include bidding and more practical demonstrations of investment and budgeting, with the intention of bringing the theoretical study closer to the real demands of the labor market.

It is indicated, therefore, that in future studies a research should be carried out in more than one educational institution so that a more comprehensive view of the impact of economic engineering on the career of professionals who graduated from the civil engineering course can be obtained, from the perspective of other people who were trained in different academic contexts. Therefore, with the expansion of the scope of the research, it will be possible to identify possibilities for curricular improvement, which are in accordance with the demands of the civil engineering sector.

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