IJIE Iberoamerican Journal of Industrial Engineering

The Influence of Investments in Education, Work Safety and Training in Accident Prevention on Corporate Sustainability Report – Case study at Petrobrás

A Influência de Investimentos em Educação, Segurança do Trabalho e Capacitação na Prevenção de Acidentes no Relatório de Sustentabilidade Empresarial – Estudo de Caso na Petrobrás

Laise Novellino Nunes de Souza[1], Habib Salomon Dumet-Montoya[2], Jader Lugon Junior[3*]

[1 3*] Instituto Federal Fluminense, Rio de Janeiro, Brazil [2] Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil
[1] lalanovellino@hotmail.com [2] habib@macae.ufrj.br [3*] jlugonjr@gmail.com
***Corresponding Author: Lugon Junior, J.**

ABSTRACT: The objective of this study was to verify, via a linear regression model, the influence of Petrobras investments in relation to the number of accidents with time away from work in annual values, during the period from 2001 to 2023 according to company reports. Investments in education; training and professional development; in occupational health and safety; in the sum of training and professional development with worker safety and health; and in the sum of education with training and professional development with worker safety and health were considered. The information was obtained by searching Petrobras Sustainability Reports for indicators related to Occupational Safety from 2001 to 2023. The analysis of the results allows us to conclude that joint investments in education, occupational health and safety, and training and professional development, generated a reduction in the number of accidents with time away from work. In particular, investments in occupational health and safety generated the greatest impact on the reduction of accidents

KEYWORDS: Work safety; Occupational medicine; Occupational hygiene.

RESUMO: O objetivo desse trabalho foi verificar a influência, via modelo de regressão linear, dos investimentos da Petrobrás em relação ao número de acidentados com afastamento do trabalho em valores anuais, durante o período de 2001 a 2023 segundo relatórios da empresa. Foram considerados os investimentos em educação; capacitação e desenvolvimento profissional; em Segurança e saúde no trabalho; na soma de capacitação e desenvolvimento profissional com segurança e saúde do trabalhador; e na soma de educação com capacitação e desenvolvimento profissional com segurança e saúde do trabalhador. As informações foram obtidas por meio da realização de uma busca, nos Relatórios de Sustentabilidade da Petrobras, de indicadores referentes à Segurança do Trabalho desde 2001 até 2023. A análise dos resultados permite concluir que os investimentos conjuntos em educação, segurança e saúde do trabalho, e capacitação e desenvolvimento profissional, geraram uma redução no número de acidentes com afastamento no

trabalho. Em particular, os investimentos em segurança e saúde do trabalho geraram o maior impacto na diminuição de acidentes.

PALAVRAS CHAVE: Segurança do trabalho; Medicina do trabalho; Higiene ocupacional.

1. Introduction

In January 2023, the Ministry of Mines and Energy launched the three-year work plan, from 2023 to 2025, for the National Hydrogen Program, aiming to lay the foundations for the hydrogen market in Brazil. The corporate sector, particularly oil companies, interested in hydrogen production, has been promoting offshore wind power generation. In December 2022, 70 projects were filed for environmental licensing with the Brazilian Institute of Environment and Renewable Natural Resources, in Portuguese, Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA (Furtado; Paim, 2024). This shows that even in fossil fuel-based energy production companies there is a growing trend in investment in renewable energy.

In 2008, Petrobras, the Brazilian Oil Company, installed a Research Center in its Rio de Janeiro (in portuguese Centro de Pesquisas no Rio de Janeiro - CenPes), a pilot plant to produce ethanol through the enzymatic hydrolysis process and the second phase was implemented in 2010 at the Bioethanol Science and Technology Center, in Campinas, São Paulo, also in 2010, the National Laboratory of Bioethanol Science and Technology was created (in portuguese Laboratório Nacional de Ciência e Tecnologia do Bioetanol - CTBE), linked to the Ministry of Science and Technology, with the objective of making viable Brazil's intention to replace 10% of all gasoline consumed in the world by 2025 (Soutinho; Rosário; Lima, 2019).

In 2019 the National Laboratory of Science and Technology of Bioethanol (in portuguese Laboratório Nacional de Ciência e Tecnologia do Bioetanol - CTBE) becoming known as the National Biorenewables Laboratory (in Portuguese Laboratório Nacional de Biorrenováveis - LNBR). The change was made to accommodate the laboratory's expanded research and operations in biotechnology. Since then, in addition to ethanol, the scope of research has also included biochemicals and biomaterials.

Every industry, including the oil and gas industry, must pay the best possible attention to industrial hygiene aspects, given the magnitude of the activity risk level for each employee. Industrial hygiene is the study of how to anticipate, recognize, assess, and control workplace conditions that can lead to illness or injury. Oil and gas companies face the challenge of how to reduce the impact on occupational health (Zahara; Mushalia; Iridiastadi, 2012).

Considering a platform that is located in the transition zone between shallow waters and the surf zone, due to the interaction of the waves with the ocean floor, the significant heights will be greater, and an increase in wave height will increase the power (80%), which makes this type of platform an attractive location for the installation of a wave converter plant, it was found that the most energetic period for the use of wave energy is winter, with the highest power found being 3.2 kW (Zandomenego; Schmidt; D'Aquino, 2016).

In New York in 1913, a meeting of safety professionals, insurance experts, civil servants, and administrative leaders was held to highlight the issue of occupational health and safety. One outcome of the meeting was the creation of the "National Safety Council", and later, several organizations were introduced, including the "British Safety Council" and the "International Labor Organization". In 1973, in the United States of America (USA), the "Occupational Safety and Health Act" (OSHA) was introduced and later other countries such as Australia and the United Kingdom took similar measures. (Ajmal et al., 2022).

According to Alimin; Syahidah; Sushandoyo (2023), Occupational Safety and Health are prioritized in the Oil and Gas Industry. This is not only due to the high risk nature of this sector but also plays a role in maintaining a company's reputation as it develops its business. If a company's occupational safety and health record is poor, investors will reconsider investing in it.

According to Moura Pereira et al. (2022), most data on Work Accidents in Brazil refer to the last 20 years. This data is spread across several databases, such as those of the Public Ministry of Labor (in portuguese Ministério Público do Trabalho - MPT) and Labor Auditors, which makes accuracy difficult, as well as the real scenario of Occupational Health and Safety (in portuguese Saúde e Segurança do Trabalho - SST) in Brazil.

Other reference bases are the National Institute of Social Security, in portuguese Instituto Nacional de Seguridade Social – INSS (INSS is a social benefit in Brazil that provides insurance for absences due to health-related accidents and, after a specified contribution period, provides a retirement pension. The amount is guaranteed by mandatory contributions from active formal workers, combined with contributions from the company and the government. "Formal" work in Brazil refers to workers under the Consolidation of Labor Laws, in portuguese Consolidação das Leis do Trabalho -CLT, which are the laws that guarantee minimum benefits for the worker, such as a minimum wage or minimum remuneration for work, 30 days of paid vacation - usually one salary plus 1/3 of salary - and working day that define the daily working hours), and the Ministry of Labor and Employment (in portuguese Ministério do Trabalho e Emprego - MTE) with Annual Social Information Report, in portuguese Relatório Anual de Informações Sociais - RAIS (Brasil, 2022).

According to Aguiar and Ribeiro (2018), there is an influence of investment in health, education and safety and occupational medicine on the number of accidents, with evidence that these variables would be important for the prevention of work accidents.

2. Objective

The objective of this work is to verify the influence of investments in education, training and professional development and occupational health and safety, in relation to the number of accidents with absence from work, in annual values, during the period from 2001 to 2023, according to Petrobras reports, and through a linear regression model.

3. Methodological Procedures

A search was conducted in Petrobras Sustainability Reports for indicators related to Occupational Safety from 2001 to 2002 (Petrobrás, 2002), from 2003 to 2004 (Petrobrás, 2004), and from 2005 to 2023 (Petrobrás, 2023a). Regarding occupational safety, the following indicators were found:

- Recordable Accident Rate per Million Man-Hours, in portuguese Taxa de Acidentados Registráveis por milhão de homens-hora (TAR), that is, the number of recordable accidents per million man-hours of exposure to risk. This includes typical cases of injuries without time off work (excluding first aid cases), injuries with time off work, cases of occupational diseases, and fatal accidents. This indicator was obtained from the 2015 Reports.

- Fatal Accident Rate, in portuguese Taxa de Acidentados Fatais- TFAT (fatalities per 100 million man-hours of exposure to risk – includes employees and outsourced workers). This indicator was found it until 2015.

- Lost Time Injury Frequency Rate or Lost Time Incident Frequency Rate – LTIFR, in portuguese Taxa de fatalidades com afastamento -TFCA, that is the number of incident victims with absence from work due to typical accidents, or cases of occupational disease per million man-hours of exposure to risk. This indicator was found in all reports from the period considered for analysis and for this reason, only this indicator will be considered in this work.

For this same period, from 2001 to 2023, a search was made for the values of investments related to workers, found in the tables under Internal Social Indicators in the Sustainability Reports, in the Financial Statements Report (Petrobrás, 2023b) for the years 2006 to 2022 and for the year 2023 the Management Report (Petrobrás, 2023c). Regarding internal social indicators, investments in Education, Training and Professional Development (investments in Training in graph) and Occupational Health

and Safety (Occupational Safety in graph) were considered.

To analyze the Internal Social Indicators in relation to the indicators related to Occupational Health and Safety, a regression method was adopted (polynomial in terms of investments) but linear in terms of the adjustment parameters, which allows finding a mathematical expression for the LTIFR in relation to the investments mentioned above.

This method consists of determining the set of parameters $\boldsymbol{\Theta}$ of a function $\mathbf{Y}(\boldsymbol{\Theta})$ from the minimization of the Chi-square function (χ^2) in the form:

$$\chi^2 = \frac{1}{N}\sum_{i=1}^{N}[y_i(x_i) - \mathbf{Y}_i(\boldsymbol{\Theta}, x_i)]^2, \quad (1)$$

in which x_i corresponds to the values of investments made each year according to the company's information. For simplicity, we will assume polynomial functions to represent the function $\mathbf{Y}(\boldsymbol{\Theta})$. For minimize the function given in Equation (1) the Program was used MINUIT (James; Roos, 1998) of the European Organization for Nuclear Research (CERN). With this program, written in FORTRAN 77, the parameters (with their respective errors) of the proposed models were determined. Then, 5 (five) analyses were proposed, namely:

- Type I: LTIFR in terms of Investments in Education.
- Type II: LTIFR based on Investments in Training and Professional Development (investments in Training in graph).
- Type III: LTIFR due to Investments in Occupational Health and Safety (Occupational Safety in graph).
- Type IV: LTIFR based on the sum of Type II and III Investments; and
- Type V: LTIFR based on the sum of investments of types I, II and III.

4. Results and Discussions

In tables 1, 2, 3, 4, and 5, the results of the analyses were recorded, considering polynomial functions of 3rd (third degree) or 4th (fourth degree),

$$LTIFR = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4, \quad (2)$$

in which x corresponds to the investment. The quality of the fit was obtained using the value of the Incomplete Gamma Function (Press, 2007).

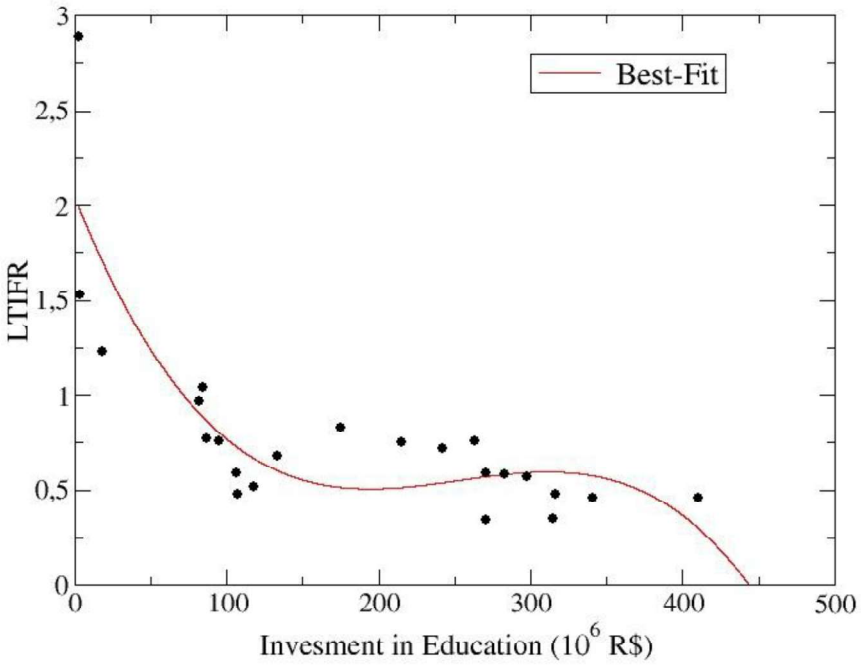
Figures 1, 2, 3, 4, and 5 represent the linear fit of the data presented in Tables 1, 2, 3, 4, and 5, respectively. According to the graphical result illustrated in Figure 1, it can be observed that the increase in Education Investment has an impact on the LTIFR, and that for investments above R$450 million, the adjustment extrapolates to a value close to zero, considering current inflation rates. Nevertheless, from R$400 million onwards, the LTIFR presents a value of 0.5.

Table 1: Polynomial functions for investments in education.

Parameters	Type I
$a_0 \pm \sigma_0$	$2{,}04 \pm 0{,}26$
$a_1 \pm \sigma_1$	$-2{,}00 \times 10^{-2} \pm 2{,}39 \times 10^{-3}$
$a_2 \pm \sigma_2$	$8{,}34 \times 10^{-5} \pm 6{,}16 \times 10^{-6}$
$a_3 \pm \sigma_3$	$-1{,}10 \times 10^{-7} \pm 1{,}83 \times 10^{-8}$
$a_4 \pm \sigma_4$	---
x^2_{min} , $Q(\frac{\nu}{2}, \frac{x^2}{2})$	$9{,}32 \times 10^{-2}$; $1(0.99999999999992084)$

Source: Prepared by the authors (2025).

Figure 1: Graph of investments in education.



Source: Prepared by the authors (2025).

Analyzing the results of the graph illustrated in Figure 2, there was no improvement in the rates related to the number of workplace accidents resulting in lost time with increased investment in training and professional development. This result

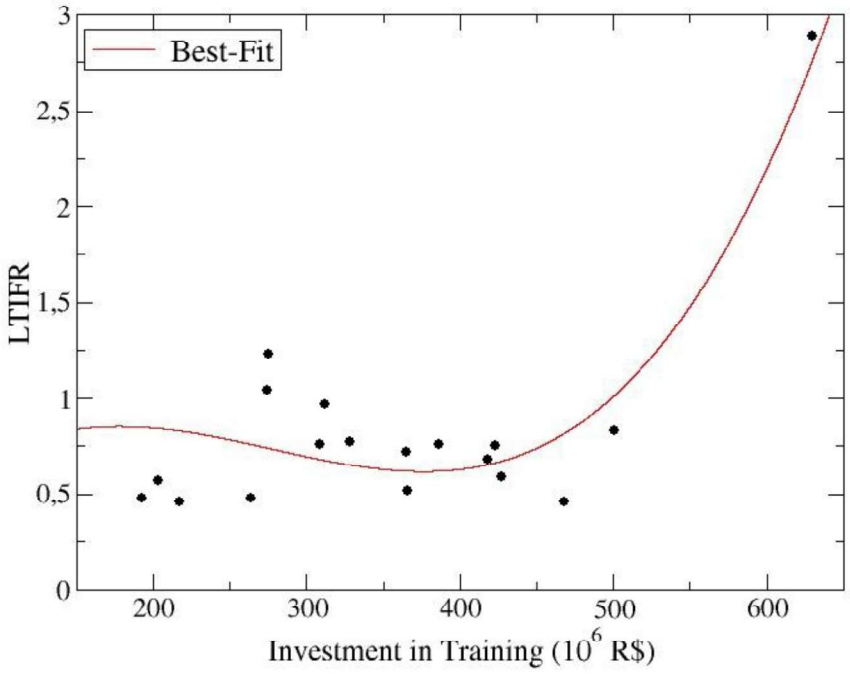
can be explained by the fact that investment was not specifically directed to the areas of engineering and occupational safety or occupational medicine. Rather, it was directed to any and all professional areas related to Petrobras activities

Table 2: Polynomial functions for investments in training and professional development.

Parameters	Type II
$a_0 \pm \sigma_0$	$-0{,}55 \times 10^{-1} \pm 0{,}95$
$a_1 \pm \sigma_1$	$0{,}12 \times 10^{-1} \pm 0{,}11 \times 10^{-1}$
$a_2 \pm \sigma_2$	$-0{,}50 \times 10^{-4} \pm 0{,}40 \times 10^{-4}$
$a_3 \pm \sigma_3$	$0{,}61 \times 10^{-7} \pm 0{,}41 \times 10^{-7}$
$a_4 \pm \sigma_4$	---
x^2_{min} , $Q(\frac{\nu}{2}, \frac{x^2}{2})$	$9{,}2 \times 10^{-2}$; $1(0.99999999999993605)$

Source: Prepared by the authors (2025).

Figure 2: Graph of investments in training and professional development.



Source: Prepared by the authors (2025).

In relation to the graph illustrated in Figure 3, the increase in investments in occupational health and safety generated a decrease in the number of work accidents

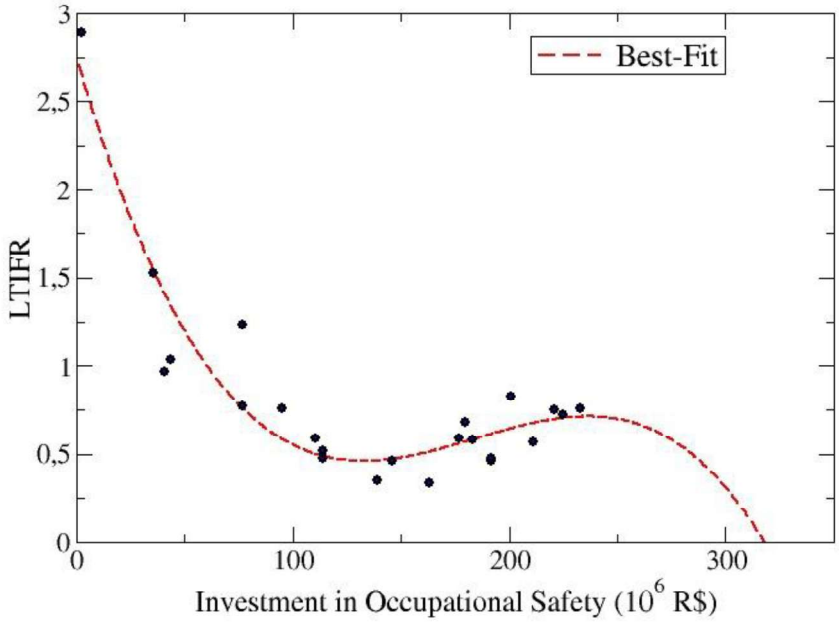
with time off, which reinforces the importance of investment in this area.

Table 3: Polynomial functions for investments in occupational health and safety.

Parameters	Type III
$a_0 \pm \sigma_0$	$2{,}76 \pm 0{,}42$
$a_1 \pm \sigma_1$	$-0{,}43 \times 10^{-1} \pm 0{,}57 \times 10^{-2}$
$a_2 \pm \sigma_2$	$0{,}25 \times 10^{-3} \pm 0{,}45 \times 10^{-4}$
$a_3 \pm \sigma_3$	$-0{,}45 \times 10^{-6} \pm 0{,}17 \times 10^{-6}$
$a_4 \pm \sigma_4$	---
x^2_{min} , $Q(\frac{\nu}{2}, \frac{x^2}{2})$	$3{,}94 \times 10^{-2}$; 1

Source: Prepared by the authors (2025).

Figure 3: Graph of investments in occupational health and safety.



Source: Prepared by the authors (2025).

According to the graph illustrated in Figure 4, investments in training and professional development combined with investments in education also led to a drop in the number of work accidents with time off. However, as it was not a targeted investment, it did not have as much impact as that shown in Figure 5, which represents the graph of investments in occupational health and safety combined with investments in training and professional development and education, which portray both investments in general knowledge of the profession and those specific to the area of occupational

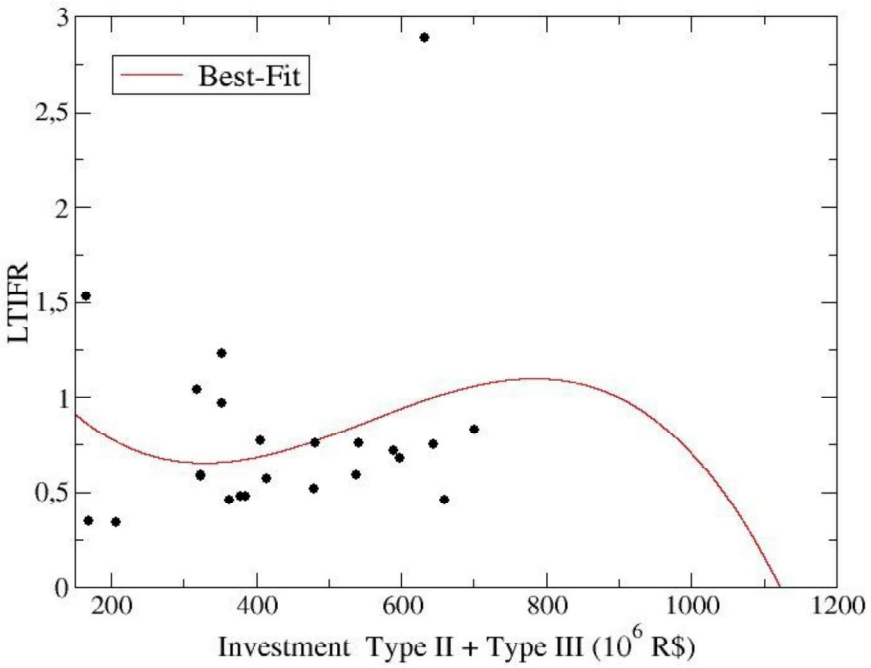
safety.

Table 4: Polynomial functions for investments in training and professional development and in worker health and safety.

Parameters	Type IV
$a_0 \pm \sigma_0$	$1{,}68 \pm 0{,}43$
$a_1 \pm \sigma_1$	$-0{,}72 \times 10^{-2} \pm 0{,}14 \times 10^{-2}$
$a_2 \pm \sigma_2$	$0{,}16 \times 10^{-4} \pm 0{,}18 \times 10^{-5}$
$a_3 \pm \sigma_3$	$-0{,}94 \times 10^{-8} \pm 0{,}24 \times 10^{-8}$
$a_4 \pm \sigma_4$	---
x^2_{min} , $Q(\frac{\nu}{2}, \frac{x^2}{2})$	$31{,}07 \times 10^{-2}$; $1(0.99998585165465215)$

Source: Prepared by the authors (2025).

Figure 4: Graph of investments in training and professional development and in worker health and safety.



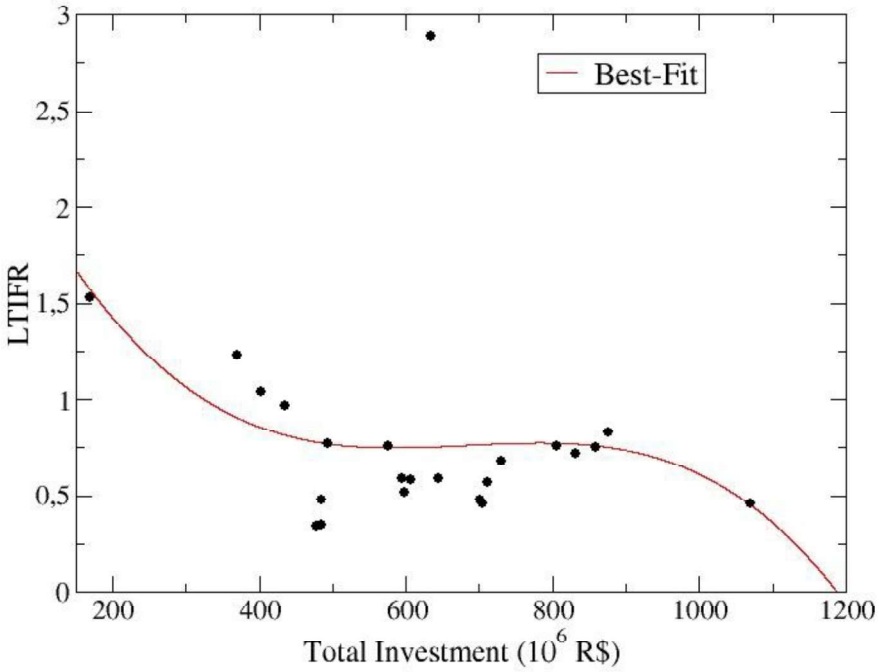
Source: Prepared by the authors (2025).

Table 5: Polynomial Functions for Total Investment (Type I, II and III).

Parameters	Type V
$a_0 \pm \sigma_0$	$2{,}77 \pm 2{,}27$
$a_1 \pm \sigma_1$	$-9{,}20 \times 10^{-3} \pm 1{,}19 \times 10^{-2}$
$a_2 \pm \sigma_2$	$1{,}38 \times 10^{-5} \pm 2{,}02 \times 10^{-5}$
$a_3 \pm \sigma_3$	$-6{,}71 \times 10^{-9} \pm 1{,}08 \times 10^{-8}$
$a_4 \pm \sigma_4$	---
x^2_{min} , $Q(\frac{\nu}{2}, \frac{x^2}{2})$	$29{,}24 \times 10^{-2}$; $1(0.99999379768475116)$

Source: Prepared by the authors (2025).

Figure 5: Total Investment Graph (Type I, II and III).



Source: Prepared by the authors (2025).

The values represented in the graphs are not in chronological order but rather based on the investments analyzed. It can be seen that at a certain point, represented in the graphs illustrated in Figure 1, Figure 2, and Figure 3, the number of workplace accidents with lost time tends to decrease sharply, and then increases again, even with increasing investments.

This small decrease in the number of workplace accidents resulting in lost time coincides with the coronavirus (COVID-19) pandemic, a period that resulted in fewer people working in person, an increase in remote work, and social isolation. This distancing of people due to the pandemic may have led to a decrease in the number of workplace accidents resulting in lost time, which was not due to the company's investments. As soon as the pandemic ended, the number of workplace accidents resulting in lost time returned to previous levels, even though the investments shown in each graph increased.

5. Final considerations

It can be concluded that joint investments in education, occupational health and safety, and professional training and development led to a reduction in the frequency of lost-time accidents. In particular, investments in occupational health and safety had the greatest impact on reducing the number of lost-time accidents.

Through a probabilistic forecast, and considering current inflation rates, investments in education would reach an optimal level in reducing the number of workplace accidents with time off work by 450 million reais, while investments in occupational health and safety would reach the same level at 350 million reais.

Analyzing, in isolation, investments in training and professional development, this parameter generated little impact on the reduction of workplace accidents with time off work. This can be explained by the fact that investment was not directed towards accident prevention and occupational medicine.

During the coronavirus (COVID-19) pandemic, there was a decrease in workplace accidents with time off, and with the return of activities, the accident rate rose, even with increased investments, in all graphs analyzed.

It is also possible to conclude that the investments used in this study by Petrobras make its activities more sustainable, as they are aligned with the Sustainable Development Goals (SDGs), reinforced in the company's sustainability reports (Petrobrás, 2023a). Some of these goals are cited in the sustainability reports, for example, on page 15 (fifteen) of the 2019 sustainability report, the base investments for this study seek to meet goal 8 (eight), "Decent work and economic growth"; goal 3 (three), "good health and well-being"; and goal 4 (four), "quality education," among others, part of the SDGs.

References

AGUIAR, L.; M. S. RIBEIRO, L. H. A INFLUÊNCIA DE INVESTIMENTOS NA SAÚDE, EDUCAÇÃO E SEGURANÇA E MEDICINA DO TRABALHO NA PREVENÇÃO DE

ACIDENTES: UM ESTUDO BASEADO EM RELATÓRIOS DA PETROBRAS | INFLUENCE OF INVESTMENTS IN HEALTH, EDUCATION AND SAFETY AND OCCUPATIONAL MEDICINE ON ACCIDENT PREVENTION: A STUDY BASED ON PETROBRAS REPORTS. . Available at: <https://www.researchgate.net/publication/330259535_A_INFLUENCIA_DE_INVESTIMENTOS_NA_SAUDE_EDUCACAO_E_SEGURANCA_E_MEDICINA_DO_TRABALHO_NA_PREVENCAO_DE_ACIDENTES_UM_ESTUDO_BASEADO_EM_RELATORIOS_DA_PETROBRAS> Accessed on August 13, 2025 (In portuguese).

AJMAL, M. et al. Safety-Management Practices and the Occurrence of Occupational Accidents: Assessing the Mediating Role of Safety Compliance. Sustainability, v. 14, n. 8, p. 4569, jan. 2022. https://doi.org/10.3390/su14084569

ALIMIN, A. R.; SYAHIDAH, S. N.; SUSHANDOYO, D. The Influence of Safety Slogan and Safety Program to Safety Culture: Case study at Drilling and Well Intervention Division one of Indonesia's Oil and Gas Company. European Journal of Business and Management Research, v. 8, n. 1, p. 64–70, 10 jan. 2023. https://doi.org/10.24018/ejbmr.2023.8.1.1768

BRASIL. Ministério do Trabalho e e Emprego (MTE). Relação Anual de Informações Sociais (RAIS). 2022. Available at: < https://www.gov.br/trabalho-e-emprego/pt-br/assuntos/estatisticas-trabalho/rais/rais-2022/sumario-executivo_rais_2022-1-1.pdf>. Accessed on August 13, 2025 (In portuguese).

FURTADO, F.; PAIM, E. Energia renovável e extrativismo verde: transição ou reconfiguração? | Renewable energy and green extractivism: transition or reconfiguration? Revista Brasileira de Estudos Urbanos e Regionais, v. 26, p. e202416pt, 7 out. 2024. https://doi.org/10.22296/2317-1529.rbeur.202416pt (In portuguese).

JAMES, F.; ROOS, M. MINUIT: Function Minimization and Error Analysis. 1998. Available at: < https://cds.cern.ch/record/2296388/files/minuit.pdf >. Accessed on August 13, 2025.

MOURA PEREIRA, D. A. et al. Análise do perfil dos acidentes do trabalho no Brasil entre 2014 e 2021 | Analysis of the profile of occupational accidents in Brazil between 2014 and 2021. Available at: < https://www.researchgate.net/publication/364310108_Analise_do_perfil_dos_acidentes_do_trabalho_no_Brasil_entre_2014_e_2021>. Accessed on August 13, 2025 (In portuguese).

PETROBRÁS. Relatório de Sustentabilidade da Petrobrás de 2002 (Dados de 2002 e 2001), 2002. Available at: < https://www.vibraenergia.com.br/sites/default/files/2021-07/relatorio-sustentabilidade-br-petrobras-2002.pdf>. Accessed on August 13, 2025 (In portuguese).

PETROBRÁS. Relatório de Sustentabilidade da Petrobrás de 2004 (Dados de 2003 e 2004), 2004. Available at: < https://www.vibraenergia.com.br/sites/default/files/2021-07/relatorio-sustentabilidade-br-petrobras-2004.pdf>. Accessed on August 13, 2025 (In portuguese).

PETROBRÁS. Relatórios Anuais | Relatórios Anuais de Sustentabilidade de 2007 a 2023 da Petrobrás. Petrobras, 2023a. Available at:

<https://www.investidorpetrobras.com.br/apresentacoes-relatorios-e-eventos/relatorios-anuais/>. Accessed on August 13, 2025 (In portuguese).

PETROBRÁS. Central de Resultados | Relatórios de Demostrações Financeiras 4T de 2023 até 2017. Petrobras, 2023b. Available at: <https://www.investidorpetrobras.com.br/resultados-e-comunicados/central-de-resultados/>. Accessed on August 13, 2025 (In portuguese).

PETROBRÁS. Central de Downloads | Relatórios Anuais de 2005 a 2023 da Petrobrás. Petrobras, 2023c. Available at: <https://www.investidorpetrobras.com.br/servicos-ao-investidor/central-de-downloads/>. Accessed on August 13, 2025 (In portuguese).

PRESS, W. H. (ED.). Numerical recipes in Fortran 77: the art of scientific computing. Modeling of Data - Chap 15. 2. ed., repr.corr. to software version 2.10 ed. Cambridge: Cambridge University Press, 2007. Available at: < https://www.aquila.infn.it/pierleoni/LFC/ROUTINES/Chap15.pdf>. Accessed on August 13, 2025.

SOUTINHO, L. C.; ROSÁRIO, F. J. P.; LIMA, A. A. DE. Mapeamento de rotas tecnológicas do setor sucro energético brasileiro. Mudança tecnológica na produção de etanol derivado da cana de açúcar | Mapping technological pathways in the Brazilian sugar-energy sector. Technological change in the production of ethanol derived from sugarcane. Revista Economia Política do Desenvolvimento, v. 6, n. 18, p. 80–89, 4 set. 2019. https://doi.org/ 10.28998/repd.v6i18.8660 (In portuguese).

ZAHARA, H. S.; MUSHALIA, S.; IRIDIASTADI, I. H. Industrial Hygiene Programs Design in the Oil & Gas Company. Procedia - Social and Behavioral Sciences, v. 65, p. 468–472, 3 dez. 2012. https://doi.org/ 10.1016/j.sbspro.2012.11.150

ZANDOMENEGO, R.; SCHMIDT, N. L.; D'AQUINO, C. DE A. ESTIMATIVA DO POTENCIAL PARA GERAÇÃO DE ENERGIA ELÉTRICA EM UMA PLATAFORMA DE PESCA NO SUL DE SANTA CATARINA | ESTIMATE OF THE POTENTIAL FOR GENERATION OF ELECTRICITY ON A FISHING PLATFORM IN THE SOUTH OF SANTA CATARINA. 2016. Available at: < https://labhidrogeo.paginas.ufsc.br/files/2016/08/1308-5363-1-RV_Final1.pdf>. Accessed on August 13, 2025 (In portuguese).

HISTÓRICO

ORIGINAL RECEBIDO EM : 29/08/2025
ACEITO PARA PUBLICAÇÃO EM: 02/12/2025

ANNEX I

Table 6: Locations researched in Petrobrás annual sustainability reports.

	Investments (in millions of R$)					
Year	**Occupational Health and Safety**	**Education**	**Training and Professional Development**	**Investment References**	**Reporting Year (Investments)**	**Pages**
2023	192,00	410,00	468,00	Administration Report (in portuguese Relatório de Administração)	2023	57
2022	146,00	341,00	217,00	Financial Statements Report [in portuguese Relatório de Demonstrações Financeiras (4T)]	2022	139
2021	163,00	271,00	44,00	Financial Statements Report	2022	139
2020	139,00	315,00	31,00	Financial Statements Report	2020	132
2019	192,00	316,00	193,00	Financial Statements Report	2019	136
2018	211,00	298,00	203,00	Financial Statements Report	2018	134
2017	183,00	283,00	141,00	Financial Statements Report	2018	134
2016	177,00	271,00	146,00	Financial Statements Report	2016	106
2015	233,00	263,00	309,00	Financial Statements Report	2016	106
2014	225,00	242,00	365,00	Sustainability Report (in portuguese Relatório de Sustentabilidade)	2015	70
2013	221,00	215,00	423,00	Sustainability Report	2013	62
2012	201,00	175,00	501,00	Sustainability Report	2013	62
2011	180,00	133,00	418,00	Sustainability Report	2011	94
2010	114,00	118,00	366,00	Sustainability Report	2010	170
2009	113,84	107,07	264,08	Sustainability Report	2010	170
2008	110,74	106,44	426,83	Sustainability Report	2008	128
2007	95,03	95,28	386,45	Sustainability Report	2008	128
2006	76,86	87,19	328,70	Sustainability Report	2006	132
2005	40,75	82,10	311,97	Sustainability Report	2005	124
2004	43,55	84,08	274,66	Sustainability Report	2005	124
2003	76,99	18,53	275,11	Sustainability Report	2004	92
2002	35,67	3,31	130,07	Sustainability Report	2002	63

Source: Prepared by the authors (2025).

Table 7: Values of the rates used in the research and their respective nomenclatures by year.

	Rate			References	
Year	Recordable Accident Rate (in portuguese Taxa de Acidentados Registráveis - TAR)	Lost Time Injury Frequency Rate (in portuguese Taxa de Acidentados com Afastamento - TFCA)	Fatal Accident Rate (in portuguese Taxa de Acidentes Fatais - TAF)	Sustainability Report of the year	Rate Page
2023	0,8	0,46	---	2023	209
2022	0,68	0,46	---	2023	209
2021	0,54	0,34	---	2023	209
2020	0,56	0,35	---	2023	209
2019	0,76	0,48	---	2019	209
2018	1,01	0,57	---	2019	21
2017	1,08	0,58	---	2019	21
2016	1,63	0,59	---	2019	21
2015	2,15	0,76	2,27	2015	48
2014	---	0,72	1,1	2015	48
2013	---	0,75	0,4	2015	48
2012	---	0,83	1,31	2015	48
2011	---	0,68	1,66	2015	48
2010	---	0,52	1,08	2010	134
2009	---	0,48	0,81	2010	134
2008	---	0,59	2,4	2010	134
2007	---	0,76	2,42	2010	134
2006	---	0,77	1,6	2010	134
2005	---	0,97	2,81	2005	57
2004	---	1,04	3,3	2005	57
2003	---	1,23	4,57	2005	57
2002	---	1,53	6,29	2005	57
2001	---	2,89	15,7	2005	57

Source: Prepared by the authors (2025).