

Chapter 15

Brazilian Model of Public Health System

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Unified Health System is the name of the Brazilian public health system created by the Federal Constitution of 1988 [1, 2, 3]. Among the units that constitute the Unified Health System, one can mention health centers, public hospitals, laboratories, blood centers [4, 5], services of health surveillance, epidemiological surveillance, environmental surveillance, as well as academic and scientific research foundations and institutes, such as Oswaldo Cruz Foundation and the Vital Brazil Institute [6, 7]. Therefore, the present work presents this model of public health system broadly.

15.1 Introduction

The development of a health model in Brazil was built based on philanthropy, most notably, charity (religious philanthropy) [8, 9], which counted still on the figure of the shaman and the apothecary [10, 11]. The main actions were carried out by the inspection of public hygiene and also by the separation of sick people from the rest of the population. It consisted of a treatment more focused on actions on the body and not on the environment. With the arrival of the Portuguese Royal Family, the first Brazilian medicine universities were founded, and the health situation started improving [12, 13]. It should be noted that the transfer of the royal family to Brazil in 1808 took place at a time when the scientific world was evolving, including medicine [14]. It is important to describe that, when they reached Rio de Janeiro, they found a city that was quite poor in terms of basic sanitation, as stated by Pinto [15]:

"Rio de Janeiro, until the arrival of the royal family in 1808, was an unhealthy, swampy city, with stagnant waters and few streets, growing disorderly. Water supply was difficult, there was no sanitation, there was a total lack of hygiene, there was no clarification since the population was practically all illiterate" [15, 16, 17].

Pinto also states that: "The population was prey acquiring diarrhea, dysentery, verminous, scabies, chiggers, grubs, and lice, not to mention epidemic and contagious diseases such as plague, smallpox, malaria, and yellow fever. The presence of the Portuguese court

in Brazil made the elites established in Rio de Janeiro gradually elaborate a project of "civilization" for the tropics" [18].

With the increased interest in diseases that until then were denied due to epidemics of smallpox and yellow fever (tropical diseases), Brazil began to join efforts to combat such diseases, as they also represented economic losses for the country [19]. It was also a way of "hiding" the reality that surrounded the federal capital [20].

15.2 Background

15.2.1 First Republic

After the proclamation of the Republic in 1889, sanitary problems persisted in the cities, which left them at the mercy of endemics and epidemics. The change in this paradigm began in 1897, with the creation of the General Directorate of Public Health, which, in 1903, under the coordination of Osvaldo Cruz, appointed by the President of the Republic, Rodrigues Alves, begins a home sanitation campaign, including the destruction of tenements and the removal of the poorest population to the outskirts [21]. This caused the so-called Vaccine Revolt. Some specific actions were also carried out, such as the hunting of mosquitoes or some specific disease; despite being drastic and controversial, such actions represented advances in the fight against epidemics, which spread easily through cities. Even though a large part of the population still did not have the resources to pay for health care [22].

After what happened at the time of Osvaldo Cruz, health reform was idealized in the country, which ended up being carried out in 1923, with the creation of the National Health Department, then linked to the Justice Ministry. Therefore, in that same year, the Eloy Chaves Law, with the emergence of the Social Security in Brazil, based on the collection of part of the employee's salary and part paid by the employer [23]. Still in the First Republic, bases were established for the creation of a national health system, characterized by the concentration and verticalization of actions in the central government [24].

15.2.2 Military Dictatorship

After the military coup, in 1964, and the advent of the so-called "Economic Miracle", the Civil-Military Government decided to centralize social security resources since, with the economic miracle, more work papers were signed, and as a result, more people sought health services, and, in this way, in November 1966, all institutes that served private sector workers were unified in the National Institute of Social Security. Such centralization represented a greater increase in the contracting of private health services to provide medical assistance to its policyholders. to the detriment of the pension's hospital units, which led to serious budget deficits and financial losses [25].

After the failure of the National Institute of Social Security, the National Institute of Medical Assistance of Social Security, in 1977, was created as a federal autarchy linked to the Ministry of Social Security and Assistance. As a differentiation from the old model, it had its own establishments, even though the procedures were carried out by the private sector, the idea being to fulfill the role of the assistance arm of the health system and the

health arm of the social protection system [5].

Analyzing the period, Felipe Asensi exposes that the use of health services was found to be linked to the employment situation, causing the exclusion of a relevant portion of the unemployed population, whether due to physical disabilities, insufficient education, or even structural inaccessibility to the formal labor market [7].

Workers who had a formal contract used the National Institute of Medical Assistance of Social Security services, and those who did not have a formal contract used, above all, the Holy Houses, philanthropic-religious institutions that supported needy citizens. Public Health in Brazil during the military regime began with a process of change that created the first foundations for the emergence of the Unified Health System in the 1990s. Ministry of Health is now active in the formulation of national health policy, outpatient medical care, health prevention, health control, and research in the health area. In this way, it ceased to be just a bureaucratic apparatus, effectively becoming an important body in the management and responsibility for conducting public health policies in the country [26].

15.2.3 New Republic

The oil crisis that hit the Brazilian economy in the second half of the 1970s and the beginning of the 1980s brought financial and political losses to the National Institute of Medical Assistance of Social Security. From the democratic opening to the New Republic, the social security deficit increased year after year. The specialized doctrine describes the period 1980-1983 in the field of social policies as the "social security crisis" [11].

Social Security in 1985 was considered bankrupt. Even skeptic people or those moved by personal and subaltern interests said that it was unfeasible. A diffuse conspiracy, for some not confessed, but insistent, announced its end as the responsibility of the State to save it and to preserve the Public Treasury. Because the Social Security deficit, insistent, catastrophic, would be irrecoverable [9].

The minister Francisco Dornelles, preparing to take over the ministry of Finance of the Tancredo Neves government dictated the maxim: "you should not hand over the Ministry of Social Security to any friend". The "bankrupt estate," an example of the impossibility of public administration, in the neoliberal view, could only have one destination: privatization. Starting with medical-hospital care, whose assets should be appropriated by private health insurance, in the sense of promoting a cut in the precarious capitalization of health in the sense of a more typically capitalist organization of the medical-business complex [13].

It should be noted that the discussion was not just about privatizing the model that existed until then under the military regime. Neoliberals would also oppose the provision of the Unified Health System in the constitutional sphere, during the constituent Assembly which resulted in the 1988 Constitution [14].

It was decided to convene the VIII National Health Conference, through a presidential decree, scheduling it to take place from March 17 to 21, 1986, in Brasília. The conference would be preceded by pre-conferences and preparatory state meetings to be held across the country and technical documents would be prepared that would serve as a basis for these previous meetings and theses to be debated at the VIII National Health Conference. Prof. Antônio Sérgio da Silva Arouca, president of Fiocruz, with Dr. Francisco Xavier Beduschi, superintendent of SUCAM and Guilherme Rodrigues da Silva, of FMUSP was designated

general rapporteur. The proposed themes were: "Health as a Right," "Reformulation of the National Health System," and "Sector Financing."

The implementation of the Unified Health System was carried out gradually: first came the universalization of care, then the incorporation of the National Institute of Medical Assistance of Social Security to the Ministry of Health, with Decree nº 99.060, and finally the Organic Health Law, nº 8.080, which founded and operationalized the Unified Health System. In a few months, Law nº 8.142 was launched, which gave the new system one of its main characteristics: social control, that is, the participation of users (population) in managing the service. The National Institute of Medical Assistance of Social Security was only extinguished on July 27, 1993, by Law No. 8689. Such a health system helped design Medicare in the USA [27].

15.3 Constitutional Principles

A closer reading of the section "On Health" of the Brazilian Constitution allows us to verify that five basic principles have been established that guide the legal system of the Unified Health System. They are universality (article 196), completeness (article 198), equity (article 196), decentralization (article 198), and social participation (article 198) [28].

15.3.1 Universality

This principle can be understood by considering that, according to the Brazilian Constitution, health is as a "right for everyone and a duty of the State." In this way, the right to health is a fundamental right of every citizen, being considered even stony clause, i.e., it cannot be withdrawn from the Constitution under any circumstances, as it constitutes an individual right and guarantee [15].

15.3.2 Completeness

Completeness confers on the State the duty of "comprehensive care, with priority given to preventive activities, without prejudice to assistance services" about the access that every citizen is entitled to. For this reason, the State must establish a set of actions ranging from prevention to curative assistance, at the most diverse levels of complexity, as a way of implementing and guaranteeing the postulate of health. "Human beings are integral, bio-psycho-social beings, and they should be treated with this integral vision by a health system that is also integral, aimed at promoting, protecting, and recovering their health" [16].

15.3.3 Equity

The principle of equity is related to the constitutional mandate that "health is everyone's right." The aim here is to preserve the postulate of isonomy, since the Constitution itself, in "Individual and Collective Rights and Duties," article 5th, establishes that "all are equal before the law, without distinction of any kind." Therefore, all citizens, equally, must have their health rights guaranteed by the State. However, regional and social inequalities can

lead to the non-occurrence of this isonomy, after all, a more deprived area can demand more expenses than the others. For this reason, the State must treat "unequals unequally," concentrating its efforts and investments in territorial areas with worse rates and deficits in the provision of public services. In "Fundamental Principles," article 3rd, the Constitution configures as one of the objectives of the Republic "to reduce social and regional inequalities" and "to promote the good of all" [17].

Equal access (principle of equity) does not mean that the Unified Health System should treat everyone equally, but rather respect the rights of each one, according to their differences, relying more on the intimate conviction of natural justice than on the letter of the law [18].

15.3.4 Decentralization

It is established in "On Health," article 198, that "public health actions and services are part of a regionalized and hierarchical network and constitute a single system, organized according to the following guidelines: I - decentralization, with a single direction in each sphere of government [...]". For this reason, the Unified Health System is present at all federative levels — Union, States, Federal District, and Municipalities, so that what is within the scope of national scope will be the responsibility of the federal government, what is related to the competence of a state must be under the responsibility of the state government, and the same definition occurs with a municipality. In this way, a greater dialogue is sought with the local civil society, which is closer to the manager, to hold him accountable for the necessary public policies [29].

15.3.5 Social Participation

It is also provided for in article 198 "community participation" in public health actions and services, acting in the formulation and control of their execution. Social control, as this principle is also called, was better regulated by the aforementioned Law nº 8.142/90. Users participate in the Unified Health System management through Health Conferences, which take place every four years at all federative levels — Union, States, Federal District, and Municipalities. In Health Boards, the so-called parity occurs: while users have half of the vacancies, the government has a quarter and workers another quarter. The aim is, therefore, to encourage popular participation in the discussion of public health policies, giving greater legitimacy to the system and implemented actions [30].

However, it is observed that the Original Constituent Assembly of 1988 did not only seek to implement a universal and free public health system in the country, as opposed to what existed in the military period, which only favored workers with a formal contract. It went further and also established principles that would guide the interpretation that the legal world and the spheres of government would make about the aforementioned system. And from the reading of these principles, one notes the concern of the Constituent Assembly to reinforce the defense of the citizen against the State, guaranteeing means not only for the existence of the system but also for the individual to have a voice to fight for its improvement and greater effectiveness [19].

15.4 Structure

15.4.1 Financing

In 2019, a Working Group (GT) in the Chamber of Deputies (lower house of Brazilian Parliament) tried to define a proposal to revise the Table of the Unified Health System procedures. The debated revision aimed to increase medical fees, for example, starting to use the same table that is used by health insurance (called "Hierarchical Brazilian Classification of Medical Procedures"). In a public hearing on the subject, Viviana Lemke, president of the Brazilian Society of Hemodynamics and Interventional Cardiology, complained that doctors have been receiving the same amounts for the procedures they perform for 11 years - BRL 122 in the case of cardiac catheterizations. Deputy Carmen Zanotto said he believed that low pay repels specialized professionals, causing queues [20].

The outdated table has been generating serious and irreparable problems for the entire system, because, due to the precarious amounts paid for services and procedures, it is increasingly difficult to find institutions, professionals, and trained technicians who agree to provide the aforementioned services to system users.

In April 2019, Leonardo Vilella stated that the Unified Health System funding, which must have the participation of the Union, states, and municipalities, has less and less participation by the Union: 72% in 2000 (with 28% due to states and municipalities), versus 42% in 2019 (with 58% on behalf of states and municipalities). The lack of review especially impacts the sector of philanthropic hospitals, responsible for most of the care provided by the public system [31].

There are many states where a complement needs to be made so that providers who have intensive care units do not disable these beds, under the penalty of generating an even greater crisis in the health system [32].

In June 2019, Thaisa Guerreiro, representative of the Public Defender's Office of Rio de Janeiro, pointed out, in a public hearing on the subject, that the daily rate of intensive care units to be paid to the Unified Health System partner network is BRL 1,000, versus BRL 10,000 paid to private hospitals by health insurance and that the discrepancy leads to the judicialization of health. The Chief Advisor for Legislative Affairs at the Federal Public Defender's Office stated, on that occasion, that the trend is to get worse, as the health budget was linked to federal government revenue, but it ceased to be with the Amendment 95 to the Constitution ("Amendment of the Expenditure Ceiling"), which corrects federal government expenditures for the prior year's inflation only [33].

At an August hearing, Henry Silver, director of Love Hospital, stated that the low values of the Unified Health System Table serve the interests of private medicine, as it empties the public health, forcing patients to resort to private health plans or procedures: "Private medicine manipulated the freezing of the Unified Health System table" [31].

While the hospital spends BRL 1,200 for each dose of the drug voriconazole, the Unified Health System pays only BRL 37.78 per dose. This drug is essential for patients who are going to undergo a bone marrow transplant. This is a discrepancy, an anomaly. Therefore, sometimes public health loses quality. I do not know if this is intentional to favor private health or if it is a lack of rationality [32].

15.4.2 National Health Card

The National Health Card is the document that allows the unique identification of Unified Health System users and contributes to the organization of health care. Its implementation was formalized by the Health Care Operational Norm NOAS-SUS 01/2001, approved by MS Ordinance No. 95 of January 2001. The card makes it possible to link the procedures performed within the scope of the Unified Health System to the user, the professional who performed them, and also the health unit where they were performed. Both users and health professionals and their units receive a national identification number [33].

15.4.3 User Rating

According to a survey released on August 19, 2014, 54% of respondents evaluated the health care provided by the Unified Health System with a score from 0 to 4, 33% with a score between 5 and 7 and 13% with a score between 8 and 10. This fact was interpreted by the Federal Council of Medicine as an 87% disapproval of the Unified Health System by the interviewees [34]. In surveys carried out in previous years, good satisfaction was found among Unified Health System users with the public health services used, at different levels of care and in different cities in the country [35].

For 93% of Brazilian voters, public and private health services in the country are fair, bad, or terrible. The Unified Health System received a negative evaluation from 87% of the population. This is the result of an unprecedented survey commissioned by the Federal Council of Medicine: “People are dissatisfied because they do not have what they need. It is a matter of perception. It is a perception survey,” says the president of the Federal Council of Medicine Roberto Luiz D’Ávila [36].

The most critical points are related to access and waiting time for assistance. Half of the respondents who needed the Unified Health System reported that it was difficult or very difficult to access services, especially surgeries, home medical care, and specific procedures such as hemodialysis and chemotherapy [37]. Among the interviewees, at least 30% declared that they were waiting or had someone in their family waiting for an appointment or consultation, examination, procedure, or surgery by the Unified Health System. Among people who have health plans, 22% said that they are waiting for some kind of service through the public network [38, 39]. Only two out of every ten respondents managed to be seen within a month, while nearly half of the population faced a wait of one to six months. A portion of 29% of the population has been waiting for more than six months, with more than half of them reporting being in line for more than a year [40]. The scope of the study was national, including metropolitan regions, inland cities of different sizes, and residents in the five regions of the country. 2,418 people were interviewed, including men and women, aged over 16 years, 60% of them living in the countryside [41].

Bibliography

- [1] Tran Dang. Former us lawful permanent residents: Retired without benefits. *Baker Institute Policy Brief*, 4, 2020.

- [2] G Carvalho. Public health in brazil. *Estud. Av*, 27(78):7–26, 2013.
- [3] Cristiane Maria daCosta Silva, Marcelo deCastro Meneghim, Antonio Carlos Pereira, and Fábio Luiz Mialhe. Health education: a historical reflection of its practices. *Ciência & saúde coletiva*, 15(5):2539, 2010.
- [4] Carlos Henrique Assunção Paiva and Luiz Antonio Teixeira. Health reform and the creation of the sistema único de saúde: notes on contexts and authors. *História, Ciências, Saúde-Manguinhos*, 21:15–36, 2014.
- [5] Polyane Alves Santos, Yuzo Iano, Kelem Christine Pereira Jordão, Gabriel Caumo Vaz, Gabriel Gomes de Oliveira, Ingrid Araújo Sampaio, and Euclides Lourenço Chuma. Analysis of the relationship between maturity indicators using the multivariate linear regression: A case study in the brazilian cities. pages 203–210, 2022.
- [6] Telma Maria Gonçalves Menicucci. The history of the public health reform in brazil and of the sistema único de saúde: changes, continuities, and the current agenda. *História, Ciências, Saúde-Manguinhos*, 21:77–92, 2014.
- [7] Ingrid Araújo Sampaio, Yuzo Iano, Aurelio Ribeiro Leite de Oliveira, Lino Marcos da Silva, Rinaldo Vieira da Silva Júnior, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, Polyane Alves Santos, and Kelem Christine Pereira Jordão. The use of the elman preconditioner in the early iterations of interior point methods. pages 355–363, 2022.
- [8] Regiane Alves Garcia. *Advancing citizen participationh governance and the right to health in brazil: the role of the national health council in healt*. PhD thesis, University of British Columbia, 2018.
- [9] Celso Fabricio Correia de Souza, Yuzo Iano, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, Valéria Sueli Reis, and Josué Mastrodi Neto. Institutional development index (idi): Calculation for municipalities in the metropolitan region of campinas (brazil). pages 245–255, 2022.
- [10] Olga Khazan. What the us can learn from brazil’s healthcare mess. *The Atlantic*, 8, 2014.
- [11] Gabriel Caumo Vaz, Yuzo Iano, and Gabriel Gomes de Oliveira. Iot-from industries to houses: An overview. pages 734–741, 2022.
- [12] Suzely Adas Saliba Moimaz, Jeidson Antônio Moraes Marques, Orlando Saliba, Cléa Adas Saliba Garbin, Livia Guimarães Zina, and Nemre Adas Saliba. Satisfação e percepção do usuário do sus sobre o serviço público de saúde. *Physis: Revista de Saúde Coletiva*, 20:1419–1440, 2010.
- [13] Domingos Teixeira da Silva Neto, Jéssica Fernandes Alves, Polyane Alves Santos, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, Yuzo Iano, and Lucas dos Santos Ribeiro. Proposal mppt algorithm using the kalman filter. pages 750–759, 2022.

- [14] Leonardo Bruscatini de Lima, Yuzo Iano, Pedro Y Noritomi, Gabriel Gomes de Oliveira, and Gabriel Caumo Vaz. Data security, privacy, and regulatory issues: A conceptual approach to digital transformation to smart cities. pages 256–263, 2022.
- [15] Gabriel Gomes de Oliveira, Yuzo Iano, Gabriel Caumo Vaz, Pablo David Minango Negrete, Juan Carlos Minango Negrete, and Euclides Lourenço Chuma. Intelligent mobility: A proposal for modeling traffic lights using fuzzy logic and iot for smart cities. pages 302–311, 2022.
- [16] Gabriel Gomes de Oliveira, Yuzo Iano, Gabriel Caumo Vaz, Euclides Lourenço Chuma, Roger Prior Gregio, and Alessandra Cristina Santos Akkari. Analysis of the ergonomic concept of public transportation in the city of campinas (brazil). pages 453–459, 2021.
- [17] Telmo Cardoso Lustosa, Yuzo Iano, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, and Valéria Sueli Reis. Safety management applied to smart cities design. pages 498–510, 2021.
- [18] Roger Prior Gregio, Yuzo Iano, Lia Toledo Moreira Mota, Gabriel Caumo Vaz, Gabriel Gomes de Oliveira, Diego Arturo Pajuelo Castro, and Carolina Fernandes Frangeto. Energy use in urban areas using neodymium magnets. pages 988–1005, 2021.
- [19] Daniel Katz Bonello, Yuzo Iano, Umberto Bonello Neto, Gabriel Gomes de Oliveira, and Gabriel Caumo Vaz. A study about automated optical inspection: Inspection algorithms applied in flexible manufacturing printed circuit board cells using the mahalanobis distance method 1. pages 198–212, 2022.
- [20] Daniel Izario, João Brancalhone, Yuzo Iano, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, and Karine Izario. 5g-automation of vertical systems in the industry 4.0. pages 35–43, 2022.
- [21] Gabriel Gomes de Oliveira, Lucas Alves Rodrigues de Sá, Yuzo Iano, and Gabriel Caumo Vaz. Security in smart home using blockchain. pages 306–313, 2023.
- [22] Gabriel Gomes de Oliveira, Yuzo Iano, Gabriel Caumo Vaz, Euclides Lourenço Chuma, Pablo David Minango Negrete, and Daniel Rodrigues Ferraz Izario. Horizontal curves with transition. the use of this methodology for the calculation of a road project in the city of campinas/sp-brazil. pages 51–65, 2022.
- [23] Juliana P da S. Ulian, Luiz Carlos Pereira da Silva, Gabriel Gomes de Oliveira, João Guilherme Ito Cypriano, Yuzo Iano, and Gabriel Caumo Vaz. Telemangement and its benefits to energy, environment, and society: A case study in street lighting. pages 178–187, 2022.
- [24] Lilian Regis Laraia, Yuzo Iano, Ricardo Takahira, Luiz Vicente Figueira de Mello Filho, Gabriel Gomes de Oliveira, and Gabriel Caumo Vaz. Technology for electric bus in the brazilian scenario: Focus on the adoption of national components. pages 276–285, 2022.

- [25] Gabriel Gomes de Oliveira, Yuzo Iano, Gabriel Caumo Vaz, Euclides Lourenço Chuma, Pablo David Minango Negrete, and Juan Carlos Minango Negrete. Prop walls: A contextualization of the theme in a case study in the city of campinas (brazil). pages 128–139, 2022.
- [26] Everton Hideo Nishimura, Yuzo Iano, Gabriel Gomes de Oliveira, and Gabriel Caumo Vaz. Application and requirements of aiot-enabled industrial control units. pages 724–733, 2022.
- [27] Gabriel Gomes de Oliveira, Yuzo Iano, Gabriel Caumo Vaz, Euclides Lourenço Chuma, Pablo David Minango Negrete, and Juan Carlos Minango Negrete. Structural analysis of bridges and viaducts using the iot concept. an approach on dom pedro highway (campinas-brazil). pages 108–119, 2022.
- [28] Leonardo Bruscatini de Lima, Yuzo Iano, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, Alecssander Daniel de Almeida, Gustavo Bertozzi Motta, Gabriel Matsumoto Villça, Matias Oliveira Schwarz, and Pedro Y Noritomi. Mathematical modeling: A conceptual approach of linear algebra as a tool for technological applications. pages 239–248, 2022.
- [29] Euclides Lourenco Chuma, Yuzo Iano, Leonardo Lorenzo Bravo Roger, Gabriel Gomes de Oliveira, and Gabriel Caumo Vaz. Novelty sensor for detection of wear particles in oil using integrated microwave metamaterial resonators with neodymium magnets. *IEEE Sensors Journal*, 22(11):10508–10514, 2022.
- [30] Y Thiagarajan, Baburao Pasupulati, Gabriel Gomes de Oliveira, Yuzo Iano, and Gabriel Caumo Vaz. A simple approach for short-term hydrothermal self scheduling for generation companies in restructured power system. pages 396–414, 2022.
- [31] Y Thiagarajan, G Palanivel, ID Soubache, Gabriel Gomes de Oliveira, Yuzo Iano, Gabriel Caumo Vaz, and Himanshu Monga. Design and fabrication of human-powered vehicle-a measure for healthy living. pages 1–15, 2022.
- [32] Alex Restani Siegle, Yuzo Iano, Gabriel Gomes de Oliveira, and Gabriel Caumo Vaz. Proposal of mathematical models for a continuous flow electric heater. pages 213–228, 2022.
- [33] Paolo Rodrigo de Oliveira Bacega, Yuzo Iano, Bruno Campos Simoni de Carvalho, Gabriel Caumo Vaz, Gabriel Gomes de Oliveira, and Euclides Lourenço Chuma. Study about the applicability of low latency in has transmission systems. pages 73–87, 2022.
- [34] Pablo Minango, Yuzo Iano, Euclides Lourenço Chuma, Gabriel Caumo Vaz, Gabriel Gomes de Oliveira, and Juan Minango. Revision of the 5g concept rollout and its application in smart cities: A study case in south america. pages 229–238, 2022.
- [35] Y Thiagarajan, Gabriel Gomes de Oliveira, Yuzo Iano, and Gabriel Caumo Vaz. Identification and analysis of bacterial species present in cow dung fed microbial fuel cell. pages 16–24, 2022.

- [36] Juan Carlos Minango Negrete, Yuzo Iano, Pablo David Minango Negrete, Gabriel Caumo Vaz, and Gabriel Gomes de Oliveira. Sentiment and emotions analysis of tweets during the second round of 2021 ecuadorian presidential election. pages 257–268, 2022.
- [37] Adolfo Blengini Neto, Yuzo Iano, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, Fabiana Silva Podeleski, Higor de Paula Kolecha, and Marcius FH de Carvalho. The bfs method in a cloud environment for analyzing distributed energy resource management systems. pages 349–362, 2022.
- [38] Leonardo Bruscagini de Lima, Yuzo Iano, Gabriel Gomes de Oliveira, Gabriel Caumo Vaz, Alecssander Daniel de Almeida, Gustavo Bertozzi Motta, Gabriel Matsumoto Villaçã, Matias Oliveira Schwarz, and Pedro Y Noritomi. Mathematical modeling: A conceptual approach of linear algebra as a tool for technological applications. pages 239–248, 2022.
- [39] Juan Carlos Minango Negrete, Yuzo Iano, Pablo David Minango Negrete, Gabriel Caumo Vaz, and Gabriel Gomes de Oliveira. Sentiment analysis in the ecuadorian presidential election. pages 25–34, 2022.
- [40] Antonio Carlos Demanboro, David Bianchini, Yuzo Iano, Gabriel Gomes de Oliveira, and Gabriel Caumo Vaz. Regulatory aspects of 5g and perspectives in the scope of scientific and technological policy. pages 163–171, 2022.
- [41] Gabriel Gomes De Oliveira, Yuzo Iano, Gabriel Caumo Vaz, Euclides Loureno Chuma, and Rangel Arthur. Intelligent transportation: Application of deep learning techniques in the search for a sustainable environment. pages 7–12, 2022.