



Sustainable Logistic Management Plan as an alternative to minimize budget difficulties of Higher Education Institutions

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Abstract

Brazil has increased its scientific production in the past four decades, with public universities playing a major role in scientific and technological research in the country. Recent cuts in governmental budgets to these institutions put them at risk of closing down, impacting not only education, but also research and development in the country, thus threatening the future of the national science and technology system. Sustainable actions may help universities to overcome this crisis. The aim of this study was to evaluate the results of the implementation, in 2008, of a Sustainable Logistic Management Plan (SLP) at the Federal University of Health Sciences of Porto Alegre (UFCSPA). Indicators were collected by UFCSPA Environmental Management Commission (EMC) and were publicly available. The study analyzed indicators such as water and energy consumption and special waste production to assess trends in environmental aspects and their respective impacts. The number of graduate and undergraduate courses at UFCSPA increased during the period, therefore most indicators showed an increase in resource consumption in absolute values. However, a decrease was observed when consumption was analyzed per capita. Accordingly, overall consumption of electricity increased 143% from 2008 to 2020, whereas a reduction per capita was observed. Special waste production increased 46% from 2013 to 2020, but per capita production remained stable and water consumption, despite having an average annual increase of 8%, also had a per capita reduction. This study shows how sustainable actions implemented by UFCSPA affected the use of resources, reducing the consumption of water, electricity, disposable materials, and waste per capita. Therefore, we can conclude that the actions implemented by the university in 2008 and monitored by the EMC in the SLP contributed significantly to achieving financial balance in the institution.

Keywords: Sustainable development planning; Implementation of sustainability plans; Sustainable logistic management plan; Strategic sustainability; Higher education institutions; Brazilian universities

1. Introduction

In Brazil and in other developing countries, the second half of the twentieth century was marked by an unprecedented expansion in demand and consequent offer/supply of higher education courses. This expansion is associated with a valorization of academic knowledge by the labor market, as well as to recognition of academic research as an important asset (APARECIDO et al., 2020). However, underdeveloped and developing countries are still characterized by significant social inequalities. Access to higher education is usually limited to a minor part of society, while most of the population has very low schooling and hardly reach university education (CEPÊDA; MARQUES, 2012).

Higher education has a strategic importance for all countries, with Higher Education Institutions (HEIs) being responsible not only for education, but also for research and development, enabling industry innovation. As a result, individuals who attend a HEI become more qualified and have more professional opportunities, and companies become more competitive internationally, increasing the country's Growth in Domestic Product (GDP) (GALLOUJ, 2018). Unfortunately, Brazil faces enormous challenges regarding higher education, research and development: low education of the population, lack of professional and technical training, and great social inequality – as reflected in educational and social statistics (ALLAIN; GRUBER; WOLLINGER, 2019).

Most HEIs in Brazil are private institutions. Although public universities represent only 12% (299 HEIs) of all HEIs in Brazil, they are responsible for approximately 80% of all scientific production carried out in the country. Out of public institutions, 128 (43%) are state, 61 (20%) municipal, and 110 federal (37%) (UFCSPA, 2019). Moreover, public HEIs are funded by the government, and students do not pay any fees. Thus, the role of these institutions in reducing social inequalities in Brazil is unquestionable, as they increase the chances of better employment in the future. In addition to the technical skills acquired in regular education curricula, it is important to realize that soft skills play a significant role in allowing students to respond to the unpredictable nature of today's work contexts and build a meaningful career for themselves and others. These soft skills can be widely acquired through public HEIs, as they are extremely qualified and universally accessible, thus allowing students to become well-prepared professionals. Consequently, these individuals will have better chances of being employed and having higher professional status (GAMBOA; PAIXÃO; PALMA, 2014).

Some Brazilian universities – most of them public – are recognized worldwide and are listed in the Times Higher Education Ranking (THE, 2021), such as University of São Paulo (USP), Federal University of Minas Gerais (UFMG), Federal University of Rio Grande do Sul (UFRGS), among others. The Federal University of Health Sciences of Porto Alegre (UFCSPA) is a recently founded public university specialized in Health Sciences and it is also included in THE Ranking. The inclusion of universities in THE Ranking reflects their quality and contribution to society. Several factors are considered in this process, most of which are related to the Sustainable Development Goals (SDG) of the United Nations (UN) Agenda 2030 (THE, 2021). Sustainability is one of the main principles assessed when analyzing the quality of an institution and its commitment to the SDGs. In addition, the Talloires Declaration, signed by more than 350 university rectors in over 40 countries in 1990, formalized the commitment to environmental sustainability in higher education.

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In this way, the UN created the Decade of Education for Sustainable Development in 2005, encouraging and requiring public and private universities to align their missions, visions, and values with sustainability (UNESCO, 2021; RAMOS, 2015).

Sustainable environments clearly contribute to reducing costs of institutions despite the relatively high investment required in the implementation phase. Accordingly, sustainable institutions not only are environment-friendly places but also spend less on infrastructure, thus becoming economically sustainable (LIMA; ALMEIDA, 2021).

Brazil faces one of the worst economic and political crises in its history (SANTOS, 2020), which has worsened with the COVID-19 pandemic. Recently, the government announced a 30% budget cut to the public federal universities, which were already struggling to sustain their infrastructure, including paying for energy and water. Therefore, urgent actions must be taken to reduce the impact of these financial restrictions (STEFAN; AGUIAR; HONÓRIO, 2020).

Despite the comparative advantages of public universities in the sense of scientific relevance through their publications, they may not be maintained or even remain viable if these institutions do not initiate extensive reform programs and structural changes, especially in their management. Formulation of institutional development projects and strategic management are essential to deal with a highly competitive and differentiated environment, aiming at sustainability, not only as a commitment to society and the environment, but also as an alternative for their financial survival (ROHRICH; TAKAHASHI, 2019).

This scenario calls for a reformulation of the methods of financing higher education in Brazil, defining criteria through the degree of efficiency, effectiveness, and scientific contribution to the country. The analysis of the budgets and general accounts of the Brazilian government showed that projections and spending on education grew until 2015 where it began a downward curve of public funding on higher education. Moreover, it is observed that such resources are still insufficient in view of the structural problems of the educational systems (SILVA, 2019).

According to the UNESCO Science Report (2021), Brazil was the second country in number of publications about SARS-CoV-2, behind only the United States. Brazilian scientists accounted for 28% of the most cited publications on the subject. Brazil has been progressively increasing the number of publications for more than 30 years. During a relatively long period, investments in science and technology remained stable. However, according to the publication, the 2015 recession in the country drastically impacted research and development (UNESCO, 2021). Unfortunately, even with eventual recovery in economic growth and increase in its GDP, governmental investments in universities continue to decrease in Brazil – reaching 19% in 2021. This will have a negative impact on the budget of federal universities and other public institutions (BRASIL, 2020; ANDRADE, 2019).

In order to adapt to the governmental financial cuts, universities must find alternatives to meet demands. This process depends on several factors, including a comprehensive understanding of the universities' managers with regards to the economic scenario, the institution's situation, and other available financial resources (GENTA et al., 2019). With all the financial difficulties over time and little prospect for improvement, organizational planning that advocates sustainability has been recognized for its potentially

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significant roles in facilitating the reduction of natural resource consumption, such as water and electricity, as well as of waste generation. Consequently, this reduces environmental impacts (GOUDIE, 2019). In fact, there is no place for institutions whose values are not based on sustainability for conservation of the planet (SOUZA et al., 2019). Thus, the incorporation of measures to minimize impacts combined with environmental indicators can contribute to decision-making.

Several HEIs worldwide have been engaged in transforming their campuses in order to become more sustainability-oriented. According to Lozano et al. (2015), areas of transformation in HEIs applying environmental indicator monitoring systems include education, research, community outreach, campus operations, assessment and reporting, institutional policy, and structure. Additionally, HEIs that apply sustainability concepts, both in professional education and institutional strategies, achieve significant positive results in all monitored areas. Moreover, sustainability is a strategic area of research, taking into account the significant role of universities in shaping worldviews, training human capital, and generating new knowledge for sustainable development (SONETTI et al., 2019).

Reduction of environmental impacts can reflect in the expansion of economic, environmental and social benefits. To obtain satisfactory results in different areas of sustainable development, it is necessary to incorporate monitoring, inspection and disclosure of information by the strategic sectors. Therefore, sustainability reports such as the Sustainable Logistic Management Plans (SLP) may be a great alternative (FRANCO et al., 2017).

In this sense, this study aims to evaluate the environmental indicators in a public HEI, demonstrating the benefits of sustainability initiatives, and highlighting the SLP as an alternative for budget stability of these institutions. Furthermore, with the evaluation of environmental indicators in a federal HEI through a case study, it will be possible to assess the environmental impacts of this institution to identify quantitative and qualitative variations over time. Based on our results, we propose implementing the SLP with concrete sustainability actions as priority initiatives for the survival of public HEIs in Brazil.

2. Material and Methods

The Federal University of Health Sciences of Porto Alegre (Universidade Federal de Ciências da Saúde de Porto Alegre – UFCSPA) is located in southern Brazil and was the object of study of this research. UFCSPA Environmental Management Commission (EMC) was created in 2009, reflecting the concern and involvement of the university with environmental quality and its direct relationship with health sciences. EMC is composed of UFCSPA academic community (professors, students and technical-administrative staff) and is responsible for the elaboration and implementation of an environmental management policy focused on sustainable development (UFCSPA, 2019). This research evaluated the results of the implementation of UFCSPA SLP, in order to define a diagnosis of sustainability actions in the Institution. It is worth mentioning that UFCSPA is the only Brazilian HEI with a specific focus on human health areas.

This a case study evaluated the indicators collected by the EMC from 2008 to 2020 and reported in the SLP, which is publicly available at UFCSPA website. The analysis of the SLP was based on the main environmental indicators of UFCSPA, such as water and energy consumption and special waste production.

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The study also assessed UFCSPA environmental education policies, which includes actions that can be qualitatively measured.

Statistical analysis was performed in SPSS software version 25 to identify trends in environmental aspects and their respective impacts during the period (2008–2020) and variation in the annual indicators average. Consumption and production *per capita* of water, electricity and waste were also analyzed.

The trend in gross consumption and *per capita* was analyzed over the period of time using linear regression analysis. To adjust the estimation of water consumption, the information of a leakage occurring between 2016 and 2019 was entered through a dummy variable. Trends were considered significant when p -value <0.05 .

3. Results and Discussion

A study analyzed data on the public budget in Brazil, revealing a decrease in the allocation of resources to universities over the past few years. Noteworthy, the impact of such a reduction in investments was higher in public universities as compared to private ones. Based on the World Bank guidelines, this contributes to the viability of financial/educational groups' profits, rather than encouraging and investing in public HEIs as a priority in the country (CHAVES et al., 2018). Survival of public universities is even more difficult because of these changes, requiring actions to minimize the impacts.

In this sense, environmental tools associated with the implementation of the SLP may be a short-term path. Creation of a SLP complies with the Brazilian Government Federal Decree No. 7746/2012, which establishes the promotion of sustainable national development in the public administration (BRASIL, 2012a). According to article 16 of this decree, dependent state-owned companies must prepare and implement a SLP, determining the creation of a committee responsible for interdisciplinary actions and comprising all areas and sectors of the institution. Thereby, this enables discussion on the topics, allowing greater involvement of stakeholders with sustainability in the Institution. Mandatory implementation of SLP emerges as a first step towards expanding sustainable thinking within public institutions, promoting discussions on relevant sustainability topics.

The SLP analyzed in this study monitored indicators from 2008 to 2020. Although the document proposes to diagnose the situation of seven topics (water and sewage; selective waste collection; purchasing and contracting; staff displacement; electricity consumption; consumables; and improvements in the quality of life in the occupational environment), it presents only five quantitative topics in the 13-year period: annual population of UFCSPA; annual water consumption; annual electricity consumption; consumption of white paper, plastic cups, printer cartridges; and annual spending for disposal of special waste.

Analysis of UFCSPA Management Report of 2020 shows a significant growth of the institution in the number of undergraduate and graduate courses. Consequently, its physical structure, as well as the number of students, professors and technical staff increased. The Report also reveals the role of UFCSPA in the dissemination of knowledge and feedback to society, both through research activities as well as through extension programs and projects. Accordingly, scientific dissemination and cultural actions developed by UFCSPA reached more than 18,000 people in 2019. This impact on society reinforces the need for the

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institution to be increasingly aligning its mission, vision and values, not only with economic and social responsibility, but also through environmental actions (UFCSPA, 2020).

In recent years UFCSPA has sought to expand its physical structure with two new buildings on its campus. Structural expansion was a response to the increase in undergraduate and graduate courses, from 3 undergraduate and 3 graduate courses in 2004 to 16 and 12, respectively, in 2019. The annual population of UFCSPA, considering its employees, undergraduate and graduate students, residency students, on-site and distance specialization students and outsourced employees has been increasing every year, with a slight decrease in the last two years (Figure 1).

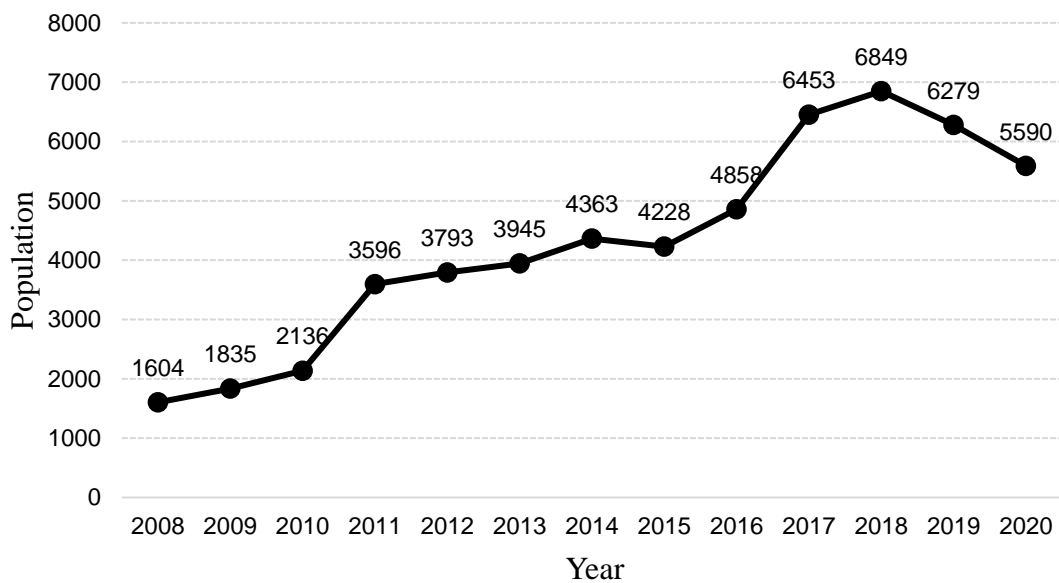


Figure 1. UFCSPA annual population (2008–2020).

In 2020, UFCSPA total population was 5,590 people, of which 4,476 were undergraduate and graduate students. On this subject, there is a significant linear trend in UFCSPA population in the period 2008–2020 with an average annual increase of 417.4 people. As revealed by our analysis, despite the increase in the institution’s community, *per capita* consumption of some resources were maintained or even decreased, which can be partially explained by the fact that some of UFCSPA resources are directed to the development of actions aimed at environmental sustainability. Moreover, UFCSPA is committed to meeting the goals defined in its SLP, permeating the Environmental Agenda for Public Administration. All actions and goals established in UFCSPA SLP are monitored by the EMC (UFCSPA, 2021).

SLP (2021) reports the amount of special waste (characterized as biological, infectious or chemical waste) produced per year (Figure 2). The SLP was not mandatory and did not exist before 2013, therefore these indicators began to be monitored as a unit of measurement in liters in 2013. Considering they are indicators that generate significant expenses, and their risks to the environment, they should be continuously monitored.

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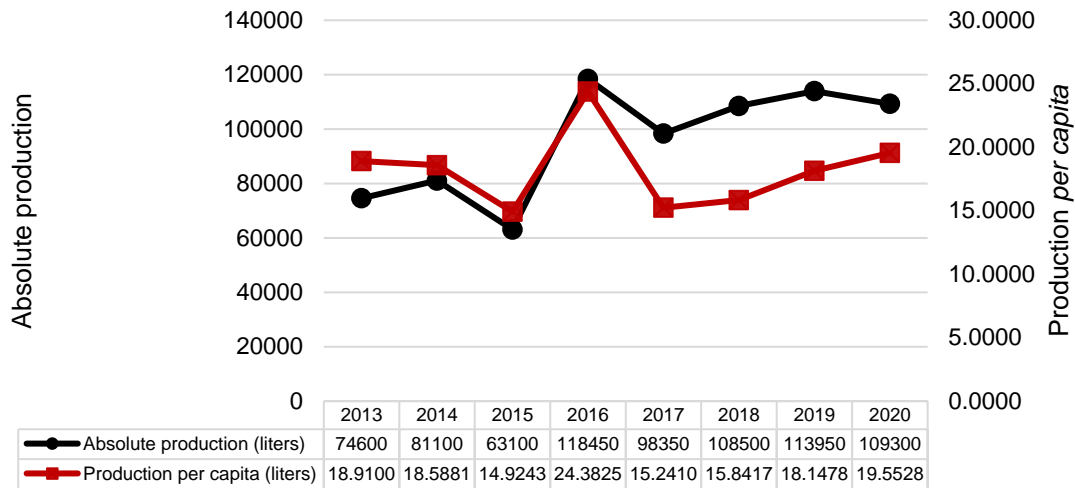


Figure 2. Annual production of special waste (in liters) at UFCSPA (2013–2020).

There was a significant linear trend in the annual production of special waste at UFCSPA (liters) in the period, with an average annual increase of 6,229.17 liters ($p=0.034$). However, in *per capita* production there was no significant linear trend, with an average annual decrease of 0.049 liters ($p=0.927$). The EMC was created in 2009, and four years later the institution was already monitoring special waste in liters, understanding its high risk to the health of the intramural and extramural community, as well as to the environment. A clear increase in waste production is observed in 2016, which can be explained by the inauguration of a new research building; a gradual increase still occurred in the following years, as new laboratories opened.

Noteworthy, because of the COVID-19 pandemic, in 2020 UFCSPA started teaching non-essential classes and activities at a distance, causing a small reduction in special waste generation. Additionally, regarding actions implemented by the university with a focus on reducing waste, we highlight: "Implement continued campaign of orientation of outsourced employees on garbage disposal after collection of the dumpsters" in 2015; "Elaborate informative labels to put on the organic and recyclable garbage cans" in 2014; "Hire specialized company for the collection of solid environmental waste type A, B and E, according to the classification of RDC 306, RDC 222 and CONAMA" and "Make available a garbage can for collection of special waste for the internal and external community" in 2017. The coincidence of the dates of actions with reductions in production of this indicator proves the efficiency of these initiatives and their environmental, social, and economic return.

An important aspect observed during the analysis of environmental indicators is that all UFCSPA rooms have trash cans to separate organic and recyclable waste. However, the quantities of each type of waste generated are not monitored, nor the amount of waste that is effectively recycled and composted due to lack of communication between the sectors that collect, segregate and quantify the waste. Notwithstanding, environmental education of people in relation to segregation was effective; also worth mentioning that this is a continuous initiative because there is a high turnover of students and employees.

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Regarding water consumption, some actions have been carried out at UFCSPA since 2008, mainly to raise awareness and reduce water consumption (Table 1). As can be observed in Figure 3, despite the university’s growth during these years, such actions resulted in a stabilization of water consumption between 2013 and 2015. It is notable the exponential increase in the years 2016, 2017 and 2018, which were caused by leaks in the public supply network. This problem was solved in 2018, generating credit on the water bills for the institution as compensation for the loss caused. After the repair, water consumption decreased in 2019. Another reduction in consumption in 2020 can be associated with the suspension of *in loco* activities due to SARS-CoV-2 pandemic.

Table 1. Initiatives to reduce water consumption at UFCSPA. Source: Adapted from SLP, 2021.

Action	Year
Install aerated, self-closing faucets in all campus restrooms	2015
Install 2-volume flush toilets in all University bathrooms	2015
Develop campaigns with the university community to reduce water consumption	2010 a 2020
Sign the common areas of the buildings about the rational use and consumption of water	2008 a 2020
Installing a rainwater harvesting system	2017

A significant linear trend was observed in water consumption at UFCSPA (m³) over the period, with an average annual increase of 3,265.8 m³ (p=0.042). However, in *per capita* consumption, no significant linear trend was observed, with an average annual *per capita* increase of 0.15 m³ (p=0.535).

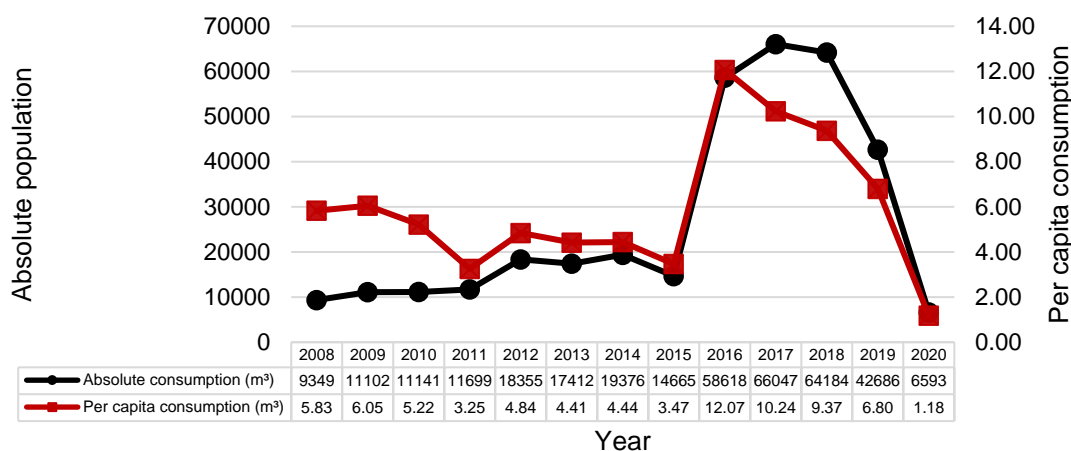


Figure 3. Water consumption (in m³) at UFCSPA (2008–2020).

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Electricity consumption increased gradually in the period, except for the years 2016 and 2018, which showed a reduction when compared with the previous year. In 2020, as expected as a result of COVID-19, there was an additional notable reduction (Figure 4). There was a significant linear trend in electric energy consumption at UFCSPA (kWh) in the period ($p=0.001$) with an annual average increase of 89,936.2 kWh. In *per capita* consumption, there was also a significant linear trend ($p<0.001$), but with an annual average decrease of 23.4 kWh.

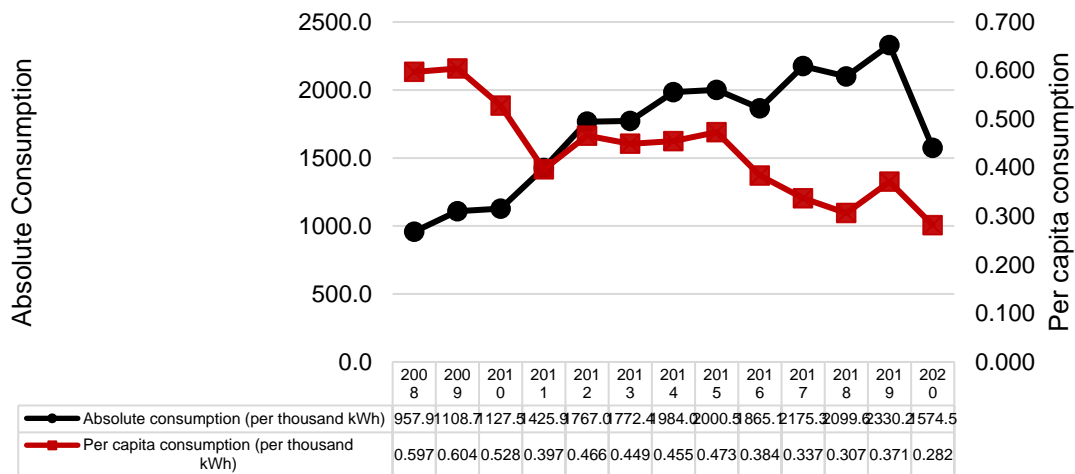


Figure 4. Annual electricity consumption (in kWh) at UFCSPA (2008–2020).

Reductions in electricity consumption in 2016 and 2018 may be considered a result of initiatives implemented in the institution, such as awareness campaigns starting in 2016. Moreover, the lighting changes, appliance replacement and use of more energy-efficient light bulbs in 2018 also contributed to reducing electricity consumption (Table 2).

Table 2. Actions to reduce electricity consumption at UFCSPA. Source: Adapted from SLP, 2021.

Action	Year
Develop campaigns with the university community to reduce energy consumption	2010 a 2020
Carry out an institutional campaign for the dismissal of monitors when users leave the room for more than 30 minutes	2014 a 2020
Lighting the area outside the building with photocell lamps	2020
Install acoustic and thermal barriers on the windows of the main building	2014 a 2015

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Use energy-saving light bulbs (LED)	2017 a 2020
Install motion sensor-controlled bathroom lighting	2015
Gradually replace old monitors with LCD monitors	2008

The last quantitative indicators monitored by SLP are the consumption of white printing paper (A4), printer cartridges, and disposable plastic cups. These indicators were previously determined as part of the SLP by federal regulation (BRASIL, 2012b). Absolute paper consumption had a slight variation, except for the year 2020, when a drastic decrease was observed, as expected due to the pandemic context (Figure 5). No significant linear trend was observed in the consumption of A4 white paper in UFCSPA (packages with 500 sheets) in the period, with an average annual decrease of 156.7 packages ($p=0.205$). However, in *per capita* consumption, the trend was significant, with an average annual decrease of 0.054 packages ($p=0,012$).

Despite having some change, we must observe that even though the UFCSPA population has increased, paper consumption remained stable, reflecting a reduction in *per capita* consumption. Many improvements in information technology have been made at UFCSPA, such as migration of official processes and documents from physical to digital systems, which contributed to such a reduction in paper consumption.

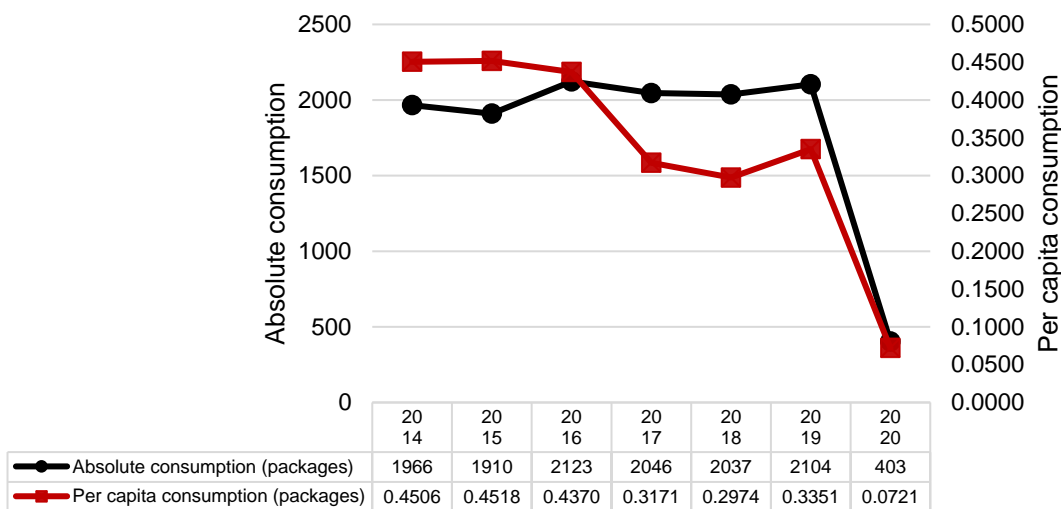


Figure 5. White A4 paper consumption (in 500 sheets packages) at UFCSPA (2014–2020).

Computerized processes contributed for reduction not only in the use of white paper but also of printer cartridges (Figure 6). No significant linear trend was observed in printer cartridge consumption at UFCSPA (units) in the period with an average annual decrease of 20.9 cartridges ($p=0.208$). However, in the *per capita* consumption, there was a significant tendency in reduction, with an average annual decrease of 0.005 cartridges ($p=0.049$).

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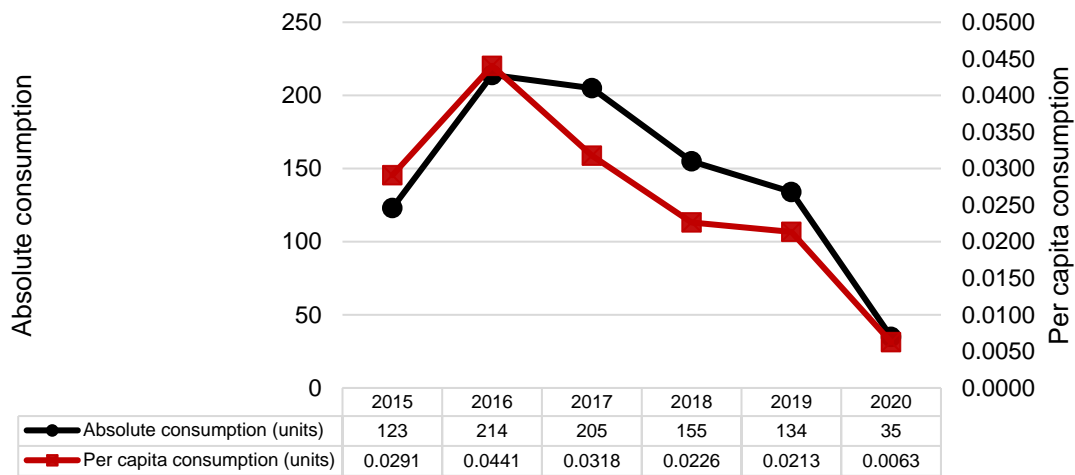


Figure 6. Printer cartridge consumption (in units) at UFCSPA (2015–2020).

When analyzing consumption of disposable cups, we obtained similar results, with an increase in consumption in 2016, the year of physical and academic expansion of UFCSPA. This decrease continued in the following years, which can be associated with the sustainability initiatives proposed by the institution.

SLP also highlighted the projects and extension programs for the intramural and extramural community. Of all the 69 projects and programs, the only project with a more environmental perspective was entitled "Sustainable technologies for dyeing fabrics aiming at the inclusion of young people (IMMIGRANT/BRAZILIAN) in vulnerable situations, using strategies of popular solidarity economy with a view to income generation". Moreover, there were 6 additional initiatives originated by EMC actions. This finding clearly shows that UFCSPA is engaged in the social sphere and in improving the quality of life in the occupational environment, but is not working specifically on environmental issues in its research and extension programs.

In its updated Institutional Development Plan (IDP 2020–2029), UFCSPA committed to engage with other sectors of society in a dialogical manner, building knowledge in the following fields: communication, culture, human rights, education, environment, health, technology and labor. For each area, UFCSPA SLP proposes a number of actions, totaling 69 (Table 3). Notably, the highest number of actions are directed to "Health", whereas "Environment" is the area with the least number of actions, including initiatives promoted by EMC (Table 4).

Table 3. Initiatives by thematic area of UFCSPA. Source: Adapted from SLP, 2021.

Subject area	Number of initiatives
Communication	8
Culture	8
Environment	7

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Health	46
Technology	9
Work	8

In its Management Report (2020), UFCSPA addresses goals to be achieved to meet the Agenda 2030. Even though these goals do not directly refer to "sustainability" or "environment", several actions carried on by UFCSPA contribute or are related to these issues, and also impact the institutional expenses. For example, in 2019 the University invested R\$ 1,283,084.59 (approximately US\$ 310,000 at that time) in solar photovoltaic plants, contributing not only to the production of sustainable energy, but also to a reduction in expenses on electricity consumption. Another initiative that contributed for sustainability and for the environment was the installation of bicycle racks in the campus, encouraging the use of alternative transport.

Finally, it is clear that UFCSPA has gradually undertaken several actions to improve the rational use of resources, and these actions have contributed for both environmental and economic sustainability. It is important for the institution to work constantly in the actions proposed in its IDP and SLP to improve indicators, thus serving as green marketing and contributing to the awareness of society.

Table 4. Actions related to sustainability. Source: Adapted PDI, 2019 and SLP, 2021.

Sustainability Initiatives	Reported document	Year
Sustainable technologies of fabric dyeing aiming at the inclusion of young people (IMIGRANT/BRAZILIAN) in vulnerable situations, using popular solidarity economy strategies to generate income	IDP	2019
Educational activities related to recycling and environmental preservation in public schools, in the city of Porto Alegre	SLP	2008
Series of lectures on Environment and Health	SLP	2009-2010
Cycle of Lectures on the Environment during the Environment Week	SLP	2013-2019
Activities on the Environment Day	SLP	2019-2020
Campaign to encourage the use of alternative transports that generate less environmental pollution	SLP	2010
Periodic orientation and training courses for the academic community in sustainable practices	SLP	2014-2020

4. Conclusion

The current economic crisis in Brazil has severely impacted public HEIs. Hence, investing in sustainable initiatives may be a way to overcome part of this problem. This study shows how actions implemented by UFCSPA, a Brazilian Federal University specialized in Health Sciences, impacted the use of resources, reducing consumption of water, electric energy and disposable materials, as well as decreasing waste generation. Notably, these actions contribute for sustainability, both in environmental as well as in economic and social terms. Recently, the significant cuts in federal funding put Brazilian public institutions at risk of closing down, threatening education as well as scientific research in the country. In the medium and long term, this will increase social inequalities and poverty. Therefore, it is urgent that the Brazilian government rethinks its policies and strategies, considering the unquestionable importance of HEIs for the development of the country.

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