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Research Article

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Citizen science in the implementation of the Sustainable Development Goals in the State of Santa Catarina, Brazil

Paola Carvalho da Silveira [1] Edgar Bisset-Alvarez [2]

ABSTRACT

Introduction: Planet Earth finds itself in a reality in which it is increasingly necessary to have tools that enable and discuss the importance of sustainability. In the world and in Brazil, the 2030 Agenda is in force, which addresses 17 sustainable goals to try to minimize the effects of the Earth's overload, as well as discussing social, economic and environmental problems. Objective: Through the conceptualization of citizen science - science with non-scientists - it analyzes the potential that the concept has in the implementation of the sustainable development objectives in the Santa Catarina 2030 Development Plan. Methodology: The research is characterized as bibliographical and documentary, where it uses data collection and documentary analysis in relation to the object of study of the research. Results: The results made it possible to approach citizen science projects and initiatives in relation to the sustainable development goals of the 2030 Agenda, obtaining a survey of citizen science projects that can be used in the SDGs of the Santa Catarina development plan, to obtain support for the main actions, or else referring to activities that can be proposed for the fulfillment of the plan. Conclusion: It was concluded that there are initiatives with the potential to be used in relation to the Santa Catarina 2030 development plan, especially those of an environmental nature, demonstrating how citizen actions can be used to fulfill the objectives established by the 2030 Agenda.

KEYWORDS

Open science. Citizen science. Agenda 2030. Sustainable development goals. State of Santa Catarina.

Authors' correspondence

[1] Universidade Federal de Santa Catarina
Florianópolis, SC - Brazil
paolascsil@gmail.com

[2] Universidade Federal de Santa Catarina
Florianópolis, SC - Brazil
edgar.bisset@ufsc.br

Ciência cidadã na efetivação dos objetivos de desenvolvimento sustentável no Estado de Santa Catarina, Brasil

RESUMO

Introdução: O planeta terra se encontra em uma realidade, na qual cada vez mais se torna necessário ferramentas que possibilitem e discutam a importância da sustentabilidade. No mundo e no Brasil, está em vigência a Agenda 2030, a qual aborda 17 objetivos sustentáveis para tentar minimizar os efeitos da sobrecarga da Terra, além da discussão de problemas sociais, econômicos e ambientais. Objetivo: Por meio da conceituação de ciência cidadã - ciência com não cientistas – analisa o potencial que o conceito tem na efetivação dos objetivos de desenvolvimento sustentável perante o Plano de Desenvolvimento Santa Catarina 2030. Metodologia: A pesquisa é caracterizada como

bibliográfica e documental, onde utiliza-se do levantamento de dados e análise documental frente ao objeto de estudo da pesquisa. Resultados: Os resultados possibilitaram abordar os projetos e iniciativas de ciência cidadã relacionando aos objetivos de desenvolvimento sustentáveis da Agenda 2030, obtendo um levantamento dos projetos de ciência cidadã que podem ser utilizados nos ODS do plano de desenvolvimento de Santa Catarina, para obter sustentação das principais ações, ou então referentes atividades que possam ser propostas para o cumprimento do plano. Conclusão: Concluiu-se que existem iniciativas com potencial para serem utilizadas frente ao plano de desenvolvimento de Santa Catarina 2030, principalmente as de cunho ambiental, demonstrando como ações cidadãs podem ser utilizadas para o cumprimento dos objetivos estabelecidos pela Agenda 2030.

PALAVRAS-CHAVE

Ciência aberta. Ciência cidadã. Agenda 2030. Objetivos de desenvolvimento sustentável. Estado de Santa Catarina.

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1 INTRODUCTION

Humanity lives in a reality in which debates on environmental issues are increasingly necessary. The way planet Earth is reacting to climate change impacts directly the environment and consequently society, where the impact of catastrophes is directly influenced by human action (Layrargues, 2000).

Over time, there have been various attempts to minimize the effects on different territories, in economic, political, structural, and environmental issues, in addition to actions to put sustainability into practice and share this knowledge, usually through conferences and meetings, some of them mediated by the United Nations (UN), active since 1945 (ONU, 2015).

Among the conferences, the highlight is one held in 2015, where heads of States belonging to the organization discussed the sustainable development goals (SDGs) for the year 2030, built on three pillars: social, economic and environmental (ONU, 2015). The plan outlined is the fulfillment of 17 goals and their 169 targets, using recommendations present in the document then created, entitled Agenda 2030.

Brazil, one of the signatory countries of the plan, needed to create mechanisms to address the goals. In the State of Santa Catarina, in the south of Brazil, the Santa Catarina 2030 Development Plan is in force, addressing demands and strategies for economic, sustainable, and innovation development for the State (Santa Catarina, 2018). According to the aforementioned author, sustainable development in the Plan is directly related to the indicators established by the 2030 Agenda.

Analyzing the models for insertion of the Santa Catarina 2030 Development Plan and the 2030 Agenda, one thinks about ways of applying and achieving the proposed goals, using not only government support – although it is the main one –, but society help in achieving the goals proposed by the Agenda, initially thinking of their own localities' participation.

Albagli and Rocha (2021) address the term Citizen Science (CS) as an application to name activities that involve "non-scientists" in the research itself, enabling society to research, volunteer, explore, and investigate matters from different fields of knowledge, thus allowing direct involvement with science, making it easier for research to not be carried out just by one body, but with help from population. Given the characteristics presented in CS activities, it can be seen as an ally to the SDGs due to its broad approach.

One of the possible paths is the adoption of the proposals arising from CS which, according to Albagli and Rocha (2021), is citizen involvement as a form of engagement in specific issues and actions, such as its potential for fulfilling the Santa Catarina 2030 Development Plan. In this context, the objective of this research was to investigate CS potential for achieving the SDGs in the State of Santa Catarina, through citizen projects and initiatives.

2 OPEN SCIENCE: LOOKING AT CITIZEN SCIENCE

Albagli, Clinio and Raychtok (2014) approach Open Science as an umbrella term that involves several perspectives and implications, allowing the connection between science and society, such as Open Access, open education and open educational resources, open scientific data, open scientific tools and materials, open research notebooks and CS.

The population can participate in other ways in the knowledge production process, such as citizen participation in research and scientific projects. The concept of CS, present in the theme of Open Science, can be understood as voluntary citizen participation in scientific research. According to Silveira *et al.* (2021) there are six representations of CS, namely: citizen laboratory, scientific dissemination, public relations in distributed computing, collaboration networks, and crowdsourcing.

For Parra (2015), CS, especially in Brazil, uses the concept imposed by the author Rick Bonney of being a tool used by scientists and science to collect data, which is more common to be found in research and projects in the scientific area.

Thus, Alan Irwin's definition can also be used for a more democratic role in research, aiming at the population's greater involvement with science, and not just its methodological participation in such research.

Even though the concepts were presented in the 20th century, the concept of CS is older, and for Rebouças (2013), CS originated at the end of the 19th century and beginning of the 20th century, in the year 1900, where counting birds was regular practice. Finquelievich and Fischnaller (2014) present that the first signs of CS appeared in the 19th century, where citizens used their knowledge to help in defining the characteristics of tides.

In the opinion of Luís (2022), CS is used as a model for an approach to answer "key questions" of scientific investigations, through volunteers (citizens) in research scientific process stages, in which they can be produced in different forms. When analyzing the theme in relation to the SDGs and the 2030 Agenda, one can think about using it for research with citizens. This participation model can be used positively by organizations and the State, enabling support for achievement of the SDGs through projects and initiatives in the area of CS.

2.1 Sustainable Development Goals and the 2030 Agenda

Sustainability is understood as a set of procedures that help the ecosystem not to succumb, enabling its preservation for future generations (Boff, 2012; Romeiro, 2012; Souza, 2021). The expression is present in the 2030 Agenda, a mechanism created in 2015 and used to achieve a better world for all people, managed by the United Nations (UN). The document was prepared and approved by the 193 UN member countries (Tomaz and Tomaz, 2021).

The 2030 Agenda, a document that aims to create an action plan to eradicate hunger, is a challenge faced by countries and of great importance for the sustainable development agenda, bringing 17 SDGs and 169 targets to be achieved (ONU, 2015). Goals are divided as follows:

Figure 1. Sustainable Development Goals

Source: Secom/TRT-RS (2020)

Although member countries can adapt the goals, which are inclusive and seek broad development for the entire society, they need to be in accordance with the 2030 Agenda, which establishes their achievement by 2030 (Burtet, Fontanela and Marocco, 2021).

In addition to the 17 SDGs set out in the 2030 Agenda, each goal has global targets to be achieved also by 2030. The targets underwent public consultations before being included in the Agenda.They are a continuation of the Millennium Development Goals, which seek to achieve unfinished goals (ONU, 2015) or improve them.

Given the presentation of the 17 SDGs, analyzing Brazil's situation in relation to the 2030 Agenda and after seven years of its implementation, it can be said that, as explained by Gomes, Barbosa and Oliveira (2020), the country still has to put a great deal of effort into achieving such goals due to the country's lack of commitment to the Agenda over the years.

The situation of the SDGs and the 2030 Agenda on Brazilian soil is retrogressing, because, as data made available by the Spotlight Report, in 2020 Brazil showed:

> 102 targets (60.35%) in a setback; 14 (8.28%) threatened; 16 (9.46%) stagnant in relation to the previous period; 29 (17.1%) with insufficient progress; three (1.77%) with satisfactory progress, and four (2.36%) without sufficient data for classification, with one (0.59%) not applicable to Brazil (Relatório Luz, 2023, p. 7).

As it is possible to verify by the Spotlight Report data, regarding Brazil's sustainability scenario, the 2030 Agenda should be an important point to be debated among the responsible bodies, since due to delays in its implementation, the SDGs are at risk of not being achieved by the time proposed by the UN.

2.2 Agenda 2030 in the State of Santa Catarina

The State's important role is to support the exercise of citizenship in its territory, obtain guidance aimed at socioeconomic and structural improvements in the area, and define objectives for a more promising future (Santa Catarina, 2018).

The State of Santa Catarina, which borders Paraná to the north and Rio Grande do Sul to the south, is a state with around 7,338,473 inhabitants and a territorial area of 95,730.690km² (IBGE, 2021). Santa Catarina, as well as some Brazilian states, strive for a long-term planning, thinking about current affairs and issues related to the future, using mechanisms that allow strategic objectives for society to be achieved (Butzke, Theis and Goularti, 2009).

The Santa Catarina 2030 Development Plan is currently in force, having started in 2018 and with end in 2030, and its implementation is linked to the guidelines on the SDGs of the 2030 Agenda of the United Nations Development Programme (UNDP) (Santa Catarina, 2018).

Santa Catarina has a history of other productions such as the plan in force. The first two plans implemented were the *Planos de Metas do Governo* [Government Targets Plan] (PLAMEG) I and II (1961-1965 and 1966-1970, respectively), then the *Projeto Catarinense de Desenvolvimento* [Development Project of Santa Catarina] (PCD) 1971-1974, and the PCD 2011-2015, previous to the current plan, which was directed at the State sustainability, however exposed by Theis and Mantovaneli Junior (2019) as vague and with implementation issues. It was from the PCD 2011-2015 that the topic was exposed as a goal in the State, but it was only addressed in the current Santa Catarina 2030 Development Plan, with 2030 Agenda aspirations. The Santa Catarina 2030 Development Plan has actions divided into sectors and focuses on five dimensions: economic (industry, services, science and technology, agriculture and fishing, culture, sport and tourism), social (education, health, public safety, social assistance, work and

housing), infrastructure and environment (infrastructure, environment and mobility), and public management (Santa Catarina, 2018).

It is divided into goals, basing on the goals proposed by the UN to accomplish the 2030 Agenda. The table below presents the SDGs and their targets:

Chart 1. Goals presented in the Santa Catarina 2030 Development Plan

Sustainable Development Goals	Goals present in the Plan
1. No poverty	End poverty in all its forms everywhere
2. Zero hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Good health and well-being	Ensure healthy lives and promote well-being for all at all ages
4. Quality education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
6. Clean water and sanitation	Ensure availability and sustainable management of water and sanitation for all
7. Affordable and clean energy	Ensure access to affordable, reliable, sustainable and modern energy for all
8. Decent work and economic growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Industry, innovation and infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
11. Sustainable cities and communities	Make cities and human settlements inclusive, safe, resilient and sustainable
13. Climate action	Take urgent action to combat climate change and its impacts
14. Life below water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Life on land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
16. Peace, justice and strong institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Source: Santa Catarina (2018).

In the table it is possible to visualize the 2030 Agenda goals used in the plan, which are presented in relation to their respective State realities. **Goals 5 – gender equality –, 10 – reduced inequalities –, 12 – responsible consumption and production -, and 17 – partnerships for the goals – are not in the table.**

Besides the State scenario, the Plan assumes other perspectives, focusing on being in line with Brazil and, in a normative way, with the whole world (Santa Catarina, 2018). The 2030 Agenda, at both national and state levels, is far from showing good achievement indicators. Several locations are not at a good level to be able to achieve the current goals, even though the State had an increase in GDP, with 4.20% in 2014 (Santa Catarina, 2018).

The 2030 vision for Santa Catarina focuses on a society that is a reference in sustainability, innovation, entrepreneurship, and social and regional equity (Santa Catarina, 2018). The proposition consists of carrying out the desired transformation through innovative ventures, but in a sustainable manner and respecting the society's fundamental values, combining continuity and change.

Thinking of Santa Catarina's future, it is necessary, in a high-level-position model, to have a democratic and transparent governance, whose mission is long-term development, without harming the population (Santa Catarina, 2018). As stated in the Santa Catarina 2030 Development Plan, "only new public governance and the institutionalization of a long-term perspective can guarantee the success of the SC 2030 Plan" (Santa Catarina, 2018, p. 29), which should be accompanied by targets and strategies that favor not only the State economic perspectives, but also the civil and sustainable ones.

Santa Catarina needs to develop actions to meet the stipulated goals, thinking about alternatives to use and take advantage of tools for the society's involvement and engagement in achieving the proposed targets, considering the use of CS (one of the Open Science pillars) as a progression instrument.

3 METHODOLOGY

This is a qualitative bibliographic documentary research. The research universe is the valid results of CS projects that meet the SDGs, and the research scope is the State of Santa Catarina.

Initially, a search was carried out on the Brazilian Biodiversity Information System (SIBBr), a platform that discloses online information about Brazilian biodiversity, where it was possible to find a total of 52 projects that encompass CS.

The Citizen Science Platform (Civis), an initiative developed by the Brazilian Institute of Information in Science and Technology (IBICT), allows learning about initiatives on CS, with a focus on Latin America and the Caribbean, and a total of 36 initiatives were found, some of which are present both on SIBBr and on Civis. Such platforms were chosen due to their proximity to projects in the area of CS.

The search to retrieve information from SiBBr and Civis was carried out by accessing the platforms, from August 7 to September 25, 2023, viewing all projects linked to CS and subsequently those that would fit as potential for the SDGs. After analyzing all the projects by reading the title and abstracts, the documents chosen were the projects that addressed CS, which obtained a real application, not necessarily applied to the context of Santa Catarina, but which could be used with appropriate modifications.

To cover the studies for the objectives of this research, source selection criteria were used for articles that mentioned the theme of CS and the SDGs in the keywords, abstract, or title.

The databases used were scientific journals in the area of Information Science and/or related ones: Information Science Database (BRAPCI), which allowed an analysis of what is produced in the area of Information Science; Redalyc, a database created in North America, to obtain information about what is being discussed on the American continent, and Scopus and Web of Science (WoS) databases, as they are international databases, which allow an analysis of scientific production at a global level.

The keywords "Ciência Cidadã" [Citizen Science] AND "Objetivos de Desenvolvimento Sustentável" [Sustainable Development Goals] OR "Agenda 2030" were used as a retrieved strategy. To obtain more documents, the same keywords were used in the English and Spanish languages. A total of 118 articles were retrieved: two articles from the Brapci database; 30 articles from WoS); five publications from Redalyc, and 81 from Scopus.

After applying the inclusion (address the SDGs and CS) and exclusion (they could not be used as CC projects) criteria, 76 articles were selected, namely: two from Brapci; 23 from WoS; one from Redalyc, and 50 from Scopus.

4 CITIZEN SCIENCE PROPOSALS FOR THE SC 2030 PLAN

The plan dimensions are presented in order as in the 2030 Agenda, numbering the SDGs and their respective targets, with posterior presentation of actions found.

Goal 1 – No poverty – aims to "end poverty in all forms everywhere," about which two articles found allow analyzing how CS can contribute to it . The study by Pateman, Tuhkanen and Ciderby (2021) analyzes the contribution of CS and the SDGs in cities in low- and middle-income countries by using one of the targets of Goal 1 to improve access to basic services through projects that enable the monitoring of SDGs, provided through data generated by citizens, given the reality of cities. This initiative could be used to strengthen actions in the State to better monitor areas at greater risk of vulnerability.

Goal 2 – Zero hunger – is related to zero hunger and sustainable agriculture, that is, aims to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture." The plan states that Santa Catarina agriculture stands out internationally in terms of productivity, competitiveness, and technology (Santa Catarina, 2018), but there are some goals that were not achieved.

One found three citizen participation projects that addressed food security, mainly by means of monitoring and participation in harvesting. Citizen participation can be found in the "Seca-Wiki" project,[1] which allows farmers to monitor the drought impacts on the Brazilian semi-arid region, in which, within the context of CS, there was development of a platform for sending and collecting agricultural data.

Such platform allows rural extension agents, and even family farmers, to be involved directly in monitoring agricultural drought in the region, having a proactive participation in the use and dissemination of agricultural data. In order to achieve sustainable production, farmers have to understand their reality and the model for achieving sustainable production.

CS can assist in this information exchange, allowing them to have the means to deal with technologies and use them in favor of their development through applications and software, as addressed in the Plan that the State should obtain a rural and fishing environment with a sustainable production through the development and use of technological and social innovations.

The projects present CS criteria and can help in the fulfillment of Goal 2 in the State, always aiming at adapting it to the location and the local residents' approval, so that the projects can be applied and analyzed in relation to whether they are viable for the place.

Goal 3 – Good health and well-being – aims to "ensure healthy lives and promote well-being for all at all ages." CS can be used to ensure information and education about health and fight against viral and communicable diseases. Actions taken guarantee the safety of science in supporting the society's well-being through virtual and real projects.

In the search for citizen participation with real applications, one found some virtual applications that help monitor insects that transmit diseases, allowing technology to play its part in citizen participation. One of the citizen projects that enable this surveillance is AeTrapp,

[1] Projeto Seca-Wiki: http://www2.cemaden.gov.br/ciencia-cidada/

which enables population to monitor Aedes mosquitoes, vectors of zika, dengue, chikungunya and urban yellow fever, thus allowing scientists or those in charge to analyze this data and monitor mosquitoes and local contamination factors (SIBBr, 2022).

A study by Albagli and Rocha (2021) addresses how CS can help in emergency situations, such as in the case of COVID-19 pandemic, which compromised global health due to the risks caused by the virus. Therefore, the State could use this acquired knowledge as a way to promote health and well-being, showing to society the vital importance of people's effective participation in public health, especially in emergency cases, as occurred during the pandemic.

Although the State has the main role in public health care, citizen participation can help governments in some locations where information is more difficult to be disseminated, especially with technology help, such as the use of telemedicine, which can be used to reduce child mortality.

Goal 4 – Quality education – seeks to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."

CS as a concept of non-scientist participation in science can be addressed in the 2030 Plan, allowing population inclusion in education, research and educational extension through projects and actions carried out in communities and places where education is somewhat difficult to be provided.

Besides, it is possible to guarantee the appreciation of professionals from different segments of the educational area, through cooperation between teachers, scientists, the community and the State, and use CS as a mechanism for insertion in science, stimulating through games, applications, environmental actions and making young people's interest in education, science and research something fundamental and essential.

The *Brydes do Brasil* Project,[2] a voluntary initiative by a team of researchers interested in gathering as many records of photo-identified Bryde's whales as possible, allows society to be mobilized and involved in participatory scientific research, promoting knowledge among students of the local schools (SiBBr, 2023). The Project allows civil society to monitor environmental initiatives, using education as a tool for teaching inside and outside the classroom.

Goal 6 – Clean water and sanitation –, which aims to "ensure availability and sustainable management of water and sanitation for all," Goal 7 – Affordable and clean energy –, which aims to "ensure access to affordable, reliable, sustainable and modern energy for all," and Goal 9 – Industry, innovation and infrastructure –, which aims to "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation," are exposed in a linked manner in the plan.

The targets presented for these SDGs are: expand the service capacity of cargo and passenger transport modes through the continuous improvement of logistics infrastructure and people connectivity, aiming to increase Santa Catarina's competitiveness; ensure quality water supply and expand sewage collection and treatment coverage, and guarantee the electrical energy supply and the energy matrix diversification.

After a survey was made, one found a project was on Civis, called "*Interactivos? Água e Autonomia - Silo Arte e Cultura Rural,*" whose objective is to experiment with propositions and solutions relating to the problems we face, such as water scarcity and carelessness in its use, considering drinking water for human and animal consumption and water intended for different uses: domestic consumption, agricultural consumption, industrial consumption, and use in recreational activities

The project could be implemented in the State as a model for the population involvement in water and sewage treatment, making participants active in caring for water and correctly

[2] Projeto Brydes do Brasil: http://www.brydesdobrasil.com.br/

disposing of waste, ensuring good quality water with the help from public administration, which needs ensure adequate information for the entire population, in addition to providing ways to contain waste thrown into rivers and lakes.

It is important to achieve an inclusive and sustainable industry, and this SDG can be achieved through the employees themselves, as CS aims for the participant contribution, but citizens with technical skills and knowledge (Sauermann, 2020) can help in the modification of the industrial movement, in addition to enabling innovation, which can be found in academia, but also in the management of knowledge present in various collaborators.

Goal 8 – Decent work and economic growth – aims to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all." One article that addresses Goal 8 was found but no initiatives towards the goal are presented.

The Plan preliminary analysis addresses how the areas of tourism, culture, and sport are expected to promote inclusive and sustainable economic growth, full and productive employment and decent work for all. Citizen initiatives work towards the implementation of CS as a model for tourism stimulus, using volunteers to preserve and monitor places where there is a demand for tourists in the region, as well as the care and promotion of local culture and sport; for this purpose, it is necessary to prepare volunteers so that they understand their importance in the regional cultural role, as well as their customs and realities (Santa Catarina, 2018).

The State has to understand the population's role in this scenario and assist in the search for economic growth not only for large businesspeople, but also for local producers, and courses and actions can be carried out through CS, enabling teaching in distant areas.

Decent work can use citizen initiatives that guarantee monitoring of farms that use slave labor. In this sense, the *Do Pasto ao Prato* [From Pasture to Plate] Project has an application that monitors and makes available to the population the number of farms fined for working conditions similar to slavery at Brazilian meatpacking plants, trying to make the meat market more transparent and sustainable (SiBBr, 2023).

Goal 9 – Industry, innovation and infrastructure – is divided in the Plan into five goals (in addition to its targets and strategic actions): accelerate the process of modernizing Santa Catarina's productive structure towards technology-intensive activities; expand the knowledge economy to all regions of the state with a view to reducing regional imbalances; promote the economic vocation of each macro-region, adding value and quality to traditional Santa Catarina products; promote, retain, and attract national and foreign investments in knowledge-intensive industrial and service sectors, and develop sustainable entrepreneurship and innovation ecosystems. No projects or participation were found that could be used under the perspective of the SC 2030 Development Plan.

Goal 11 – Sustainable cities and communities – aims to "make cities and human settlements inclusive, safe, resilient and sustainable," and one found the *Fala Curitiba* Project, from the city of Curitiba, whose aspiration is to bring citizens and municipalities closer together, allowing the population to be part of a smarter city and be involved in decision-making (Ferreira and Coelho, 2021).

People in charge of the project gather information in person and an application collects virtual information, allowing the public body to be aware of which public policies that are requested by region the most, crossing location information from the addresses of citizens who participated in the consultation and evaluation of the city's public facilities, making daily work easier and supporting the State in planning and decision-making (Ferreira and Coelho, 2021).

For the State of Santa Catarina, the application could be used with the same objective, but adapting it to the reality of its people, especially in cities where there is a large population, which ends up making it more difficult to know the public policies most requested by region and its needs, since with improved public policies, cities present more positive and sustainable impacts.

Goal 13 – Climate action –, Goal 14 – Life below water –, and Goal 15 – Life on land – are linked to climate change, which is already an experienced reality, and it is necessary to combat climate change and its effects, conserve and sustainably use the oceans, seas and marine resources for sustainable development.

With regard to Goal 13, which aims to "take urgent action to combat climate change and its impacts," the *Guardião da Chapada* Project can be used as an example of a citizen project; the initiative aims to conserve the pollination service and the diversity of pollinators through public engagement in monitoring the flower-floral visitor interaction in the Chapada Diamantina territory.

The project is based on a research model that guarantees the voluntary and conscious citizen participation in the production of scientific knowledge and in raising public awareness of the importance of the services provided by pollinators for the conservation of natural heritage and food production (SiBBr, 2023).

Santa Catarina, as well as several parts of the country, has to combat climate change, which has been occurring over the years. Citizen actions can be important as a model for raising awareness among the population, mainly using projects that aim to reduce climate change or promote its possible prevention, such as the case of the low sewage rate in the State (Santa Catarina, 2018), which could be studied as a model project that aims to improve water quality, using citizens as monitoring volunteers.

Regarding Goal 14, which aims to "conserve and sustainably use the oceans, seas and marine resources for sustainable development," there are projects to conserve marine and coastal environments, some using mobile applications as support and others using data from volunteers for scientific analyzes and research, such as Blue Change, which assists in projects on waste issues in the seas and whose expectation is to awaken an interest in science and environmental conservation among beach users (SiBBr, 2023).

The *#DeOlhoNosCorais* Project is a scientific dissemination and CS initiative that promotes citizen monitoring of corals on the Brazilian coast by sharing images on Instagram (SiBBr, 2023). There are projects to control biodiversity, such as *Biodiversidade do PEF*I, *BioTiba - Projetos de Biodiversidade*, *Listas Ecológicas de Espécies de Borboletas* (LEEB), all directed at controlling and observing the Brazilian ecosystem.

The State of Santa Catarina has a large coastal strip, which increases its need for conservation. Several actions that allow citizens to control and monitor aquatic environments can be rethought by the State, as there are many researchers and volunteers who have a direct connection with issues arising from aquatic life and have vast knowledge to assist governments in the sustainable development of marine life in Santa Catarina.

Technology is very present in actions linked to terrestrial life (SDG 15), mainly through applications, pieces of software, and mechanisms that enable the control of this information, as shown in the study by Kamp *et al*. (2016), which uses unstructured CS data. It's possible to mention projects such as *Eco inovação* and *Cidadania Digital*, which map the *cerrado* species and use a technological platform for mobile devices and the Internet with the purpose of facilitating the recording of information about the *cerrado* flora (SiBBr, 2023), which could be used to record Santa Catarina biomes.

In turn, MIND.Funga, through a digital environment of macrofungus images and data (Cellphone Application - Android), aims, with the support from volunteer citizens, to: a) provide interaction and innovation in the recognition of macrofungi, and b) expand the recognition of native macrofungal species in high-altitude ecosystems in Santa Catarina, with more precise information on their species richness and distribution.

It is important to note that there are already some projects in Santa Catarina, such as MIND.Funga, which have the support from the State Environmental Institute but that do not receive financial support from it (SiBBr, 2023). In the area of biological sciences, several citizen actions are present, some for recording and monitoring birds, biomes, quantifying

animals, making information available to scientists and helping with state and national biodiversity. It is therefore important to increase the number of projects in the State and not just support them, but make financial resources available so that the projects can continue active, with direct support from the state government.

Goal 16 – Peace, justice and strong institutions –, aims to "promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels."

In Santa Catarina 2030 Development Plan, this SDG is present as follows: promote peaceful and inclusive societies for sustainable development, providing access to justice for all and building effective, responsible and inclusive institutions at all levels (UNDP. SUSTAINABLE DEVELOPMENT GOAL 16 – 2030). The suggestion, proposed based on the readings carried out for the work, is society inclusion in State decisions, listening to the people and ensuring safe living in cities, what can be done through citizen-based initiatives using applications or models in a face-to-face format, to control and analyze the violence rate in cities, as well as the police presence in regions that need public security the most.

Goal 16 is aligned with the following Plan objectives: reduce the incidence of violent crimes and the power of criminal organizations focused on drug trafficking; increase security and a sense of security; reduce violence and traffic deaths; guarantee social reintegration of people deprived of their liberty and adolescents under socio-educational measures; increase the level of understanding and resolution capacity of the population and public authorities in relation to natural catastrophic events, for which no initiatives were found in the research.

It was possible to found, through the propositions of citizen actions, a number of projects involving CS, and many have their implementation exposed by data from the initiatives, using volunteers or data collected by them to maintain the projects active.

Regarding Goals 9 (industry, innovation and infrastructure) and 16 (peace, justice and strong institutions) no projects were found that could be used under the perspective of SC 2030 Development Plan.

As a research limitation, the mention is that the Santa Catarina 2030 Development Plan does not cover Goals 5 – gender equality –, 10 – reduced inequalities –, 12 – responsible consumption and production -, and 17 – partnerships for the goals –, resulting in a study where it is possible to see that there are initiatives that could also meet the SDGs if present later in the Plan, since although the Plan talks about social equity, there is no state targets for reducing inequalities.

In this context, it is noted that there are numerous initiatives that can help in achieving the goals, and presence of State agents that can help in changing society's behavior towards achieving the SDGs is important, besides being a multiplier of initiatives, allowing the population to understand that to do their part, they do not necessarily need to understand or be linked to the scientific or political environment, but rather with initiatives that are present in their own daily lives.

The process of achieving goals in Santa Catarina is permeated in the daily lives of the population, as shown by some current initiatives in the analysis of results, where data generated or monitored by society could act in the implementation and citizens' awareness regarding the Santa Catarina 2030 Development Plan.

6 CONCLUSION

This article had the general objective of investigating the potential that CS offers for the achievement of the SDGs in the State of Santa Catarina. The identification of actions present in CS allowed learning about their presence in different areas of knowledge, and projects and initiatives focused on the environmental area are predominant, with 32 initiatives related to Goal 14 – Life below water –, and 80 related to Goal 15 – Life on land –, with the largest

number of projects found involving CS and its possible use for the SDGs, finding presence of Citizen Science as a result, mainly in environmental actions.

For other objectives present in the 2030 Agenda, few works were found that are in line with the SDGs, showing that although present in some objectives, CS needs to get closer to the 2030 Agenda, mainly by using the citizen as a voluntary agent of change.

In order for the initiatives to be implemented and the goals set out by the government of Santa Catarina to be achieved, it is necessary to think about the great help that organizations can provide to the commitment to sustainability; the State, through its commitment to the population, could carry out training, encouragement and mobilization of civil society, so that people can assist governments directly or indirectly in the indicators, allowing a more agile response for the year 2030, given the way in which society knows environmental, economic and social issues on a daily basis.

The federal and state institutions present in the State, although not addressed in the SC 2030 plan (only for the creation of the Plan), if involved in the topic, could do a lot of work to contribute to its implementation, reducing the difficulties encountered.

Mechanisms found in science, such as research, extension work, volunteering, and scientific discoveries, can help the State in implementing the Plan, carrying out actions that promote the population involvement, enabling people to take part in research and collect information voluntarily and in a more agile manner. Although the Plan is a document created by the government and entities, the commitment and achievement of results imposed by the goals and targets can be a joint effort with the population.

The research expects, as a final result, to contribute and present CS as a model to be used to achieve the SDGs in the State of Santa Catarina, demonstrating how citizen actions can be used to achieve the goals established by the 2030 Agenda, and subsequently for other movements that involve the possible effectiveness of CS projects and initiatives.

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