v. 5, n. 1, 2025

Scientific Journal of Applied Social and Clinical Science

THE COMPLEXITY OF ECOSYSTEM THINKING IN LAND MANAGEMENT: ANALYSIS AND CONTRIBUTIONS TO GOVERNANCE INDICATORS IN THE STATE OF SANTA CATARINA

Acceptance date: 22/01/2025

Rafael Lublo
Universidade Federal de Santa Catarina (UFSC), Department of Architecture and Urbanism, Graduate Program in Architecture and Urbanism. Florianópolis, SC, Brazil, Master's Degree in Urbanism, History and Architecture of the City
Orcid Id 0000-0002-3291-5622

Jose Ripper Kos
Universidade Federal de Santa Catarina (UFSC), Department of Architecture and Urbanism, Graduate Program in Architecture and Urbanism. Florianópolis, SC, Brazil, PhD - Information Technology and Architecture
Orcid Id 0000-0002-4760-0017

Abstract: Research focusing on various frontiers of territorial planning indicates a global scenario that calls for drastically different ways of planning, building and governing cities. However, cities are complex and varied, depending on their unique circumstances, with different barriers, limitations and opportunities, such as resources, capital and leadership. The aim of this research is to contribute to the reduction of complex problems in territorial planning through the management of the Governance of the State of Santa Catarina. To this end, it explores the relationship between its methodology for Governance Performance Indicators and the 169 targets of the 17 Sustainable Development Goals from the analytical perspective of the 13 ecosystem dimensions proposed by the Urban Ecology Laboratory of the Federal University of Santa Catarina. Data was collected and compiled between 2020 and 2022 using causal loop diagrams to capture the complex interaction between different factors inside and outside the system. The results radar chart shows satisfaction rates of less than 50% in all 13 dimensions, evidenced by the decentralization of the spheres of governance. This diagnosis indicates a compromising level compared to that suggested by international reference authors and guided by the 17 Sustainable Development Goals. The result highlights and reinforces the need to reduce the fragmentation of public policies that has been contributing to an unsustainable future of the Anthropocene. It proves that integration between the public and private sectors and civil society is a prerequisite for decision-makers in territorial planning.
Keywords: Ecosystem approach. Governance Performance Indicators. Government of the state of Santa Catarina. Sustainable Development Goals.

INTRODUCTION

Complex systems researchers generally say that humans have a cognitive blind spot that makes us ignore what is not seen. They offer this compelling insight into why traditional science and engineering practices struggle to find meaningful solutions to complex problems. The Americans David Krakauer, dedicated to the evolution of intelligence and stupidity on earth, and Geoffrey West, a theorist in physics and biology dedicated to the unifying power of phenomena at scale, illustrate this vision with a story from the Second World War about analyzing the location of bullet holes in planes returning from missions

They recount that when World War II bombers returned from their missions riddled with bullet holes, the first response was, unsurprisingly, to add armor to the most damaged areas. However, statistician Abraham Wald made what seemed like a counterintuitive recommendation to add reinforcement to these undamaged parts. Wald had uniquely understood that the planes that were shot up where no bullet holes were seen were the planes that never made it back. Of course, that was where the real problem lay. Reinforcements were added to the apparently intact places and losses dropped dramatically (KRAKAUER; WEST,2020).

By directing attention to the damage not caused during the global COVID-19 pandemic, where the deepest nature of the crisis was the collapse of several coupled complex systems, according to American Suzan M. Fitzpatrick (2020) (president of the James S. McDonnell Foundation, a funder of research in behavioral sciences and complex systems) the global pandemic revealed the fragility of several engineering systems that we rely on. But while the virus is where our attention has been drawn, the pandemic was not the cause of social fragilities, but rather the widespread failures of complex systems resulting from a willingness to ignore the damage we don't see.

Chinese researcher Xuemei Bai (2018), in her book *Uban planet: knowledge towards susteinable cities,* launches an integrative approach to the urban environment, including researchers from various disciplines (sociology, evolutionary political science, geography, economics and engineering) with perspectives from often neglected voices (architects, journalists, artists and activists). One of the objectives was to provide a perspective to connect challenges and solutions on a local scale with drivers and political structures on a regional and global scale.

Evidence shows that increasingly positive and sustainable outcomes in the urban context require an ecosystem approach that integrates perspectives from urban planning, design, mobility, sanitation and environmental science. With this perspective in mind, the *Urban Knowledge-Action Network - Urban KAN*, one of the 8 interconnected *Future Earth* networks launched at the Habitat III Conference, can represent an integrative and transdisciplinary approach to engage researchers, policymakers and other stakeholders on urban issues at various levels, facilitating the co-production of knowledge needed to tackle urban challenges.

Future Earth's 19 global research projects have been established in recent decades under the support of global environmental change programs, namely: DIVERSITAS, the International Geosphere-Biosphere Program - IGBP and the International Human Dimensions Program on Global Environmental Change - IHDP. These projects manage international research campaigns, databases and monitoring matrices. They produce global and socially relevant research, and mobilize capacity and communities through international open science conferences, regular *workshops* and events, with the aim of becoming global governance policies (FUTURE EARTH, 2022).

Data from the United Nations World Organization - UNO indicates that more than half of the world's population now lives in urban areas, and both the proportion and the numbers continue to grow. For various reasons, cities are an important part of life on the planet. By 2030, around 60% of the world's population will live in urban areas. Currently, almost a billion people live in irregular housing and, in addition, cities are responsible for 75% of carbon emissions in the atmosphere, one of the Greenhouse Gases - GHGs. Therefore, making cities more sustainable and fair is essential for the survival of the planet and humanity. This is why urban life is part of the Sustainable Development Goals - SDGs for 2030 (UN, 2022).

The SDGs are part of the so-called "2030 Agenda", a global pact signed during the United Nations Summit in 2015 by the 193 member countries. The 2030 Agenda is made up of 17 ambitious and interconnected goals, broken down into 169 targets, with a focus on overcoming the main development challenges faced by people in Brazil and around the world, promoting global sustainable growth by 2030 (UN, 2022).

The 17 SDGs cover different themes, integrating environmental, social and economic aspects. As well as the targets for each SDG, they were designed to be interdependent. In other words, once a country has achieved one of them, it will most likely have made progress on others. Beating all the targets of SDG 11 (Sustainable Cities and Communities), for example, and achieving a sustainable city, means that the municipality has also achieved SDG 6 (Clean Water and Sanitation), SDG 8 (Economic Growth) and SDG 15 (Protection of Life on Land) (UN, 2022).

Some interpretations of city-building from research by Asian groups indicate that many of the barriers are likely to be similar in systematically advantaged countries in the Global North and systematically disadvantaged countries in the Global South, with isolated

management and decision-making reducing the ability to develop integrated systems (BAI, 2018). However, cities are complex and varied, with different barriers, limitations and opportunities, such as resources, capital and leadership, depending on their unique circumstances.

In Brazil, one of the main challenges in implementing SDG 11, for example, is still in the area of data. As this is an SDG that is both interdisciplinary and hyperlocal, the greatest difficulty lies in finding out the indicators for each city in order to know which targets need to be strengthened. This is why integration between the public and private sectors and civil society is essential. Current urban governance practices tend to be inefficient, rarely making the most of synergistic potentials and often producing unsatisfactory results. Among the main barriers to the adoption of systemic approaches pointed out by Xuemei Bai: institutional evolution/behavior; failure to recognize the systemic nature of cities; inadequate mental models; lack of incentives; inadequate decision support systems; and path dependency and entrapment.

In this vein, this research addresses the complexity of ecosystem thinking in land management, with a view to guaranteeing positive and simultaneous impacts for the environment, the economy and the most vulnerable social groups. It takes advantage of the ability to connect scientists from all fields with leaders from the public and private sectors, civil society, funding agencies and other arenas. It applies an ecosystem approach to produce actionable knowledge in the urban sphere for the governance of the State of Santa Catarina.

Adopting the premise that we ignore what is not seen and the proportion and absolute numbers of the world's population living in urban areas, which are constantly growing, means understanding that we need different ways of planning, building and governing cities. Based on this premise, the research seeks to present answers and results based on the initiatives implemented in the state of Santa Catarina, but which until now have only been carried out in isolation. It seeks to point to an evolution of governance management towards the expansion of awareness that will make it possible to guarantee positive and simultaneous impacts if dealt with through the logic of integration.

The central question to be answered by this research is: How can we contribute to reducing the fragmentation of state governance for territorial planning through Governance Performance Indicators? It aims to contribute by analyzing the current management methodology as an auxiliary tool in the transition to a model anchored in ecosystemic thinking that allows governance to expand its decision-making power in territorial planning.

In order to achieve the expected results, the research was structured in stages: carry out a literature review to develop a theoretical framework that offers support for the ability to analyze complex problems through ecosystem thinking; identify the governance structure and territory of the case study object, i.e. the state of Santa Catarina; map the IDGs and metrics used by the governance of the state of Santa Catarina as a delimiter of measurable attributes for territorial planning; to extract data from the current methodology by IDGs of the state of Santa Catarina, correlating its metrics with the goals of the 17 UN SDGs; and to contribute to the recalibration of the current governance methodology of the state of Santa Catarina through the synergy relationships generated by the integration between its 161 IDGs and the 17 UN SDGs.

THE SAMPLE UNIVERSE

The governance of the State of Santa Catarina, sensitive to global concerns, validated its intention to transition to a state model of sustainable development at the United Nations Climate Change Conference - COP26, held in Scotland in November 2021, and confirmed it at COP27, held in Egypt in November 2022.

Laboratories at the Federal University of Santa Catarina (UFSC), such as the Urban Ecology Laboratory (LEUr), corroborate the theme, dedicating themselves to the study of large urban centers as dynamic hubs of economic production and technological innovation through the perception of cities as complex scenarios, connecting to other global networks of researchers, observatories and platforms.

Santa Catarina's current state governance methodology, implemented by means of IDGs, is surrounded by initiatives and implementation actions, although the strategic vision is still immature. It still depends on the development of scientific research that will improve the decision-making capacity of government managers. At times, the process needs recalibration and, at others, the reconstruction of metric approaches.

The object of this case study is the governance methodology adopted by the state of Santa Catarina, located in the southern region of Brazil, in the Global South (Figure 1). The state of Santa Catarina has 295 municipalities, the capital is the city of Florianópolis, and according to data from the Executive Secretariat for International Affairs - SAI, it holds 1.13% of the national territory occupying an area of 95,737.90 km²; 3% of the Brazilian population 7,164.788 (2019); is in 10th place in the national ranking in number of inhabitants; has a GDP of R$ 277.19 billion (2017); is in 6th place in the national economic ranking; and is in 1st place in the national ranking in life expectancy rate, with 83.2 years for women and 76.7 years for men (SAI, 2022).

Figure1 - Geographical location of the state of Santa Catarina in the local and global context
Source: SAI (2022).

The state of Santa Catarina developed the Santa Catarina Development Plan 2030 - PlanoSC 2030, defining the state's functions in terms of guidelines aimed at developing socio-economic improvements in order to correct structural and cyclical distortions, outlining objectives and targets through 161 IDGs with actions aimed at 4 areas of concern: economic development, social development, infrastructure and mobility, and public management.

The administrative governance structure is made up of state secretariats, public and mixed companies, foundations and autarchies. For this research, we have used the nomenclature "governance silos" to represent these distinct structures, each with independent decision-making powers and managed from a central nucleus represented by the figure of the state governor, assisted by the Santa Catarina Project Management Office - EprojSC for program development and project execution.

Having been regulated by Decree No. 632 of June 2020, EprojSC is an environment aimed at managing state projects to qualify the strategy of the Santa Catarina government. It is made up of a multidisciplinary team involving accountants, administrators, engineers, architects, lawyers and other professionals, who create parameters and tools to manage state projects (EPROJSC, 2022). Therefore, each silo of state governance is monitored by means of IDGs that make up the current management methodology based on government programs and projects managed on the ProjetaSC Platform, which is the domain of EprojSC.

METHODOLOGICAL DEVELOPMENT

The challenge of looking at complex problems in territorial planning generates the research method of looking away from the specific problem to approach it from an integrated global perspective. This methodology allows awareness to expand and identifies the correlations between the spheres of governance involved, enhancing and highlighting the synergy generated as a factor in reducing fragmentation.

The proposed methodology involves understanding the flows of inputs and outputs in programs and projects and examining territorial, environmental, social and economic management practices in the state of Santa Catarina. From the perspective of ecosystem thinking, patterns and paths are identified that can contribute to the transition to a model of sustainable governance by analyzing the correlations of responsibility and co-benefit.

The government's current method of measuring IDGs was institutionalized by the Santa Catarina state government in 2019. It is planned to take place in annual cycles, and is always recalibrated at the end of each cycle, between December and February. With the proposed analysis and contributions of this research, it is believed that the evolution of the method will enhance assertiveness in the execution of the IDG metrics, as it is anchored in the goals defined by the UN SDGs.

As support for alignment with the 17 SDGs, actions are being implemented through projects and programs under the "State Policy on Climate Change and Sustainable Development of Santa Catarina", established by Law No. 14,829 of August 11, 2009, and the following actions have already been instructed:

a) Charter of State Environmental Agencies for the Climate - Abema's Charter, containing 17 commitments, signed in 2019;

b) Letter of Commitment from the Alliance for Climate Action - ACA Brazil, signed in 2021;

c) Governors' Climate Alliance, signed in 2021;

d) Protocol of Intent of the Interstate Climate Consortium - Green Brazil Consortium, signed in 2021;

e) Membership of ICLEI South America, with the aim of implementing sustainable development actions based on mitigating and adapting to climate change, signed in 2021.

DATA COLLECTION

The mapping and understanding of the SDGs, through their relationship with the Areas of Concern of the SCP 2023 Plan, becomes the necessary and sufficient subsidy for carrying out the relevant analyses proposed as the objective of this research, being the basis for the analytical structuring interrelated with the 17 SDGs and the proposed methodology.

Data was collected and compiled from 2020 to 2022 using an analytical structure using Excel software, with the development of causal loop diagrams to capture the complex interaction between different factors inside

and outside the system. Only public domain accesses to government platforms were used for data collection.

Data was collected from the following locations: the ProjetaSC platform (Figure 2), which monitors all the projects in the governance silos; the CEON platform (Figure 3), which manages the SDG metrics; and the UN portal (Figure 4), which directs the targets and monitors the 17 SDGs.

DATA ANALYSIS AND COMPILATION

For the analysis of the cross-relationship between each of the metrics of the 161 IDGs and each of the 169 targets of the 17 SDGs, 27,209 analysis relationships were generated. One question was asked in each relationship in order to diagnose whether the state's governance performance complies with the UN's provisions. To this end, the central question of the analysis seeks to identify whether governance metrics are contributing to achieving the goals set by the UN. The question is structured as follows: Does the metric _____ of the Governance Performance Indicator _____ under the code _____ and responsibility of the governance silo _____ contribute to achieving the target _____ of the SDG _____?

The analysis for each cross-relation generates affirmative answers using the numerical value "1" and negative answers using the numerical value "0". Arbitrating a numerical percentage for each answer transforms the qualitative affirmative and negative result into a quantitative result. The total percentage for each SDG was divided internally into equal parts in proportion to the number of targets for each SDG. To illustrate how the question was posed, Figure 5 shows the flow of reasoning about the methodological development, where the rectangle represents the start of the question and the circle the end of it.

To illustrate the cross-relationship between the SDG metrics and their contribution to achieving the SDG targets, Figure 6 shows the structure of SDG 1. The structure of SDG 1 has been subdivided by the UN into 7 targets, numbered 1.1 to 1.5 and 1.a to 1.b. To transform the cross-ratio into a quantitative result, the total percentage of 100 is divided proportionally by 7 targets, generating a 14% index assigned to each target. To arrive at the final index of the percentage contribution of each SDI in relation to each SDG, the simple sum of the indices of the affirmative responses is made.

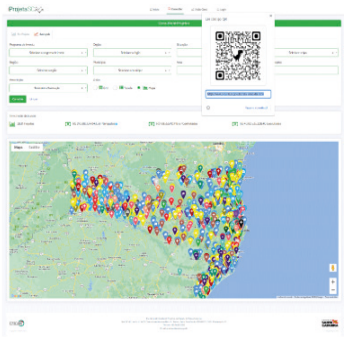
Transposing the question asked for each of the 27,209 cross-relationships into a descriptive textual format, representing the cross-relationship between the IDG 2 metric and SDG 1 metric 1.5, we have the following model:

The metric Index of physical and apparent losses of treated water in the distribution system (as a percentage of total production) in municipalities served by CASAN of the Governance Performance Indicator Water losses under code 2 and responsibility of the CASAN governance silo contributes to achieving target 1.5 by 2030, build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters of SDG 1 to eradicate poverty in all its forms everywhere? ANSWER: yes = 1

The complete analytical structure of the cross-relationship between the 161 SDGs and the 169 targets of the 17 SDGs generates an extensive and complex structure developed in Excel software, illustrated in Figure 7.

RESULTS AND DISCUSSIONS

The way in which the research data is organized, when it intends to integrate the governance silos in order to issue highly qualified results, makes them dependent on each other for territorial planning. The challenge of governance is to find possibilities and alter-



Source: www.projetasc.gov.br

Source: www.sc.gov.br

Source: www.un.org

Figures 2, 3 and 4 - Data collection environments for developing the method

DIAGNOSIS: What is the current percentage of **contribution to meeting the goals** of the 17 SDGs that the projects managed in the ProjetaSC government tool are offering?

DESCRIPTION OF CURRENT METRICS	IDG	CODE	SILO RESP.	%	TOTAL	SDG 1						
						OBJECTIVE: to end poverty in all its forms, everywhere.						
						CONTRIBUTES TO ?						
						By 2030	By 2030,	Implement, at	By 2030,	By 2030,	1.a Ensure	1.b Create solid policy
						1.1	1.2	1.3	1.4	1.5	1.a	1.b
Index of physical and apparent losses of treated water in the distribution system (as a percentage of total production) in municipalities served by CASAN	Water losses	2	CASAN	43%	3	0	1	0	1	1	0	0
Percentage of treated sewage coverage in urban areas (municipalities served by CASAN).	Urban coverage - sewage	3	CASAN	100%	7	1	1	1	1	1	1	1

Figure5 - Illustration of the logical routing of the cross-analytical question between metrics and targets

Source: prepared by the author (2022).

DIAGNOSIS: What is the current percentage of **contribution to meeting the goals of** the 17 SDGs the objectives of the projects managed in the ProjetaSC Government tool are **offering?**

DESCRIPTION OF CURRENT METRICS	IDG	CODE	SILO RESP.	%	TOTAL	SDG 1						
						OBJECTIVE: to end poverty in all its forms, everywhere.						
						CONTRIBUTES TO ?						
						1.1	1.2	1.3	1.4	1.5	1.a	1.b
Index of physical and apparent losses of treated water in the distribution system (as a percentage of total production) in municipalities served by CASAN	Water losses	2	CASAN	43%	3	0	1	0	1	1	0	0
Percentage of treated sewage coverage in urban areas (municipalities served by CASAN).	Urban coverage - sewage	3	CASAN	100%	7	1	1	1	1	1	1	1

Figure 6 - Example of cross-analysis of SDGs 2 and 3 with the 7 targets of SDG 1

Source: prepared by the author (2022).

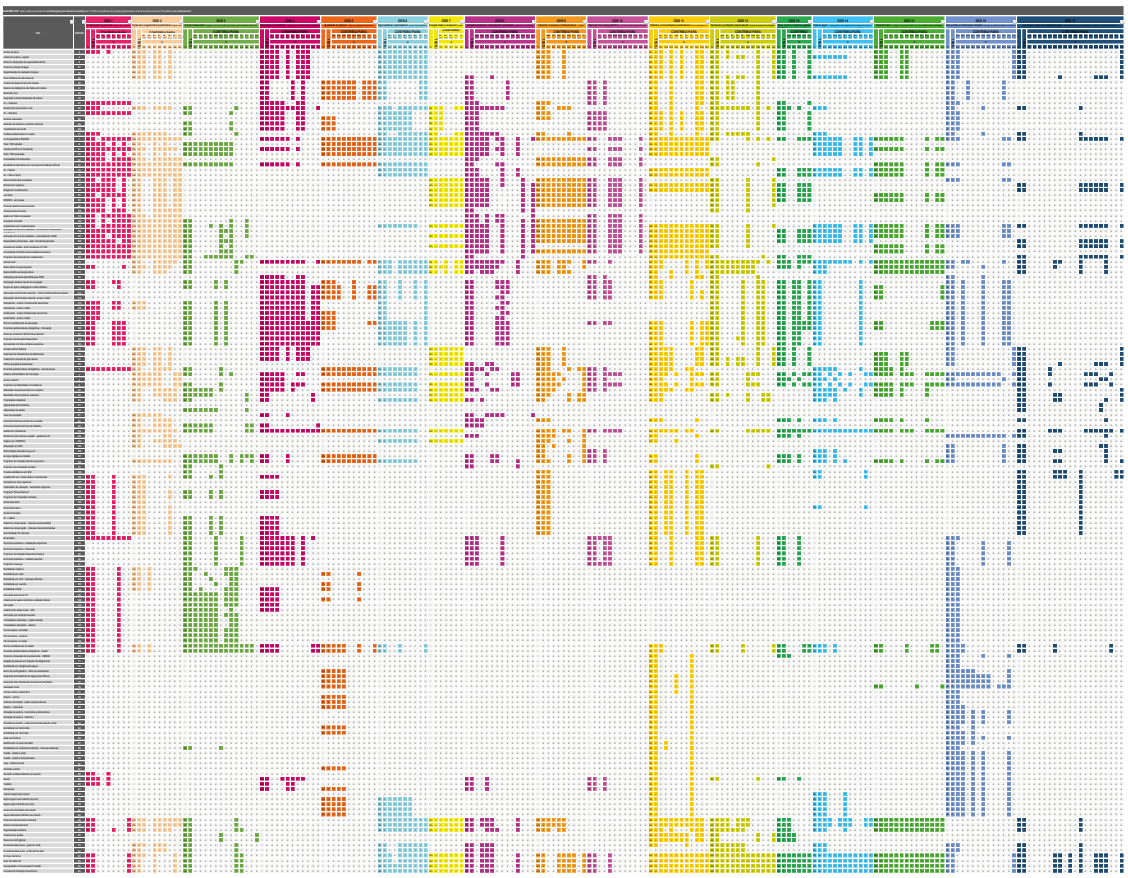


Figure 7 - Illustration of the complete analytical structure with the 27,209 qualitative analyses, highlighting the specific sector illustrated in the previous figure

Source: prepared by the author (2022).

ECOSYSTEM VISION DIMENSIONS	ODS 1	ODS 2	ODS 3	ODS 4	ODS 5	ODS 6	ODS 7	ODS 8	ODS 9	ODS 10	ODS 11	ODS 12	ODS 13	ODS 14	ODS 15	ODS 16	ODS 17
WATER	0%	50%	0%	60%	0%	100 %	0%	1%	25%	0%	50%	29%	40%	17%	25%	17%	9%
COMMUNITY	21%	6%	3%	41%	39%	44%	14%	12%	7%	13%	37%	23%	14%	1%	0%	12%	1%
CONSUMPTION AND DISPOSAL	14%	62%	8%	0%	0%	75%	40%	42%	12%	0%	20%	45%	0%	10%	0%	8%	5%
ECONOMY	82%	81%	20%	6%	21%	32%	54%	39%	63%	30%	63%	9%	28%	29%	29%	6%	11%
ECOSYSTEMS	5%	54%	10%	27%	30%	87%	67%	47%	54%	3%	37%	70%	40%	33%	100%	11%	16%
EDUCATION	27%	2%	12%	89%	18%	39%	0%	20%	0%	8%	24%	26%	54%	9%	5%	31%	0%
ENERGY	0%	50%	0%	45%	0%	0%	100 %	4%	25%	0%	50%	32%	40%	0%	19%	8%	10%
GOVERNANCE	5%	47%	20%	18%	37%	32%	37%	18%	30%	9%	20%	9%	22%	24%	21%	16%	12%
MOBILITY	11%	17%	8%	9%	0%	0%	0%	1%	10%	0%	43%	1%	0%	1%	0%	0%	6%
HEALTH AND WELL-BEING	15%	4%	44%	24%	7%	2%	0%	4%	0%	6%	9%	4%	9%	2%	2%	11%	1%
SECURITY	2%	0%	0%	3%	16%	8%	0%	1%	0%	1%	12%	0%	1%	3%	1%	36%	0%
NATURAL SOIL	19%	79%	10%	0%	0%	100 %	100 %	33%	46%	0%	77%	45%	20%	53%	100%	0%	5%
ENVIRONMENTAL RESILIENCE	7%	25%	13%	0%	0%	66%	50%	23%	31%	5%	71%	66%	60%	53%	50%	6%	22%

Figure8 - Integrated analysis results matrix by ecosystem vision dimension

Source: prepared by the author (2022).

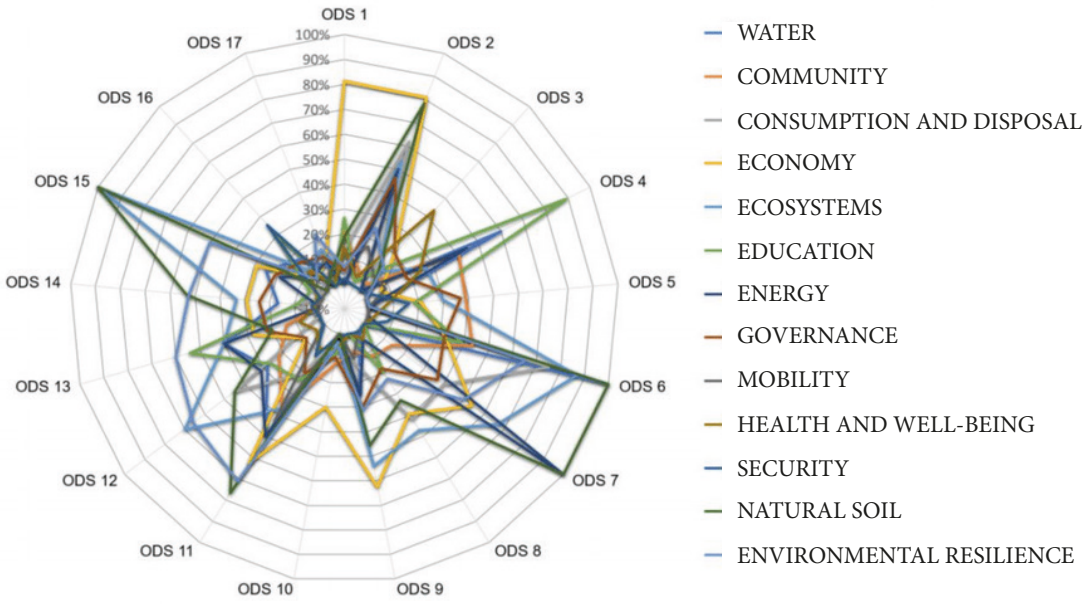


Figure 9 - Radar of integrated analysis results by ecosystem vision dimension

Source: prepared by the author (2022).

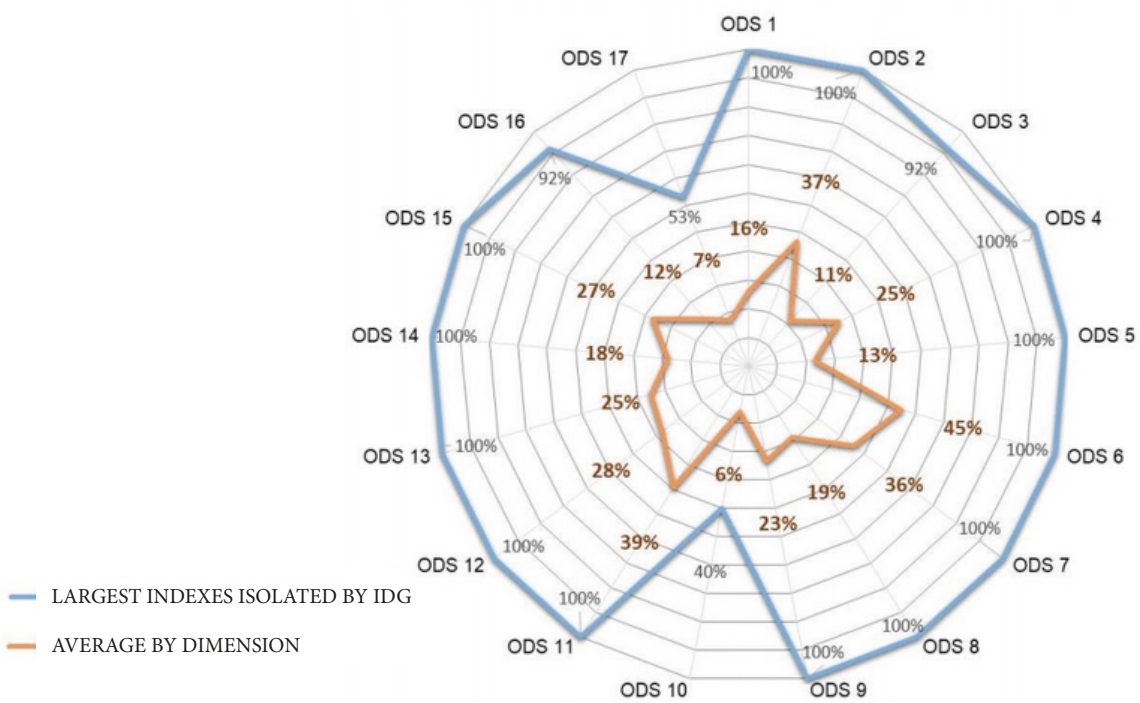


Figure10 - Results of the average total per dimension and the highest indexes isolated by IDG.

Source: prepared by the author (2022).

natives for merging social, political, environmental and, above all, economic sensitivities to create healthy, rationally sound and emotionally attractive urban communities aimed at collective well-being.

The 13 dimensions proposed by LEUr suggest a self-organization of the state's SDGs based on the goals of the 17 UN SDGs already structured in the state through the SCP 2030 Plan. This transdisciplinarity is corroborated by the authors cited in the research's theoretical framework, when they interpret the emergence of the realignment and integration of global policies.

The main contribution of the research is through the presentation of results in radar format, as it graphically establishes an integrated approach to the SDGs. This perspective generates systemic analyses of results based on the interrelationships between governance silos and promotes awareness-raising among both policymakers and decision-makers. Each of the 13 dimensions was analyzed using 2 types of radar chart: the first showing the percentage result achieved by each SDG in contribution to the 17 SDG targets, and the second showing the average result of the grouping of SDGs by dimension in contribution to the 17 SDG targets.

The data found in the results was classified by percentage of compliance with the IDG metrics in terms of contribution to achieving the goals of the 17 UN SDGs: compromising level contribution between 0% and 49%, regular level contribution between 50% and 75%, and excellence level for contributions between 76% and 100%. The summary of the output data is condensed in Figure 8 in table format and in Figure 9 in radar graphic format.

Identifying the institutional structures and their responsibilities opens up the possibility of reorganizing the bases needed to *start* producing efficiently in the territory. In this sense, looking at the average integrated indices becomes an important tool to support decision-making by state governance, as shown in Figure 10

Due to the low level of connection between the 161 SDGs and the centralization of their responsibilities in disintegrated spheres of governance, the results radar of the integrated analysis showed low density at the levels of excellence and high density at the levels of compromise. The results found show that all 13 dimensions had indices of less than 50%, which is considered a compromising level when it comes to meeting the targets of the 17 SDGs.

The various SDGs with excellent rates of contribution to the UN's 17 SDGs, but hitherto carried out in isolation, clearly indicate that their metrics can contribute to solving complex problems in territorial planning, if treated using the logic of an integrated ecosystem vision

FINAL CONSIDERATIONS

Integration between the governance silos responsible for the SDGs is urgent. For example, those related to the Economy should be integrated with the others, as they could create new programs to contribute to all 17 SDGs; those related to Consumption and Disposal, Ecosystems and Natural Soil, as they are not being addressed by a sufficient set of SDGs; those related to Mobility, as they are not directed towards the user and only monitor the percentage of works carried out on the modes that connect cities; those related to Sanitary Sewage treatment, as they co-benefit several areas such as the SDGs related to Health, Education, Environment, Tourism, Fishing, etc.

The results showed that the governance performance of the state of Santa Catarina, from an integrated perspective, was much lower than expected. This further highlights the problem of the current methodology adopted, with the initial limitation of having

been created to assess the different governance silos in isolation. As long as the method continues to make only one governance silo responsible for a given IDG, fragmentation will be reinforced rather than providing integration, and the results will not be sufficient to achieve efficient territorial planning for the future in the Anthropocene.

Certain sectors of the state government's structure are already working efficiently, but are still acting in isolation, and should promote integration to support and disseminate knowledge to the less efficient in a systemic way, with techniques capable of creating solutions to complex territorial planning problems.

The capacity of the silos responsible for some Education-related SDGs, for example, has high potential to contribute to the recalibration of other SDGs, for example with a focus on Health and Well-being, Security, Equality, Energy and Water, and actions for global change. A quality educational base and the prospect for a social organization with an expanded consciousness tend to contribute significantly to the future of the Anthropocene.

Prioritizing the 17 SDGs through a policy of transition to a state model of sustainable development strengthens the use of positive synergies and collaboration between the various management sectors. After all, using a strategic ecosystem approach is more relevant than just identifying negative/cautious *trade--offs* without adopting efficient parameters in isolation.

Support in the development of system monitoring and decision support tools tends to allow the true impact of urban activities to be measured and clearly demonstrated. Therefore, stronger and closer links between governance silos should be promoted through the systemic evolution of the ProjetaSC tool, developed and managed by EprojSC. This promotion should be based on the identification of co-responsible and co-beneficiary governance sectors or silos anchored in the fulfillment of the 17 UN SDGs and self-organized in an integrated manner according to the 13 dimensions proposed by LEUr.

The poor connection between the 161 IDGs and the centralization of their responsibilities by governance silo leads us to conclude that there is a reversal of territorial planning priorities in the state of Santa Catarina. The integrated vision of the SDGs and the strengthening of connections between the governance silos could achieve levels of excellence in meeting the UN SDGs. The governance of the state of Santa Catarina used in this time frame is surrounded by positive initiatives and implementation actions, but still lacks maturity in its strategic vision. Because it is rarely making the most of the synergistic potential of its current practices, it produces unsatisfactory results, which tends to be inefficient.

Therefore, the research proves the fragmentation and highlights the need for ecosystem thinking in public policies that contribute to a sustainable future in the Anthropocene. In this sense, in order to guarantee positive and simultaneous impacts throughout the territory, we point to the need to evolve the governance management of the state of Santa Catarina by recalibrating the IDG metrics and integrating the model between its spheres of governance.

REFERENCES

BAI, X. The process and mechanism of urban environmental change: an evolutionary viewInt. **International Journal of Environment and Pollution**, v. 19, n. 5, 11 maio 2004.

BAI, X. Integrating global environmental concerns into urban management the scale and readiness arguments. **Journal of Industrial Ecology**, v. 11, n. 2., p. 15-29, abr. 2007.

BAI, X. *et al.* Urban policy and governance in a global environment: Complex systems, scale mismatches and public participation. **Current Opinion in Environmental Sustainability**, v. 2, n. 3, p. 129-135, ago. 2010.

BAI, X. *et al.* Plausible and desirable futures in the Anthropocene: A new research agenda. **Global Environmental Change**, v. 39, p. 351–362, 1 jul. 2016a.

BAI, X. Eight energy and material flow characteristics of urban ecosystems. **Ambio**, v. 45, n. 7, p. 819–830, 1 nov. 2016.

BAI, X. *et al.* Defining and advancing a systems approach for sustainable cities. **Current Opinion in Environmental Sustainability**, v. 23, p. 69-78, dec. 2016b.

BAI, X. Advance the ecosystem approach in cities. **Nature**, 4. jul. 2018. Disponível em: https://www.nature.com/articles/d41586-018-05607-x. Acesso em: 30 nov. 2022.

BAI, X. Advance the ecosystem approach in cities. **Nature**, v. 559, p. 7, 5 jul. 2018b.

BAI, X.; CHEN, J.; SHI, P. Landscape urbanization and economic growth in China: Positive feedbacks and sustainability dilemmas. **Environmental Science and Technology**, v. 46, n. 1, p. 132–139, 3 jan. 2012.

BAI, X.; SHI, P.; LIU, Y. Society: Realizing China's urban dream. **Nature**, v. 509, n. 7499, p. 158–160, 8 maio 2014.

BIOGRAFIE. Biografieonline. **Jane Jacobs.** 2022a. Disponível em: https://biografieonline.it/. Acesso em: 5 nov. 2022.

BIOGRAFIE. Biografieonline. **Le Corbusier**. 2022b. Disponível em: https://biografieonline.it/. Acesso em: 5 nov. 2022.

CHAVEZ, A. *et al.* Understanding, implementing, and tracking urban metabolism is key to urban futures'. *In:* ELMQVIST, T. *et al.* (ed.). **The urban planet:** knowledge toward sustainable cities. Cambridge: Cambridge University Press, 2008.

COLE, R. J. *et al.* A regenerative design framework: Setting new aspirations and initiating new discussions. **Building Research and Information**, v. 40, n. 1, p. 95–111, 1 jan. 2012.

DA SILVA, J.; KERNAGHAN, S.; LUQUE, A. A systems approach to meeting the challenges of urban climate change. **International Journal of Urban Sustainable Development**, v. 4, n. 2, p. 125–145, nov. 2012.

DAVIS, M. **Planeta Favela**. 1. ed. São Paulo: Boitempo, 2006.

DE GERONI, R. **Co-existing with water in complexity:** the institutional gaze. 2021. Dissertação (Mestrado) - Universidade Federal de Santa Catarina, Florianópolis, SC, 2021.

DE OLIVEIRA, J. A. P. *et al.* Governança urbana e a abordagem por sistemas para co-benefícios saúde-ambiente em cidades. **Cadernos de Saúde Pública**, v. 31, sup. S25-S38, jan. 2015.

DIAS, F. **Relação do campus com a cidade:** a interdependência dos limites do Campus Trindade da UFSC da concepção de Projetos Regenerativos. 2019. Dissertação (Mestrado) - Universidade Federal de Santa Catarina, Florianópolis, SC, 2019.

DUARTE, F.; ROJAS, F. Intermodal Connectivity to BRT: a comparative analysis of Bogotá and Curitiba. **Journal of Public Transportation**, v. 15, n. 2, p. 1–18, 2012.

ELMQVIST, T. *et al.* **Urban Planet:** Knowledge towards Sustainable Cities. Cambridge: Cambridge University Press, 2018.

ELMQVIST, T. *et al.* Urbanization in and for the Anthropocene. **NPJ Urban Sustainability**, v. 1, n. 1, dez. 2021.

EPROJSC. **Escritório de Gestão de Projetos de Santa Catarina**. Disponível em: https://www.eproj.sc.gov.br/. Acesso em: 13 ago. 2022.

FILÁRTIGA, M. **Guias de Projeto Regenerativo para campus universitário**. Tese (Doutorado) - Universidade Federal de Santa Catarina, Florianópolis, SC, 2020.

FITZPATRICK, S. M. Complexity Blind Spots. **The Bridge**, v. 50, n. 4, p. 13–15, 2020.

FUTURE EARTH. **Future Earth:** Urban Knowledge-Action Network. Disponível em: https://futureearth.org/. Acesso em: 18 jul. 2022.

GLAESER, E. L.; KAHN, M. E. The greenness of cities: Carbon dioxide emissions and urban development. **Journal of Urban Economics**, v. 67, n. 3, p. 404–418, maio 2010.

SANTA CATARINA. Portal do Estado de Santa Catarina**. Secretarias de Estado.** 2022. Disponível em: https://estado.sc.gov.br/orgaos-do-governo/. Acesso em: 14 ago. 2022.

GRUBLER, A. *et al.* **Urban Energy Systems.** 2012. Disponível em: https://www.pik-potsdam.de/members/weisz/recent-publications-1/GEA_Chapter18_urban_lowres.pdf. Acesso em: 30 nov. 2022.

GUAN, D. *et al.* The drivers of Chinese CO2 emissions from 1980 to 2030. **Global Environmental Change**, v. 18, n. 4, p. 626–634, out. 2008.

HARVEY, D. **Cidades Rebeldes:** do direto à cidade à revolução urbana. São Paulo: Martins Fontes, 2014.

HARVEY, D. **Os sentidos do mundo**. 1. ed. São Paulo: Boitempo, 2020.

IRVINE, S.; BAI, X. Positive inertia and proactive influencing towards sustainability: systems analysis of a frontrunner city. **Urban Transformations**, v. 1, n. 1, dez. 2019.

JACOBS, J. B. **Morte e vida das grandes cidades**. 3. ed. São Paulo: WMF Martins Fontes, 2011.

KOS, J. R. 2020. **A resiliência das cidades e a regeneração ambiental**. Projeto de Pesquisa para Edital do CNPq.

KRAKAUER, D.; WEST, G. The Damage we're not attending to. Scientists who study complex systems offer solutions to the pandemic. **Nautilus**, 8. jun 2020. Disponível em: https://nautil.us/the-damage-were-not-attending-to-237882/. Acesso em: 30 nov. 2022.

LEUR. **Laboratório de Ecologia Urbana - PósARQ UFSC**. 2022. Disponível em: https://leur.ufsc.br/. Acesso em: 14 ago. 2022.

LIN, B. B. *et al.* Integrating solutions to adapt cities for climate change. **The Lancet Planetary Health**, v. 5, n. 7, 1 jul. 2021.

LIU, Y.; LU, S.; CHEN, Y. Spatio-temporal change of urban-rural equalized development patterns in China and its driving factors. **Journal of Rural Studies**, v. 32, p. 320–330, 2013.

LIU, Y.; YANG, R.; LI, Y. Potential of land consolidation of hollowed villages under different urbanization scenarios in China. **Journal of Geographical Sciences**, v. 23, n. 3, p. 503–512, 1 jun. 2013.

MARICATO, E. Metrópole periférica, desigualdade social e meio ambiente. *In*: VIANA. GILNEY; SILVA, M.; DINIZ, N. (ed.). **O desafio da sustentabilidade**. São Paulo: Editora Fundação Perseu Abramo, 2001. p. 215–232.

MARICATO, E. **Para entender a crise urbana**. São Paulo: Expressão Popular, 2015.

MARTINS, A. I. M. L. **Contributos da gestão e planeamento da mobilidade urbana para a construção de cidades saudáveis**. 2019. Tese (Doutorado) - Universidade de Lisboa, Lisboa, 2019.

MCPHEARSON, T. *et al.* Advancing Urban Ecology toward a Science of Cities. **Overview Articles**, v. 66, n. 3, 2016.

NUNES SILVA, C. Governing Metropolitan Lisbon: A tale of fragmented urban governance. **GeoJournal**, v. 58, n. 1, p. 23-32, 2002.

ONU. Organização das Nações Unidas. 2022. Disponível em: https://brasil.un.org/pt-br. Acesso em: 11 ago. 2022.

ORR, D. W. **The nature of design:** ecology, culture, and human intention. New York: Oxford University Press, Inc., 2002.

PLANOSC 2030. **Plano de Desenvolvimento de Santa Catarina 2030**. 2022. Disponível em: https://www.sde.sc.gov.br/index.php/biblioteca/plano-sc-2030. Acesso em: 10 nov. 2022.

PROJETA SC. **ProjetaSC - Escritório de Gestão de Projetos do Estado de Santa Catarina**. 2022. Disponível em: http://www.projeta.sc.gov.br/. Acesso em: 11 ago. 2022.

REVI, A. *et al.* Towards transformative adaptation in cities: the IPCC's Fifth Assessment. **Environment and Urbanization**, v. 26, n. 1, p. 11–28, 2014.

SAI. **Secretaria Executiva de Assuntos Internacionais de Santa Catarina**. 2022. Disponível em: https://sai.sc.gov.br/. Acesso em: 13 ago. 2022.

SETO, K. C. *et al.* Human Settlements, Infrastructure, and Spatial Planning. *In:* EDENHOFER, O. *et al.* (ed.**). Climate change 2014:** Mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press, 2014.

SETO, K. C.; GÜNERALP, B.; HUTYRA, L. R. Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. **Proceedings of the National Academy of Sciences of the United States of America**, v. 109, n. 40, p. 16083–16088, 2 out. 2012.

SHEN, L. *et al.* Urbanization, sustainability and the utilization of energy and mineral resources in China. **Cities**, v. 22, n. 4, p. 287–302, 2005.

SMITH, T. F. *et al.* Systems approach to regional climate change adaptation strategies. *In:* SMITH, T. F. *et al.* **Case studies of adaptive capacity:** systems approach to regional climate change adaptation strategies. Camberra: CSIRO Sustainable Ecosystems, 2008.

SONG, J. *et al.* Adaptation as an indicator of measuring low-impact-development effectiveness in urban flooding risk mitigation. **Science of the Total Environment**, v. 696, 15 dez. 2019.

TOZAN, Y.; OMPAD, D. C. Complexity and dynamism from an urban health perspective: a rationale for a system dynamics approach. **Journal of Urban Health: Bulletin of the New York Academy of Medicine**, v. 92, n. 3, 2015.

UNDERWOOD, E. The race is on to build an AC unit that doesn't cook the planet. **Antropocene Magazine**, 8 jul. 2020. Disponível em: https://www.anthropocenemagazine.org/author/emily-underwood/. Acesso em: 30 nov. 2022.

UNDP. **Policy and programme brief:** UNDP support to the implementation of the 2030 Agenda for sustainable development. jan. 2016. Disponível em: https://www.undp.org/sites/g/files/zskgke326/files/publications/SDG%20Implementation%20and%20UNDP_Policy_and_Programme_Brief.pdf. Acesso em: 30 nov. 2022.