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SMART CITIES: EPISTEMIC SANDBOX FOR A RESTORATIVE AND REGENERATIVE CIRCULAR ECONOMY

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ABSTRACT

The research aims to explore the epistemic challenges presented by neo-extractivism, economic eco-decoupling and degrowth that influence the (re)thinking of economic models. The general objective is to highlight conceptual elements related to smart cities, sustainable development goals and objectives, with an emphasis on SDG 11, which deals with sustainable cities and communities, and their interconnection with other goals and targets of the 2030 Agenda. In this context, the absence of objective public policy aimed at the circular economy in Brazil will be addressed. The specific objective will analyze the semiotics of smart cities, based on interdisciplinary STS(A) approaches, which dialogue in different scientific microcosms, where natural, social and applied sciences model resignifications for the (post)modern and society of the twentieth century. XXI. The methodology used will be qualitative and exploratory, based on the hypothetical-deductive method. From this scenario will emerge the epistemic "sandbox", in which the paradoxes between the monocultural abyssalism of the Global South and the Global North will be revealed, unveiling concerns that favor post-abyssalism and point to a regenerative Circular Economy.

Keywords: CTS(A). Sustainable development. Circular Economy. Smart Cities. Economic Epistemes.

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INTRODUCTION

Impacts, growing urbanizations, the need for (eco)management, economic circularity, *smart cities* , etc., are currently expressions used in epistemological twists that orbit reflections on smart urban environments. Depending on the approach, *smart cities* have existed since primitiveness. In the century. II B.C., in the face of the Silk Road, cities such as Harappa and Mohenjo-Daro brought prosperity, but faced adversity according to Frankopan (2015); in the same way, Neolithic cities such as Jericho and Aleppo, approximately 9,600 and 8,000 years in the past respectively, grouped hunter-gatherers into primitive urban systems according to Simmons (2007). Technological advances are evident in the evolution of urban environments which, in turn, keeping the due proportions, have always been intelligent.

The holistic view of urban centers in *time* contributes greatly to epistemological twists in the social studies of science, technology and society, which, in particular, observes the need for a socio-environmental approach to STS(A). The temporal unfolding of those primitive cities results, through the natural evolution of the human of the space-time fabric, in urban centers and *megacities*. The "Urbanocene" (Chwalczyk, 2020), emerges. Complex, multifaceted and meta-individual realities about limits to growth, based on interlocutions of the Club of Rome (1968) and the Meadows Report (1972), unveil contexts about the limits of the Earth-system. Dialoguing with such limits, epistemes on (eco)development, sustainable development and an agenda with transnational objectives and goals lay bare, on the other hand, sensitive planetary limits, to be achieved, in theory, by 2030. However, as warned by the latest report of the United Nations (UN), only 17% of the goals and targets for sustainable development will achieve the ambitious global sustainability project by that date.

The epistemes above flow, among other contexts, into projections of intelligent urban environments, that is, a conceptual model of sustainable eco-efficiency supported by interdisciplinary sciences and technologies; *Smart cities,* then, have become protagonists of Promethean solutions to the challenges of urbanization and (re)balance in the relationship between Man and Nature? STS(A) approaches have become guiding in the (re)thinking of urban (eco)management. Systemic-operational instruments and mechanisms, based on sustainable development, an oxymoron according to Gudynas (2015) and Sachs (1999), leads to an abysmal monocultural stir between the Global North and South.

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Meanwhile, it is necessary to point out that the study will not observe Promethean concepts or idealizations of a (post)modern Holocene oasis, with zero carbon emissions, etc.; it will observe, however, the conflict in the compatibility of circular socioeconomic ideals, which orbit *smart cities*, in the face of postures of the global North and South in the face of neo-extractivism, degrowth) and eco economic decoupling. In this scenario, the question of the role of weak, strong and super-strong ecology as a parameter when (re)thinking sustainalist ideals will be observed.

In this way, in the first item of this study, issues pertinent to the intelligent urban environments that orbit information and communication technologies that strive for the fluidity of urban mobility, (eco)efficient management of the energy *grid* driven by *design will be pointed out* , where science and new technologies, in theory, would emerge solutions to those *megacities* and urban centers in the face of a (re)thinking of the urban socio-environmental uproar. In time, still in the first item, the reflection on challenges and limitations that orbit the implementation of projects for smart cities will be compared in the face of the need for identity public policy in the Brazilian State; In this scenario, is there concern around the existing guidelines, as they would have the power to encompass *smart cities*? This is a feasible concern, because (eco) ideals for smart urban environments are based on interconnections, systemic cooperation and economic circularity, and the Brazilian State does not have a clear public policy in this regard.

Based on the argumentative construction above, the second item of this study will orbit the questions about neo-extractivism, degrowth and economic decoupling from nature. Dialoguing with such questions, elements will be pointed out about the way in which the (post)modern envisions ecology. Such an approach to the consolidation of semiotics on future arguments around the sustainalist ideals pursued in the twentieth century is seminal. The fact is that *smart cities* can have different approaches where homogenized models do not meet local peculiarities. In this way, instead of an approach based on political-economic globalization, the necessary vision of glocalization is necessary, as there are sensitive and abyssal differences between the positions of the global North and South, which will be satisfactorily observed. Whether or not neo-extractivism is suitable for the Global South, degrowth and economic decoupling, in turn, could be understood as more suitable for the Global North. There is an epistemological clash in search of post-abyssal postures that surround this discussion.

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From the above argumentative link, it will be observed, on the other hand, the failure to achieve the sustainable development goals by the deadline enshrined in the proposal of the Global Agenda for 2030.

METHODOLOGY

The qualitative exploratory methodology, based on the hypothetical-deductive method, in view of the procedure that transitions from the general to the particular, will be the basis for structuring and aligning the discussions proposed in the items previously presented. This approach allows for an in-depth and interdisciplinary analysis of the concepts, creating connections between different theoretical and practical dimensions. In this context, the methodology will seek to achieve the outlined objectives. For the general objectives, general and auxiliary approach methods will be used, such as bibliographic and descriptive research. These methods will guide reflection on the conceptual elements related to smart urban environments and their connection with the Sustainable Development Goals (SDGs).

The analysis will focus on the integrative application of these goals, with an emphasis on their interconnections, especially highlighting SDG 11, which deals with sustainable cities and communities. The approach will be holistic, considering the SDGs in their entirety and exploring effective ways of implementation in urban settings. The methodological procedures will also be applied to the specific objectives, which will address smart cities through the prism of epistemological twists related to neo-extractivism, degrowth and economic eco-decoupling. These perspectives will challenge traditional and stagnant economic models, allowing the observation of regenerative economic circularity alternatives. In addition, the influence of public policies — or the absence of them — on the dynamics of smart cities will be analyzed, proposing ways to integrate the principles of the Circular Economy in urban contexts.

In this scenario, the study, driven by the methodology and its methods, will allow the emergence of concerns. If there are smart cities, will there also be "smart laws" for "smart" urban citizens? The reflection will open space for dialogue between different fields of knowledge, establishing an epistemic *"sandbox*" where traditional and contemporary approaches can be confronted and resignified. Thus, the study will reveal paths for a regenerative economy that transcends the limits of extractivism and promotes an effective integration between society and the Earth-system.

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URBAN INTELLIGENCE – (RE)THINKING CITIES

Smart cities integrate a mosaic of information and communication technologies (ICTs) to collect, analyze and use data in real time, aiming to improve various aspects of the urban environment, from the management of public services to the creation of innovative solutions to complex challenges that, observing urban mobility, efficient management of the "*grid*"energy, pollution, waste management, etc., which, in turn, express (eco)innovative technologies, based on sustainable and regenerative designs; It is a Promethean posture that, in theory, allows the eco-efficient construct of planning and decisions of smart urban centers, promoting transversal civic engagement in the face of collaborative metropolitan governance.

The search for systemic operational eco-efficiency strives for responsible investments along five main axes, observed and containing; the fact is that ideopolitics about *smart cities* unfold in different epistemes, such as, for example, the idealism of a global network of ecovillages that adduces the concept of "an intentional or traditional community that uses local participatory processes to holistically integrate ecological dimensions, economic, social and cultural sustainability" (Chaves, 2020, p. 332) with the socio-environmental regenerative intent. Now, would these ecovillages, in the future, be observed as anthropocene cities? Perhaps, because in the past Neolithic cities are an argumentative pendulum for reflections in the present, this temporal question reveals the brief scale of human experience.

(Re)thinking the urban environment, in the face of interdisciplinary STS(A), reveals the necessary recognition of a disconnection, in the face of eco-effective ideopolitics that allow (re)construction leveraged by reflections that orbit *smart cities;* In this way, a fit could be observed, as circular economy ideals seek to (re)configure linear postures, inherited from ancestry; however, different lines of thought are observed as a shield against the ideopolitics of economic circularity. Neo-extractivism, degrowth, and economic decoupling from nature represent distinct reflexive paradigms of the global North and South. In this framework, developmental counterpoints collide, as sustainability demands post-development that "addresses these multiple contradictions by adopting principles of natural repair and regeneration, starting with local responsibility" (McMichael, 2021 p. 89). From a post-developmentalist perspective, epistemological twists emerge; these, in turn, have a common trait in the circular economy, however peculiarities are observed according to the

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economic identity of each place under analysis; In this context, at first, issues are observed that flank neo-extractivism as a circular economic parameter.

A posture arising from statements from the global South, according to Acosta (2013), defends the preservation of natural resources and the diversification of the economy to reduce dependence on extractive activities, and in this way, "As a way to mitigate the consequences of urban growth, the prospection of Smart Cities emerges, which, from a technological perspective, seeks to optimize the use of resources, to promote the quality of life of citizens. (...)" (De Carvalho *et al.*, 2024, 17706); However, it is sensible to consider that,

> "The Latin American debate distinguishes three forms of extractivism: "predatory", which has been practiced in the region; " sensible", which would respect certain ecological and social standards, and would be put into practice in the post-extractivist transition phase; and "indispensable", in which the criteria that define it are the object of a social negotiation." (Gudynas, 2011, p.67-9)

In this context, predatory extractivism is indicative of economic linearity, which goes against the ideopolitics of circularity; sensible and indispensable extractivism flanks the circular economy paradigms, which, in turn, is the cardinal point for *smart cities.* Smart urban environments seek to syncretize a mosaic of ideas that strive for sustainability, however, considerations about neo-extractivism must be taken care of, which "fosters conflicts related to natural resources, does not create jobs, and externalizes social and environmental costs" according to Hargreaves (2020, p. 171). Noble ideas of environmental protection were embraced by Latin American nation-states, however progressive postures orbiting resource nationalism "is neither transformative into emancipatory (*idem,* p. 173) but only a greenish reformulation of the linear extractivism of yesteryear.

The fact is that socioeconomic and political-cultural archetypes are rooted in human knowledge and the collective reverberates such postures, and it is true to say that *smart cities*, inserted in this epistemic context, are inclined to postures of economic circularity according to the cognitive capacity of a historicization process; now, in this sense, it is feasible to state that, in comparison with other ways of thinking and other processes of historicization, There are other approaches to what is meant to deal with natural resources and their (eco)exploitation

In the global North, in the face of the discussion about capitalism "*ad infinitum*", the episteme of degrowth emerges; the uproar is based on capitalist globalization and the

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perception of inequality in space and time; What is certain is that the discussions took shape in 2008 "when this form of capitalist globalization unleashed or accentuated a deep crisis in many regions of the world" (Acosta; Brand, 2018, p. 80) and, in this aspect of growth, arising from aspirations of the global North, observes a dual proposal,

> "On the one hand, it suggests integral social change and identifies the "imperative of capitalist economic growth" as a fundamental problem. On the other hand, it seeks to contextualize in a broad and integral way the various concrete experiences." (Acosta; Brand, 2018, p. 109, emphasis added).

As previously alluded to, postures of economic circularity are sensitive according to the cognitive capacity arising from a process of historicization. Complex relationships involving socioeconomic, political and environmental issues, linked to the problem of modernization, foresee new answers, but currently take into account eco-effective criteria that are undoubtedly distinct between the global North and South; in other words, there are sensible differences for the (re)thinking of developed nation states and emerging economies. Flanking the discussions about degrowth, the question about the economic decoupling of nature is observed.

In the economic and environmental context, eco-economic decoupling translates the idealism of economic expansion without equivalent increases in environmental pressure. In several economies, the growth of production (GDP) intensifies the impact on the environment, according to Roser (2018); beyond this perception, observing that the uncoupling echo is observed in a dual way is sensible; (i) relative decoupling occurs when the ecological intensity per unit of economic output decreases; in this way, there would be a reduction in the impacts on resources compared to the GDP, which could still be growing; (ii) on the other hand, absolute decoupling represents a real reduction in impacts on resources; in this aspect, to be achieved, it would be necessary to have an (eco)efficient increase in the use of resources at a rate equal to or greater than economic growth, according to Jackson (2009).

Now, if neo-extractivism "not only criticizes the exploitation of natural resources and the socioeconomic, political and ecological problems that it entails (...)" (Acosta; Brand, 2018, p. 141); if neo-extractivism "is a reformist trajectory, disguised by the mantle of liberal development (...)" (Hargreaves, 2020, p. 173); "Degrowth is a new term that means a radical political and economic reorganization, leading to a drastic reduction in resource use and energy consumption." (Kallis *et al.,* 2018, p. 292), and; "There is no empirical evidence

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to support the existence of an eco-economic decoupling on the scale necessary to avoid environmental degradation." (Ward, 2021); a provocation coming from Latour's thought is pertinent to this context: "Where to land?" (Latour, 2020).

From Latour's point of view, the question is pertinent. If there are discrepancies between the lines of thought of the global North and South, *will smart cities* also be discrepancies? Now, "The global North continues to impose its vision of the world, ignoring or subordinating the local and community knowledge of the global South, perpetuating a colonial epistemology that legitimizes exploitation and domination." (Santos, 2010, p. 132); if abyssalism is historical, would post-abyssalism have in the Circular Economy and *Smart cities* a lever for overcoming?

THE PROMETHEAN OVERCOMING OF THE LINEAR BEHAVIORAL-ECONOMIC ARCHETYPE

"Promethean" is a strong metaphor interconnected with ideas of overcoming; This, in turn, is an affront to (post)modern colonial epistemology. Post-abyssalism is rooted in the alternation of stagnant economic paradigms, in other words, of the linear capitalist economy. The "greening" of socioeconomic, environmental and political relations leverages possible instruments that bequeath, to future generations, a parameter of sustainability. It is pertinent that the expression "parameter" is allocated in the previous statement, as it is a choice of the present generation, the legacy of an ecologically balanced Earth-system. Promethean, then, because it is a mission with multi-existential challenges.

One of the challenges can be addressed to the way in which humans assimilate ecology as the essence of their existence. (Eco) ideals demand engagement and, in this sense, a "hollow ecology, which does not pursue a profound change and often promotes technological solutions based on the same values and methods of the industrial economy (...)" (Solon, *apud* Naess (1973), 2019, p. 156) is opposed to a lever of overcoming. Dialoguing with this position, Yearley (1995, p. 462) already stated that:

> "On the one hand, the perception that movements in organizations are becoming closer to established science may be a disadvantage because many of the most radical supporters of the green movement ideologically oppose the technological society and its scientific contributions and are alienated from things that scientists have done (...)."

Reflecting on the above considerations is sensible, because if a "hollow ecology" does not alternate traditional methods of industrial economy, overcoming would be

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centered on disrupting this positioning. The rupture could be observed as a "green movement", however, according to Yearley (1995), there is a denial of the technological society. In this context, an invitation to a reflective paradox.

The fact is that smart cities integrate a variety of information and communication technologies (ICTs). Science and new technologies support resignifications, anticipating possible eco-efficiency; In this way, the following are observed: (i) public policies based on Sustainable Development Goals (SDGs); (ii) use of ICTs, striving for mobility and greater fluidity in vehicle traffic; (iii) *"smart*" energy *grid* in the face of wind, solar and cogeneration systems; (iv) water resources, under "*smart*" management, become the object of reuse and reuse, among others. There is, in this context, an intertwined relationship between urban eco-constructivism and the sustainable development goals that are, or would be, applied in an integrative way; in this way, as previously considered, "Cities are considered smart when they are identified as containing smart investments along the axes: economy, mobility, environment, human resources and smart lifestyles." (C40, 2011, p. 32).

Smart investments? They have always existed, keeping the due proportions, according to the cognitive limits of each epoch under analysis; In other words, investments have never stopped being smart, however, the scope of it varies in the human time ruler. In the era of industrialization, the objectives were different compared to the century. II BC, on the Silk Roads, or in the century. XI in the face of the revolution of Eurocentric agriculture, perhaps of the century. XIV-XV, a time of great explorations and commercial expansion; However, reflecting that profit was a common trait in all time frames is feasible. What is certain is that there are currently resizing the axes sensitive to *smart cities* where, with due proportions, overcoming is possible.

Technological advances, based on technoscience, seek to establish eco-management; these, in turn, are observed under the influence of the 2030 Agenda and in this vein, SDG11 on sustainable cities and communities guides, in an integrative way, a (re)thinking through goals, in brief synthesis: 11.1, safe housing and affordable prices for basic services; 11.2, provide access to effective and sustainable transport systems; 11.3, increase inclusive and sustainable urbanization; 11.4, to protect and safeguard the cultural and natural heritage of the world; 11.5, reduce deaths and the number of people affected by disasters; 11.6, reduce the negative environmental impact per capita of cities; 11.7, Provide universal access to safe, inclusive, accessible and green public spaces; 11a, support positive economic, social and environmental relations; 11b, increase the number of

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cities and settlements with policies and plans adapted to climate change; 11c, support the least developed countries for sustainable and resilient constructions (UN Brazil, 2024).

There is a concern in the above context; if the implementation of the SDGs must be observed in an integrative way, it is up to the Brazilian State to provide clear mechanisms for the success of such implementation; it is certain that, in the absence of normative guidelines that guarantee the success of *smart cities*, goals and objectives become symbolic, however, in the integrative context exposed above, STS(A) encourages civic participation and collaboration of various "*stakeholders*""Urban governance, including glocalized governance, companies, academic institutions and communities, promoting an inclusive, eco-effective, democratic and techno-scientific approach, as

> "Smart *cities* emerge as a possible response in the face of the social construction of knowledge. Smart cities represent the sum of reflections that strive for economic circularity. The rethinking of the life of Man in large urban centers and their socioeconomic interrelations, in the face of incremental, radical and disruptive innovations, express the search for eco-effectiveness; In this context, cities and urban areas are complex social ecosystems, where ensuring sustainable development and quality of life are important concerns. (...)" (Komninos, *et. al*., 2011, p. 286.)

To realize, from the outset, that there are limitations in the face of existing public policies and challenges to be overcome is necessary; the construction of normative guidelines prone to the thought of economic circularity and "*smart cities*" is necessary. However, under what parameter? Neoextractivism or degrowth? Eco-decoupling or neo-extractivism?

The question is relevant, because it is up to the State to have a clear ideopolitics for the exchange of economic linearity for circularity, fostered in intelligent urban environments. In the Brazilian legal system, timid postures in this context are observed through the National Solid Waste Policy (PNRS), Law 12.305/10 and the National Urban Development Policy (PNDU), Law 10.257/01.

The PNRS aims at the integrated management and adequate management of solid waste, encouraging reduction, reuse and recycling, but timidly introducing reverse logistics as a circular economic instrument; in this sense, smart cities lack effectiveness in the waste collection system, minimizing costs and environmental impacts (Albino *et al.*, 2015); The PNDU seeks to promote the sustainable development of urban areas, combating social inequality, improving urban infrastructure and ensuring access to basic services for all citizens; It should be noted that such a national policy was public in 2001, there is legal

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effectiveness, however, pondering on its social effectiveness is sensible, because *smart cities* seek urban mobility, energy efficiency and quality of life of urban inhabitants, but to materialize there must be social effectiveness in the implementation of the normative guidelines, exposed above.

What is certain is that there is no public policy of Circular Economy in the Brazilian State; there is Bill 1874/22 for this economic parameter, in the SF-SEXPE - Expedient Secretariat since March 21, 2024; in particular, item VI, of article 2 of the PL, provides: "circular economy: economic system that maintains the circular flow of resources and associates economic activity with the circular management of finite resources, through the addition, retention or recovery of their values (...)"; the information would be frivolous if the existence of a route to economic circularity (REC), structured in 2019 by the Ministry of Integration and Regional Development (MDR), which seeks to achieve sustainable development patterns, were not observed; Now, would a route, goals and objective, exposed above, be only symbolic?

If "*smart cities*" strive for (re)thinking, (re)doing and resignifying economic parameters based on circularity, objective public policies are necessary; Perhaps one is on the path, or route, because there is a need for a political-economic identity, but also a socio-environmental identity that determines where to go. Now, "Where are we heading?" could be combined in parallel with Latour's provocation, "Where to land?" (Latour, 2020); moreover, if the "era of *smart cities* has arrived" (Karvonen *et. al.,* 2018, p. 01) and "multiple cities are following smart urbanism as a model" (Cugurullu; Acheampong, 2020, p. 389), it is feasible that regulation by a State, which aims at the success of the Circular Economy, avoiding the (un)due expropriation of third parties, of noble ideals that orbit sustainability.

SMART CITIES FROM WHAT PERSPECTIVE?

There are distinct epistemological twists, dichotomous approaches that mirror abyssal ideologies. Ideals of economic circularity, even protagonists of avant-garde ideals, are not homogeneous. The fact is that, historical cycles repeat themselves, colonialism transcends neocolonialism, extractivism neoextractivism; In the same way, the prefix "post" came to represent contexts that seek to break with multi-millennial archetypes: post-industrialism, post-development, etc. Now, the "neo" and the "post" create "bridges" for the ecology of knowledges, yet the global North and South are protagonists of antagonistic

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circular economic thoughts; it is certain that the Earth-system is one, indivisible, an interconnected world-system; So, should the understanding of "*smart cities*" also be? In addition to an assertive response, a restlessness. If "+science" provides the expansion of cultural capital, and the collective awareness of a socio-environmental *ethos*, its realization would be operationalized by "+technologies" in favor of the collective which, in turn, would generate "+well-being", collective as well. But from which collective? North? South? Perhaps we are sinning by obviousness, however economic models of nation-states have "local" peculiarities.

Starting from the assumption that neo-extractivism would be suitable for the global South would lead to the perception that smart urban environments, at least, would observe sensible or indispensable extractivism as a parameter, excluding predatory extractivism; this time, it would be possible to flank the goals and SDG11, observed satisfactorily; however, meeting the deadline set by 2030 would require profound changes in economic identity, for example, Brazilian economy, because as alluded to, there is no national identity policy of circular economy as a foundation for "*smart cities".*

On the other hand, starting from the assumption of degrowth as a parameter for smart cities is a challenge, as the Brazilian state is extractive, deeply rooted in the exploitation of natural resources and the commodification of natural resources; moreover, the issue of gross domestic product (GDP) and the search for growth, as an emerging economy, would be confronted by the notable contradiction between the current abundance of global wealth and a constant increase in misery, environmental degradation, according to Raworth (2019). As alluded to earlier, post-development "addresses these multiple contradictions (...)" (McMichael, 2021 p. 89).

In time, economic eco-decoupling in Brazil would also be an illusion (Ward, 2021), because even in the face of the existence of supposedly green technologies, they demand finite natural resources and could not grow "*ad infinitum*" in the face of absolute decoupling, but would relative decoupling then be a viable answer? Now, the justification that the exploitation of natural resources would occur with ecological intensity, per unit of economic production, diminished guaranteeing economic growth, is only a (re)arrangement.

It is feasible to affirm that an intelligent urban environment is a unit of systemic economic (eco)production; from this perspective, science and new technologies, it is imagined, are beyond the semantics evidenced by Bazzo (2003, p. 120-121) when he

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exposed the linear model of development, where it was understood that "+ science = + technology = + wealth = + well-being. (...)". So, even with the circular economy as a common trait in the epistemes observed above, what would be the appropriate parameter? Ideopolitics of the global North, already developed? Or, from the global South and its developing economies, emerging so to speak? *Smart cities,* in addition to a Promethean vision where a harmonious interaction between postmodern city dwellers and nature is proclaimed, supported by advanced technologies to provide and promote sustainability, must take into account ideopolitics without sides; there is no side, the Earth-system is not flat.

The fact is that the smart urban model is committed to minimizing the environmental impacts associated with unbridled urbanization; implementing, therefore, innovative technologies to meet, in theory, the criteria required by SDG11; under this premise, smart urban models can contribute significantly to the preservation of the environment (Evans *et al.*, 2018).

In this way, sensible or indispensable neo-extractivism (post-extractivism), degrowth and eco-decoupling from nature seek detachment from economic linearity and the adoption of circularity as a core foundation for *smart cities;* however, neo-extractivism does not, as it is only a (re)arrangement, maintaining linear postures "close" to capitalist economic idealism. Initiatives such as the creation of innovation ecosystems, startup incubators and entrepreneurship support programs are the common thread to create a more dynamic and resilient urban economy (Hollands, 2008).

This time, intelligent and, in theory, post-developed urban environments are supported by incremental, radical or disruptive science and technologies; beyond ICTs, sustainability as a tangible goal demands the engagement of citizens in the face of clear ecological policies that, in turn, would provide a participatory (eco) democracy (Bibri; Krogstie, 2017). However, in order not to be just a Promethean simulation of sustainable environments, public policies guided by economic circularity are obviously necessary. It is the State that conducts the ideals of a nation, regardless of political-party positioning, because the Earth-system is not political or has a party. It is not enough to observe different epistemological contributions fought for STS(A) interdisciplinarity, there is a lack of sustainable and regenerative political-economic identity that combines new technologies with principles of social and environmental justice to create more resilient and equitable urban environments for the (post)modern city.

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In this vein, *Latin American smart cities* emerge as a significant field of study and practice, reflecting the efforts of the global South to adopt technologies to address complex urban challenges. As highlighted by Caragliu, Del Bo and Nijkamp (2009), the digital transformation in these cities seeks to improve the efficiency of urban services and promote sustainable development; in this way, efforts such as the "Smart City" program in Medellín, Colombia, illustrate the integration of innovative technologies to promote social inclusion and improve the quality of life of citizens (Restrepo, 2019). However, challenges such as digital disparity and data privacy persist as important concerns, requiring inclusive approaches and appropriate policies to ensure that benefits are equitably distributed (Caragliu *et al*., 2009). But, under what parameter are the examples recorded? It leans towards neo-extractivism (post-extractivism), at least sensible.

By seeking sustainable developmental alternatives, Latin American cities, based on ideopolitical ideas of economic circularity, foresee postures of (re)balance in the relationship between Man and Nature; However, post-development addresses multiple contradictions that orbit different perceptions of the global North and South and, in this sense, if there are projections for *smart cities,* they can follow lines of thought that strive for degrowth, or in anti-neoliberal and progressive mobilizations at the turn of the century in Latin America, which result in post-extractivist smart urban models. From this context a concern arises: are "*smart cities*" just a remodeling of conventional technologies?

In reflection on the above question, Renato Dagnino's (2004) thought is of added value, because when he discusses "On the analytical-conceptual framework of social technology", in addition to conventional technology (CT) and appropriate technology (AT), solidary technoscience (TS) and sociotechnical adequacy (AST) should, or should, involve the (re)thinking of such smart urban centers, in the face of the incorporation of scientific-technological knowledge fostered by research centers in favor of eco-effective innovations that, in turn, involve, or would involve, post-abyssal thinking; whether it is based on *degrowth* or neo-extractivism.

However, as mentioned earlier, the goal and targets for sustainable development are based on innovative science and technologies to meet the criteria required by SDG11 for human existence in the "urban era", the Urbanocene (Chwalczyk, 2020). What is certain is that the objectives are also observed in an interconnected way. The interrelatedness and interdependence of the sustainable development goals represents the success of the human agenda for 2030.

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Sustainable cities and communities and inclusive and sustainable human settlements (SDG11), could be considered smart urban means; These, in turn, would need responsible means of production and consumption (SDG 12), because the *design* of "*smart cities"* fosters (eco)technologies, (eco)innovations, (eco)designs capable of breaking the traditional model of feedback from the urban system. Considering the binomial (eco) responsible production-consumption requires (eco)literacy, through the necessary quality education (SDG04) which, in return, would leverage "+science" and "+technology" as a result of the promotion of knowledge. The social appropriation of knowledge, in theory, would provide health and well-being (SDG 03); on the other hand, it would promote gender equality, ending all forms of discrimination and, in theory, inequalities (SDG 05). In the sustainable (eco)developmental context, take into account that health, in addition to being observed for humans and non-humans, orbits the Earth-system in an integrative way as well. Salutogenic and restorative and regenerative design (Wahl, [2016] 2020) capillarizes systemic well-being, and, under this premise, co-creates systemic health where the human is an emergency of earthly life (Morin, 2003).

Furthermore, if smart cities adopt regeneration designs that, in turn, demand restorative postures, where the (re)thinking of structures through incremental, radical and disruptive innovations is the result of (SDG 04), and through this would develop quality, reliable, sustainable and resilient infrastructures that would have the power to promote inclusive and sustainable industrialization (SDG 09). Under the influence of the previous SDG, predicting that such an industrial process would promote decent work and balanced economic growth, through policies oriented towards the development of systemic-sustainable productive activities and decent job creation, i.e., work-growth instead of employment-wage, would be a possible result (SDG 08). In this way, the eradication of poverty would become a tangible goal, with adequate social protection measures and systems for the vulnerable (SDG 08).

The construction of this resilient system would, in theory, make it possible to eradicate hunger and improve human nutrition, as it would require the resignification of the secular agriculture model to a system adequate to the sustainalist ideals (SDG 02) where, in turn, individuals would have real conditions to financially afford decent food, since work and growth would allow them to do so. To this end, the (re)design of access to clean and affordable energy, both for the production and consumption chain, would be necessary. Improved energy efficiency would be a result of the interconnection of previous sustainable

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development goals, which would ultimately enable success in ensuring universal, reliable, modern and affordable access to energy services (SDG 07).

In this way, (eco)innovations that orbit smart urban centers would restructure water management where sanitation and hygiene, appropriate to the smart city model, would have the power to guarantee drinking water with universal and equitable access (SDG 06). (Eco)literacy and awareness in the management of water resources would be the guiding thread for the conservation of oceans, seas and marine resources for sustainable development (SDG 14), where, in turn, collaborative engagement for actions against climate change would be observed (SDG 13).

The (eco)constructivist mosaic above would then allow for a symbiotic Man-Ecosphere relationship where, in turn, it would promote terrestrial life through the sustainable use of terrestrial biomes (SDG 15). What is certain is that there is a need to strengthen partnerships and means of implementation to (re)structure partnerships, beyond the walls of a smart city, would call for a global conspiracy for the success of this regenerative and restorative human (eco)enterprise (SDG 17).

At this point, it is wise to ponder on SDG 16 – peace, justice and effective institutions, as these are conscious choices, appropriate to humans. In time, as mentioned in the introduction, only 17% of the sustainable development goals will achieve the ambitious global sustainability project by 2030, according to the UN (UNRIC, 2024). Observing such a statement, from the perspective of the multiexistential human failure in the conspiracy for its existence in the Earth-system, unveils the socio-environmental catastrophizing. On the other hand, envisioning the above scenario under the semiotics of the complex realities experienced by contemporary society, dictates the emphatic need for (eco)literacy (Wahl, [2016]2020, p. 169), as the integrative application of the SDGs demands not only symbolic engagement, but based on a "mental ecology" as a subjective and psychic field that includes perception, culture, and identity (Guattari, [1989]2022).

In perspective, mental ecology allows the notion of belonging to something, in this case, to the Earth-system; it is certain that such a posture is opposed to the perception of appropriation of spaces in the Ecosphere in an (in)consequential way. Urbanization is the appropriation of spaces from the world-system. Perhaps such a statement is obvious, however, the (re)urbanization through models of intelligent urban environments, refers the (post)modern human to a symbiosis with his *"habitat*". Thus, (eco)literacy dialogues with the success of the integrative application of the SDGs, as well as possibly "*smart cities*".

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This is a conjecture, as successes, both in smart urban projects and the full execution of the objectives of the 2030 global agenda, are interconnected by the social appropriation of knowledge where science and (eco)innovative technologies (STS-A) have the power to base idealizations on achievements.

In view of the context exposed above, the perception of Cabral and Barreto (2024, p. 7934) is constructivist, because "(...) education is seen as a means of transforming lives and realities, recognizing the importance of the SDGs in the formation of conscious and active citizens in sustainable development."; In this way, (eco)literacy represents a process of rooting new postures, and it is true to say that, for this, there is a (long) process of rupture with the multimillennial linear archetype shaped by human developmental behavior.

The fact is that, if the Epistemic "Sandbox" on economic circularity is Promethean, on the other hand, it would be the consented decisions (implicit and explicit) of the international community, nation-states, smart urban environments and vice versa (glocalization) that would allow the (un)success of the integrative application of the SDGs. "Smart city" models, whether based on neo-extractivism, degrowth, economic (eco)decoupling from nature, etc., could be the blueprint for the (eco)effective global environmental climate governance model. However, transposing ideopolitics is necessary to leverage overcoming.

It is certain to state that the integrative-systemic interconnection, elaborated above, represents a reflexive essay subject to critical (re)constructions. The future of the past tense is used in verbal inflections on purpose, as they represent a semiotics of becoming. In other words, it projects possibilities and potential paths that, although conditioned by present choices, point to a horizon of continuous transformation open to critical reexamination.

CONCLUSION

Concerns were exposed in the reflections on "urban intelligence – (re)thinking cities" and "*smart cities* from what perspective?". The CTS(A) dialogue provided a holistic view, with a socio-environmental approach, for the discussions presented. In this way, the comparison of intelligent urban environments, in addition to the benefits carried by science and new technologies, exposes an epistemological clash over economic paradigms that orbit the way in which Circular Economy is considered between the global North and South.

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Distinct thoughts were evidenced that, from the perspective of abyssal thinking, are dichotomous, embodied by developed nation-states and emerging economies of the global South; degrowth and eco-economic decoupling from nature are fostered by developed states; on the other hand, neo-extractivism represents the Latin American identity posture. However, it was observed that, regardless of the existing abyssalism, the Circular Economy is a post-abyssal common trait for conceptions about *smart cities*.

A post-abyssalism based on identity transcendences was fostered, as economic circularity in intelligent urban environments, to the detriment of capitalist globalization, observes glocalization as a point of overcoming homogenized ideopolitics. In particular, it was observed the absence of an objective public policy on circular economy in the Brazilian State, only a circularity route proposed by the Ministry of Integration and Regional Development (MDR) and timidly, through the National Solid Waste Policy (PNRS), reverse logistics as a circular parameter. In time, the National Urban Development Policy (PNDU) was observed, which, in turn, seeks to promote the sustainable development of urban areas. The provocation about such guidelines being symbolic was observed, in particular, in line with the goals and objectives of sustainable development (SDG11) and the difficulty of their integrative application.

Thus, the proposal of an integrative-systemic mosaic was presented, based on reflections on restorative-regenerative (re)design, in which the SDGs were grouped in an integrative essay. This approach seeks to establish connections that transcend isolated analyses, promoting a holistic and interdisciplinary view.

It is worth noting that the integrative-systemic interconnection elaborated represents a reflexive essay, open to critical (re)constructions. The use of the future tense in verbal inflections was deliberate, functioning as a semiotics of becoming. In other words, a scenario of possibilities and potential paths was projected, which, although conditioned by present choices, point to a horizon of continuous transformation that is receptive to critical reexamination.

As stated, the analysis of the global scenario reveals that only 17% of the Sustainable Development Goals (SDGs) will be achieved by 2030 (UNRIC, 2024), evidencing a systemic failure that exposes human vulnerability in the Earth-system. This reality highlights the urgency of (eco)literacy as an integrative strategy to promote a "mental ecology" that encompasses perception, culture, and identity. This process involves not only understanding the SDGs, but also reshaping human interactions with the

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environment, especially in the context of urbanization and (re)urbanization, where smart models can enable sustainable coexistence. Thus, the application of the SDGs depends on the social appropriation of knowledge that connects science, technology and innovation, influenced by STS-A, in concrete practices. In this sense, education and (eco)literacy are fundamental to break linear paradigms and entrench sustainable attitudes.

If *smart cities* are a possible socio-environmental solution, they demand Circular Economy as a paradigm; however, there is an epistemological sandbox on the agenda, as observed. Are the constructs of intelligent urban environments in nation-states, without a concrete identity posture, influenced by epistemic dichotomies? An appropriate provocation as a conclusion, since *Brazilian smart cities* follow conscious or indispensable post-extractivist Latin American parameters, or those coming from the global North?

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