

Three moments of sustainable development in the habitat cities and communities of Mexico

Tres momentos del desarrollo sostenible en el hábitat de ciudades y comunidades sostenibles de México

Juan Gabino González-Becerril

*Center for Research and Advanced Population Studies (CIEAP) Autonomous
University of the Mexico State, Mexico*

Summary

In the context of the neoliberal model and that of the self-denominated fourth transformation of Mexico, the review of three moments of sustainable development of Mexican cities is proposed. For which it is proposed as an objective of this investigation to present three moments related to the dimensions and indicators that allow the monitoring of the 2030 objectives in the main cities of Mexico. Through the application of the multiple correspondence methodology, it is argued that the significant social inequalities are the result of both the transformation in the economic model and the public policies implemented, in addition to the pandemic, which still demands attention to achieve compliance with the Millennium objectives in the metropolitan areas of our country.

Keywords: 2030 Goals, indicators, sustainable cities, model, development and scene.

Resumen

En el contexto del modelo neoliberal y el de la autodenominada cuarta transformación de México, se plantea la revisión de tres momentos del desarrollo sostenible de las ciudades mexicanas. Para lo cual se plantea como objetivo de esta investigación el presentar tres instantes relacionados con las dimensiones e indicadores que permiten el seguimiento de los objetivos 2030 en las principales urbes de México. Mediante la aplicación de la metodología de correspondencia múltiple, se sostiene que las significativas desigualdades sociales son el resultado tanto de la transformación en el modelo económico como de las políticas públicas implementadas, además de la pandemia, que aún demanda atención para alcanzar el cumplimiento de los objetivos del milenio en las áreas metropolitanas de nuestro país.

Palabras clave: Objetivos 2030, indicadores, ciudades sostenibles, modelo, desarrollo y escena.

INTRODUCTION

Sustainable development show the lack of uniformity in their progress and setbacks (Arias, 2006). Likewise, the interpretation and representation of the indicators is not homogeneous. This is due to the marked iniquities present in the urbane structure, in the iniquities of the life of the population, in the processes of the peri-urbanization and gentrification, as well as in its ecological situation, its global or peripheral character, its integration into the national or international system, its mobility and sustainable displacement, its pattern of agglomeration, dispersion, randomness and relocation, its articulation or neighborhoods, its environmental and, above all, its public and social policy (Larralde, 2016).

Sustainable development indicators, as mentioned, are not sufficient to understand the complexity of cities and metropolitan areas, both in our country and globally. It has been proposed to adopt neutral perspective regarding the SDGs to facilitate better interpretation. However, their relevance is indisputable for developing societies, since they allow us to unravel the multidimensional development agenda (Perez and Medina, 2023).

The importance of this study lies, first of all, in the possibility of evaluating the benefits or progress of public policy on the quality of life of the population living in cities at the three different times. In addition, it seeks to identify the challenges and obstacles faced by the evolution of sustainable development in the indicators in the urban environment. It is essential that public policy, both in its neoliberal stage and in the fourth transformation, addresses this issue and recognizes the relevance of meeting the 2030 millennium goals in the cities of Mexico. At the same time, it is expected that the methodology used, which groups cities with similar characteristics, will have significance, while at the same time, it will be useful for future research, as well as its approach.

In this study, the relevance of the indicators corresponding to 61 metropolitan areas of Mexico is statistically analyzed. To this end, the work is organized as follows: the genesis of sustainable development at global level, definition state of the art and in Latin America is presented, goal 11 of the United Nations 2030 Agenda, which focus of sustainable cities, is detailed, as well as the 17 SDG indicators, the methodology used and the sources of information used are described, and a section dedicated to the applied technique or methodology is included.

The results are structured in what we have called three stages of the sustainable development in the metropolitan areas of Mexico: a) first stage

addresses sustainable cities and communities in 2015; the second stages refers to sustainable cities and communities in 2020, a year marked by the COVID-19 pandemic that paralyzed the world; and c) the third stage analyzes sustainable cities and communities in 2023, five years after the fourth transformation. Finally, the discussion of the results and conclusions.

GENESIS OF SUSTAINABLE DEVELOPMENT IN THE WORLD AND LATIN AMERICA

Background

The concept of sustainable cities a community, which serves as the basis for the new international development agenda of countries, seems to be simple at firsts glance, however, in reality, it contains an intricate imbalance in the interaction between the population, economic and social development and the environment. This last aspects is inseparable from human beings who reside in metropolitan areas or cities in the world like in our country.

The definition of sustainable development originated in the Brundtland Commission created by the United Nations General Assembly in 1983. In its report entitled “Our Common Future” (1987), the term “Sustainable development” was defined as development that meets the needs of present generations without jeopardizing the ability of future generation to meets theirs. Approach aimed to address the protection of the environment and the development of developing countries, which required the integration of environmental policies with economic and social development strategies. As a result, the “three dimensions” or “three pillars” of sustainable development were identified: economic, social and environment with the central focus (Pinciple 1, CEPAL, 2020).

In 2010, the United Nations General Assembly decided to hold the Rio+20 conference, defined essential themes: the institutional framework for sustainable development and the “green economy withing the framework for sustainable development and the elimination poverty”. The notion of the free economic proposed that the paradigm shift required to protect the environment could, in turn, create new opportunities for economic growth, a relevant aspect in the context of a global economic crisis. One of the most relevant conclusions of Rio+20 was the beginning of the process to establish the sustainable development goals (SDGs). This would mean the convergence of the international process towards sustainable development with the global development agenda for the period after 2015,

rerepresenting a fundamental advance toward the authentic integration of the sustainable development indicators as a guiding principle, thus overcoming the limitation of environmental institutions and the associated discourses (CEPAL, 2013; CEPAL, 2020).

The Economic Commission for Latin America and the Caribbean (CEPAL) affirms that equity and environmental sustainability are essential, which requires structural transformation in the economic system that require significant social consensus. This entity has highlighted in its reports the relevance of the equity trilogy particularly in “Structural change for equity: and integrate visions of development” (CEPAL, 2014a, p. 17) and “Pacts for equality” (CEPAL, 2014b), as well as in various collaborative studies in the United Nations system, such as “Sustainable development in Latin America and the Caribbean: monitoring of the United Nations Development Agenda post 2015 and Rio+20” (CEPAL, 2014a) which integrate these proposal in the development of indicators at a regional and global level, with the aim of achieving more sustainable development, in which Mexico also participates.

Key definitions of sustainable development

Sustainable development is the result of the evolution of previous concepts, meanwhile, its meaning continues to be dispute in academic, political and institutional setting (Sobrino, Garrocho, Graizbord, Brambila and Aguilar, 2015; Reyes, Ibañez and London, 2023). But, in addition, there are various definitions about the sustainable development of cities. However, the United Nations, maintains that sustainable cities are those that integrate urban greenery, renewable energy production, non-motorized mobility or circular economy in their city model.

Sustainable urban development is based on fundamental principles and brings benefits such adaptation to climate change (ONU, 2016). This concept, as pointed out by Sobrino and his coauthors must add dimensions that have to do with politics and urban demography. In politics because it is necessary to include the role of the State, the democratization process and participatory planning.

For urban demography, due its direct relationship with the processes of demography growth (the demography growth of returnees is increasingly increasing), the fundamental elements are the distribution of the population in national territories, migratory movements, as well ethnic components. Here a systemic definition is derived by the including the economic, social,

environmental, political and demography aspects of the city with its structural mutations in the context of sustainable development (CEPAL, 2012).

State of the art and sustainable development

In a timeline of sustainable development that begins with the Industrial Revolution in 1760 and the pollution resulting from this development model. Key milestones then occur such as the Earth Summit in Stockholm in 1972 that established environmental education, the Brundtland Report of 1987 that contrasted economic development with sustainability, and Kyoto Protocol of 1997 that aimed to reduce greenhouse gas emissions, ending with the World Summit on Sustainable development in 2002 (Miranda, Suse, Cruz, Machado, & Campos, 2007). However, in its previous evolution, the concern of Robert Malthus in 1798 stands out, who highlighted his concerns about the scarcity of natural sources. These concerns are an example of an environmental commitment and are related to the concept of sustainable development as that which meets the needs of the present without compromising future generations due to high demographic growth and that State policy was required for this (cited in González and Olguín, 2020). However, the concept of sustainable development has been questioned due to its economic (neoliberal) origin since it offers ideal concepts and indicators. At the same time, a systemic or complexity approach is proposed rather than using limited and fragmented sources (Colom, 2007).

However, in this issue what is the role of the city population in the focus attention? In a context where a State collaborate with international organizations and local governments with a humanistic approach to serve the population in metropolitan areas, it is crucial to carry out action that strengthen the transformative capacity of the dimensions of sustainability in cities (Bárcenas, 2024). Through participation and urban leadership, we contribute to eliminating the barriers that restrict Access to secondary and high education, as well as eradicating inequality in access to labor market.

Likewise, it is essential to ensure that poverty is eradicated, ensure access to health services, put an end to the physical, symbolic structural and the environmental violence they face, and guarantee citizen's full exercise of their right, include sexual and reproductive rights. To achieve these objectives, it is necessary to have an adequate diagnosis that adopts an urban-demographic approach, considering the elements of sustainable development in our time.

This analysis must show the "necessary" relationships between population-city growth, the availability of resources and the economic and social

development of the city. In this sense, the modern urban planning process requires the implementation of measures that introduce the necessary modifications in the relationship between population and resources, in order to achieve the established urban development goals. This perspective has given rise to what is known as “urban-population policies” that take into account the balance of sustainability of globalizing cities and spaces of citizen rights (García, 1968; Borjas 2013).

GOAL 11 OF THE 2030 AGENDA OF THE UNITED NATIONS AND SUSTAINABLE CITIES

The meeting conferences and agreements allude to cities directly, while New Urban Agenda, which ratified at the United Nations Conference on Housing and Sustainable Urban Development —Habitat III— in Quito, Ecuador, on October 20, 2016, established guidelines and principles for the planning, construction, development, management and improvement of urban area, organized into five pillars of application: i) national urban policies, ii) urban legislation and regulation, iii) urban planning and design, iv) local economy and municipal finances, and v) local implementation (ONU-HABITAT, 2016).

The Quito Declaration Sustainable Cities and Human Settlements for all highlights the persistence of various forms of poverty, the increase the social inequalities and environmental degradation as fundamental obstacles to sustainable development at a global level. Social and economic exclusion, along with spatial segregation, are unavoidable realities in urban areas and humans settlements (ONU, 2016). It is therefore essential to take advantage of the opportunities provided by the urbanization to foster sustainable and inclusive economic growth as well as social and cultural development, and environmental protection, thereby contributing to the achievement of transformative and sustainable development.

ONU-Habitat maintains that the implementation of the New Urban Agenda (2020), is essential to eliminate poverty and hunger in all its forms, reduce inequalities, foster sustainable and inclusive economic, achieve gender equality and empower all women and girls to participates fully in sustainable development, improve the health and well-being of the population, increase resilience and the protect the environment in line with the goals set for 2030.

Goal 11 of the United Nations 2030 Agenda aim to make cities more inclusive, safe, resilient and sustainable. Cities are the future of global lifestyle, and more than half of the world’s population resides in urban areas.

However, many of these cities are not adequately prepared for rapid urbanization, resulting in the growth of informal settlements and challenges such as inequality, pollution and vulnerability to climate change.

In Mexico, a study has been carried out on the progress of the metropolitan areas in relation to meeting the 17 Sustainable Development Goals (SDGs). A notable case is that of the city of Guadalajara in this context. Likewise, urban municipalities play a fundamental role in implementing the SDGs and promoting resilience in cities.

It is essential for the well-being of all citizens to promote the sustainable development of cities, which entails a transformation in the way urban environments are designed and managed to address current and future challenge.

METHODOLOGY AND SOURCES OF INFORMATION

Sustainable cities and communities represents the framework of social human life. It is environment in which a society is nourished by technology, as well as information and communication, through platforms such as the one we use for this work. In this sense, we base ourselves on the indicators of the Report on the Sustainable Development Goals, 2015, 2020 and 2023 (17 objectives), prepared by Ministry of Economy and the INEGI of our country.

Therefore, our document emphasizes that “other data” other than those provided by official sources, obtained from platforms expressly designed for this purpose through the use of the Internet, are not used, taking into account the dimensions oriented to the sustainable development of 61 metropolitan areas (ZM) of our country. It includes 61 ZM, which are those that have their sustainable development indicators monitored at the three points in time analyzed here. The ZM and the dimensions of sustainable development cover issues that have generated intense debates in the academic and social spheres, and at the same time, they are presented as phenomena of continuous reflection until the year 2030.

In this study, to operationalize the dimensions, the objective of sustainable cities or metropolitan areas is considered as central variable. The sustainable development indicators are integrated as variables that contribute to the Multiple Correspondence Model (MCM), highlighting water and sanitation. The social or population dimensions covers the following aspects: eradication of poverty by 2030; zero hunger; health and well-being; quality education; gender equality; and reduction of inequalities. Regarding the economic dimension they include: decent work and economic

growth; industry, innovation and energy; responsible production and consumption; and affordable, not polluting energy.

On the other hand, the environment dimension includes: action for climate and the conservation of terrestrial ecosystems. Finally, the government dimension encompasses the objectives of peace, justice and strong institutions, as well as the alliance to achieve the objectives (Table 1).

Table 1: Indicators by objective and goal of the SDGs 2030 of the main Metropolitan Areas of Mexico, 2015, 2020 and 2023

Dimensions		Objectives	Goals	Indicators
Cities or metropolitan areas	Sustainable cities and communities	11. Make cities and human settlements inclusive, safe, resilient and sustainable	Goal 11.1, Goal 11.2., Goal 11.3., Goal 11.4, Goal 11.5, Goal 11.6., Goal 11.7., Goal 11n.1, Goal 11n.2	Precarious urban housing, people with disabilities, backward times, indigenous people, lands and population, cities, urban planning and management, deaths and disappearances, solid waste, suspended particles, open spaces, housing backwardness and green areas
	Water and sanitation	6. Ensure availability and sustainable management of water and sanitation for all	Goal 6.1., Goal 6.2., Goal 6.3, Goal 6.4., Goal 6.5., Goal 6.a., Goal 6n.1, Goal 6n.2	Percentage of supplies, sanitation, quality, management, cross-border, expenditure, piping and zones
Population or social	End of poverty 2020	1. End poverty in all its forms everywhere	Goal 1.1, Goal 1.2, Goal 1.3., Goal 1.4., Goal 1.5, Goal 1.a, 1n.1, Goal 1n.2, Goal 1n.3	Global, national, regional, municipal poverty threshold by sex, children, multidimensional, social protection, homes and services, land ownership, deceased and missing persons, public spending on services, poverty situation, health personnel, vaccination, retirement, daycare, social security and others

continue

	Zero hunger	2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Goal 2.1, Goal 2.2., Goal 2n.1, Goal 2n.2, Goal 2n.3	Food security, stunting, malnutrition, anemia, food insecurity and agricultural performance
	Health and well-being	3. Ensure healthy living and promote well-being for everyone at all ages	Goal 3.1, Goal 3.2, Goal 3.3, Goal 3.4, Goal 3.7, Goal 3.9, Goal 3.c, Goal 3n.1, Goal 3n.3, Goal 3n.4	Maternal mortality, childbirth, MI, HIV, Tuberculosis, malaria, communicable diseases, chronic diseases, suicides, contraceptives, adolescent fertility, mortality due to risks, lack of access to health, entitlement, catastrophic expenses, overweight and obesity
	Quality education	4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Goal 4.1, Goal 4.2, Goal 4.3, Goal 4.4, Goal 4.5., Goal 4.6, Goal 4.a., Goal 4.c, Goal 4n.1, Goal 4n.2	Basic education completion rate, learning, enrollment, technology and information, parity, literacy, schools with infrastructure, teacher training and violence
	Gender equality	5. Achieve gender equality and empower all women and girls	Goal 5.2, Goal 5.3, Goal 5.4., Goal 5.5, Goal 5.6, Goal 5.a., Goal 5.b, Goal 5n.1, Goal 5n.2, Goal 5n.3	Physical or psychological violence, indigenous language, domestic work, paid and unpaid, proportion of women in the political sphere, right to property of men and women, lag in income and schooling, violence against boys and girls, among others.
	Reduction of inequalities	10. Reduce inequality in the MZs and between them	Goal 10.1., Goal 10.2., Goal 10.3., Goal 10.4, Goal 10n.1, Goal 10n.2, Goal 10n.3	Household expenditure and income, sex, age and disability, discrimination, income concentration index, LGBTQTQI+

continue

Economic	Decent work and economic growth	8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Goal 8.1, Goal 8.2, Goal 8.3, Goal 8.4., Goal 8.5, Goal 8.6., Goal 8.7, Goal 8.8, Goal 8.9, Goal 8.10, Goal 8n.1, Goal 8n.2, Goal 8n.3, Goal 8n.4	GDP per capita, PO, non-agricultural employment, informality, consumption, income, unemployment, NEET, child employment, moral and non-fatal occupations, occupations in the financial and tourism sector, affiliated with the IMSS and others
	Industry, innovation and energy	9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Goal 9.1., Goal 9.2, Goal 9.3., Goal 9.4, Goal 9.5, Goal 9.b., Goal 9.c, Goal 9n.2, Goal 9n.3	Rural population, transportation and passengers, GDP, employment, manufacturing, credits, polluting emissions, added value, researchers per inhabitants, proportion of GDP in research, mobile network, technologies, subsidies and SMEs
	Responsible production and consumption	12. Guarantee sustainable consumption and production patterns	Goal 12.2, Goal 12.5, Goal 12.b., Goal 12n.1, Goal 12n.2	Consumo interno, per cápita, PIB, reciclables, residuos sólidos, aspectos económicos y de sustentabilidad del turismo, fertilizantes y otros
	Affordable and non-polluting energy	7. Guarantee access to affordable, reliable, sustainable and modern energy for all	Goal 7.1, Goal 7.2, Goal 7.3, Goal 7n.1, Goal 7n.2, Goal 7n.3	
Environment	Climate action	13. Adopt urgent measures to combat climate change and its effects	Goal 13.1, Goal 13.3, Goal 13n.1, Goal 13n.2	Mortality, disappearances, disasters, gases, particles, ozone, climate change and fossil fuels

continue

	Life of terrestrial ecosystems	15. Protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss	Goal 15.1, Goal 15.4., Goal 15.5, Goal 15n.1, Goal 15n.2	Forest resources, biological diversity, protected areas, wetlands, biodiversity, green areas, extinction, losses and deforestation
Governance	Peace, justice and strong institutions	16. Promote peaceful and inclusive societies for sustainable development, facilitate access to justice for all and build effective and inclusive institutions at all levels that provide income	Goal 16.1, Goal 16.3., Goal 16.5, Goal 16.6, Goal 16.7., Goal 16.9., Goal 16.b, Goal 16n.1, Goal 16n.2, Goal 16n.3	Deaths, violence (various), prison occupation, contact with officials, expenses, satisfaction, inclusion, survivors, human rights, justice and trust
	Alliance to achieve the objectives	17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	Goal 17.1, Goal 17.3, Goal 17.4, Goal 17.6, Goal 17.8, Goal 17n.1, Goal 17n.2, Goal 17n.4, Goal 17.19	Government income %GDP, taxes, remittances, debt, internet access, subnational governments, information on platforms, culture and public budget
Index	General index	The majority	The majority	The majority

Source: prepared based on the UN, (2023); IMCO, City Banamex and Centro Molina (2023) and INEGI, (2023).

METODOLOGY OR TECHNIQUE

The multiple correspondence model constitute a statistical technique of a descriptive or explore nature, whose purpose is to condense a large amount data into a limited number of dimensions, minimizing the loss of information as much as possible. In this sense, its purpose is similar to that of factorial methods, although in correspondence analysis, the approach is applied to categorical or ordinal variables (De la Fuente, 2011).

Correspondence analysis is a statistical method used to graphical examine the relationship of dependence and independence between a set of categorical variables related to metropolitan areas (sustainable cities and

communities) and sustainable development, using data extracted from a contingency table that was constructed for this purpose (Table 1).

Each modality of the table is assigned a point in the space R_n (generally $n = 2$), in such a way that the relation of proximity and distance between the determined points represent the relation of dependency and similarity that exist between them.

The coding and organization of the dimensions, variables and indicators related to the problem was carried out. Simultaneously, the percentages of progress towards the 2030 Sustainable Development Goals (SDGs) were classified into quartiles, which implies an n -dimensional approach ($n \geq 61$) for the analysis of the problema using the Multiple Correspondence Analysis Method (De la Fuente, 2011).

Subsequently, the model corresponding to the years 2015, 2020 y 2023 were executed in IBM's Statistical Package for Social Sciences (SPSS) software, addressing the problem from a two-dimensional perspective, which facilitated the performance of the correspondence analysis itself.

Let X and Y be two categorical variables, were these variables are observed in N elements of a population (metropolitan areas or cities) and the recorded as they appear in <https://ics.novagob.mx/>. Table 2 illustrates that the intersection of a row and a column gives rise to a cell or box, whose observed frequency is denoted as n_{ij} . In this way, the Spss 21 software is used to identify groups of cities or metropolitan areas that are convergent or divergent. It is important to note that at each moment or year related to the 2030 objectives, the matrix was constructed and the variables were coded according to the quartile corresponding to each variable X or Y for the years 2015, 2020 and 2023 (Table 2).

Table 2: Double entry table of sustainable development indicators

X/Y	y_1 = general index	y_2 = end of poverty	...	y_i	y_{17} = Alliance to achieve the objectives	
X_1 = Acapulco	$n_{11} (e_{11})$	$n_{12} (e_{22})$	...	$n_{ij} (e_{ij})$	$N_{im} (e_{im})$	N_i
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
N_i	$n_{i1} (e_{21})$	$n_{i2} (e_{22})$	...	$n_{ij} (e_{ij})$	$n_{im} (e_{im})$	
X_{61} = Zamora (X_k)	$n_{k1} (e_{k1})$	$n_{k2} (e_{k2})$	...		$n_{km} (e_{km})$	N_m
	N_1	N_2	...		N_m	NN

Source: own elaboration based on the UN, (2023); IMCO, CityBanamex and Centro Molina (2023) and INEGI, (2023).

THREE SCENES OF SUSTAINABLE DEVELOPMENT IN THE METROPOLITAN AREAS OF MEXICO

From the matrix present above, the result are detailing in the following sections, which address sustainable cities and communities for the years 2015, 2020 and 2023. The differences, positions, progress and groupings of cities in the aforementioned years are emphasized, highlighting their convergence in relation to the indicators of sustainable development.

(1) But before moving on the analysis of results, it is necessary to present the following about the three scenes.

In the summaries of the models, it is observed that for the year 2015, the magnitude of the variance is broken down into two dimensions: on contributes 35 per cent and another 20 per cent to the changes in sustainable cities and the SDG indicators. In the model corresponding to the year 2020, as well as in the third, these indicators were set at 33 and 21 per cent, respectively. This implies that the total variance is explained in 55 and 55 per cent by these two dimensions, which have equivalent importance. This suggest that they are adequate to describe the sustainable development and metropolitan areas of Mexico in the years 2015, 2020 and 2023. It is important to note that there is no universally accepted threshold for the minimum percentage of variance. In this case, it will depend in the application, the specific year of the implementation and the context in which the sustainable development indicators were developed.

(2) The discriminant measure reveals that the most significant variables for the SDG of the 61 cities of our country in 2015, in dimensión one are: The general index (0.83) decent work and economic growth (0.74), end to poverty (0.73), zero hunger (0.55) and industry innovation and energy (0.54). In dimensión 2 of the same year, the variables that contribute to the sustainable development of the 61 metropolitan areas in our analysis are the same. For the year 2020, these measures and variables maintain their relevance in dimensión 1 of sustainable cities, highlighting the impact of the health and well-being variable (0.43) due to Covid-19 pandemic (Table 2). In addition, other indicators are beginning to gain importance in this dimension, such affordable and non-polluting energy, reduction of inequalities, and water and sanitization, among others. In what we have called the third scene, 2023, the most relevant indicators for understanding sustainable cities continue to be: end of poverty, zero hunger, health and well-being, decent work and economic growth, industry, innovation and energy, as well as the general index. However, in dimension 2, other indi-

cators emerge such the water and sanitation, gender equality, industry, innovation and energy, responsible production and consumption, affordable and no-polluting energy, and alliances to achieve the objectives (Table 3). However, is it in these and other indicators were greater effort and attention is required from public policy.

Table 3: Discrimination measures for the 61 sustainable cities or metropolitan areas of Mexico and the SDGs 2015, 2020 and 2023

Indicators	Discrimination measures, 2015			Discrimination measures 2020			Discrimination measures 2023		
	Dimension			Dimension			Dimension		
	1	2	Media	1	2	Media	1	2	Media
Sustainable cities	0.37	0.22	0.30	0.31	0.13	0.22	0.37	0.30	0.34
Water and sanitation	0.21	0.19	0.20	0.25	0.20	0.22	0.12	0.37	0.25
End of poverty	0.73	0.42	0.58	0.68	0.16	0.42	0.59	0.19	0.39
Zero hunger	0.55	0.38	0.47	0.48	0.08	0.28	0.48	0.01	0.24
Health and well-being	0.33	0.15	0.24	0.43	0.06	0.25	0.55	0.13	0.34
Quality education	0.39	0.04	0.22	0.05	0.21	0.13	0.34	0.10	0.22
Gender equality	0.22	0.28	0.25	0.14	0.25	0.20	0.08	0.32	0.20
Reduction of inequalities	0.08	0.05	0.07	0.06	0.40	0.23	0.07	0.12	0.09
Decent work and economic growth	0.74	0.48	0.61	0.80	0.07	0.44	0.72	0.15	0.44
Industry, innovation and energy	0.54	0.19	0.36	0.58	0.08	0.33	0.53	0.24	0.39
Responsible production and consumption	0.05	0.04	0.05	0.04	0.38	0.21	0.07	0.41	0.24
Affordable and non-polluting energy	0.06	0.05	0.06	0.03	0.67	0.35	0.05	0.36	0.20
Climate action	0.07	0.17	0.12	0.30	0.12	0.21	0.17	0.08	0.12

continue

Life of terrestrial ecosystems	0.17	0.07	0.12	0.08	0.21	0.14	0.07	0.17	0.12
Peace, justice and solid institutions	0.26	0.01	0.13	0.11	0.08	0.10	0.08	0.04	0.06
Alliance to achieve the objectives	0.33	0.20	0.27	0.45	0.15	0.30	0.42	0.41	0.42
General index	0.83	0.52	0.67	0.81	0.28	0.55	0.87	0.14	0.51
Total assets	5.93	3.45	4.69	5.60	3.52	4.56	5.57	3.53	4.55

Source: own elaboration based on INEGI (2015, 2020 and 2023).

First scene of sustainable cities and communities for the year 2015

Scatter Figure 1 presents a simple convergence analysis. The variation observed between cities in 2015 suggests that a negative relationship indicates a situation of convergence, where cities with lower scores experienced more significant improvements compared to those with higher scores. In contrast, a positive relationship signals a divergence, in which differences in scores widen in that year.

For example, the first group of metropolitan areas and their sustainable development indicators includes Celaya (5), Tula-Tulancingo (54), Puebla-Tlaxcala (39), Oaxaca (34), Matamoros (25), Campeche (3), Toluca (53), Poza Rica (38), Tehuacán (49), Villahermosa (58), Reynosa (42), Nogales (32), Nuevo La-redo (33) and Piedras Negras (37), which show greater divergence as sustainable cities or metropolitan areas in 2015. This is mainly expressed in their indicators of the general index, decent work and economic growth, as well as in the objectives of zero hunger and end of poverty (Figures 1 and 2).

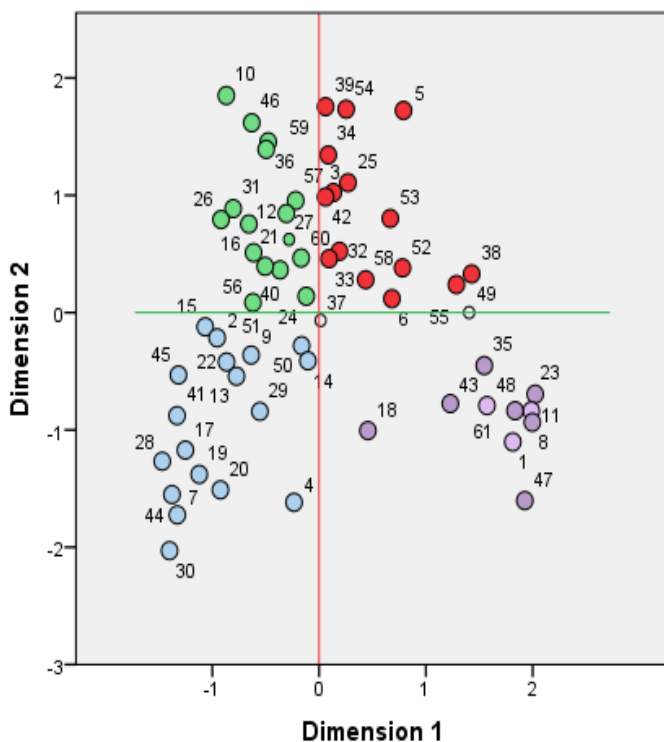
A second set of sustainable cities and communities includes Colima-Villa de Álvarez (10), Tampico (46), Xalapa (59), Pachuca (36), Morelia (31), Cuernavaca (12), Mérida (27), La Laguna (21), Mazatlán (26), Ensenada (16), Valle de México (56), Puerto Vallarta (40) and other locations. These cities and metropolitan areas showed greater variability in their sustainability in 2015, especially in relation to the gender (in)equality objective (see Figures 1 and 2).

The third group of sustainable cities and communities includes Monterrey (30), Saltillo (44), Chihuahua (7), Mexicali (28), Juárez (20), Hermosillo (19), Guadalajara (17), Querétaro (41), Culiacán (13), San Luis Potosí (45), La Paz (22), Monclova-Frontera (29), Tepic (50), Tijuana (51), Ciu-

dad Victoria (9), Aguascalientes (2), León (24) and other locations. These cities and metropolitan areas stand out for their focus on sustainable production and consumption, access to affordable and clean energy, the preservation of terrestrial ecosystems, the reduction of inequalities, climate action, as well as access to water and sanitation.

A fourth group of sustainable cities and communities includes Orizaba (35), La Piedad-Pénjamo (23), Tecomán (48), Cuautla (11), Chilpancingo (8), Acapulco (1), Tapachula (47), Zamora (61), Rioverde (43), Guaymas (18) and other locations. These cities show greater variability or divergence in relation to the 2030 SDGs, covering areas such as industry and technological innovation, health and well-being, quality education, and collaboration to achieve the objectives that promote the sustainable development of cities and communities (Figures 1 and 2).

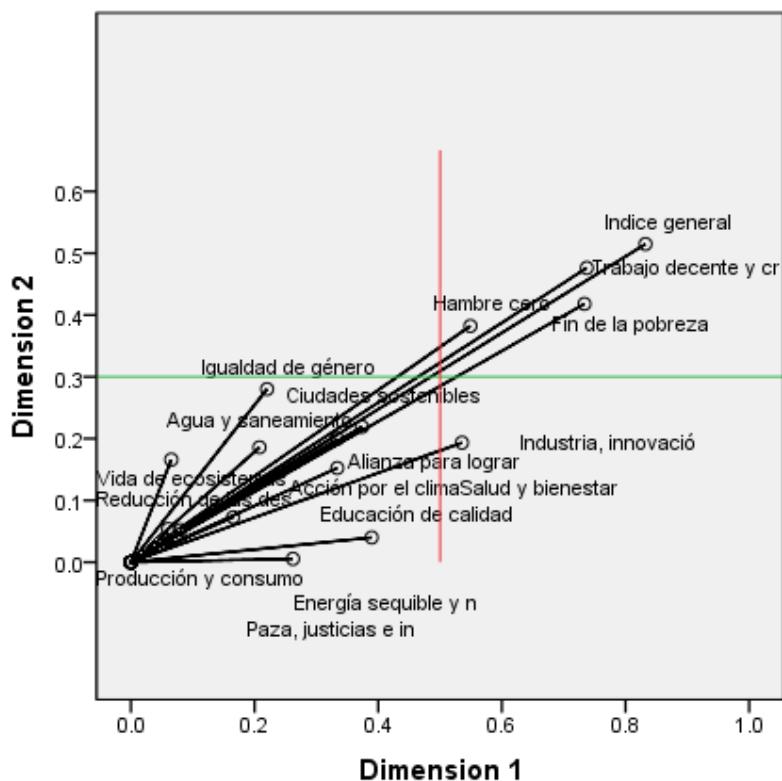
Figure 1: Bispatial scatterplot of sustainable cities and communities, 2015



Main normalization by variable.

Source: own elaboration based on INEGI (2015)

Figure 2: Discrimination measures of sustainable cities and communities in Mexico, 2015



Main normalization by variable.

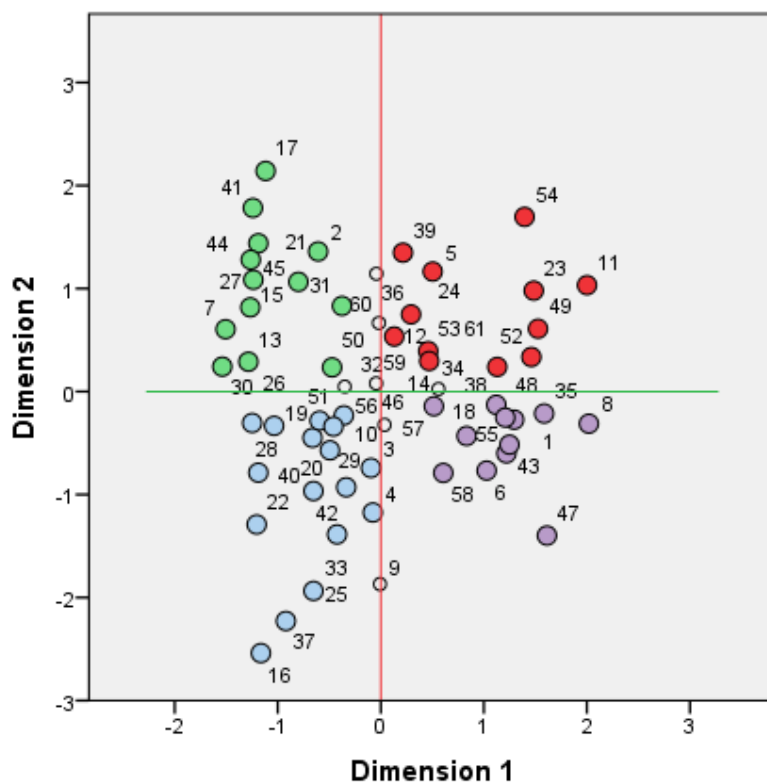
Source: own elaboration based on INEGI (2015)

Second scene of sustainable cities and communities for the year 2020, the year of the Covid-19 pandemic that closed the world

It is essential to note that, before proceeding with the description, it is necessary to recognize that this scene, within the framework of the Covid-19 pandemic, negatively affected the progress made in the field of sustainable cities and communities. This health crisis presented a significant challenge to the full implementation of the 2030 Agenda, and its consequences include an increase in extreme poverty, as well as an increase in inequalities and injustice at a global level (UN, 2023).

This implied that the second scene of sustainable cities and communities will show greater differences in relation to the 17 objectives taken up in this study, established for 2030. The cities that evidenced divergences in the areas of industry and innovation, as well as in the sustainable city and community objectives due to the pandemic, include Zamora (61), La Piedad-Pénjamo (23), Orizaba (35), León (24), Celaya (5), Puebla-Tlaxcala (39), Poza Rica (38), Tuxtla Gutiérrez (55) and Tehuacán (49) (Figures 3 and 4).

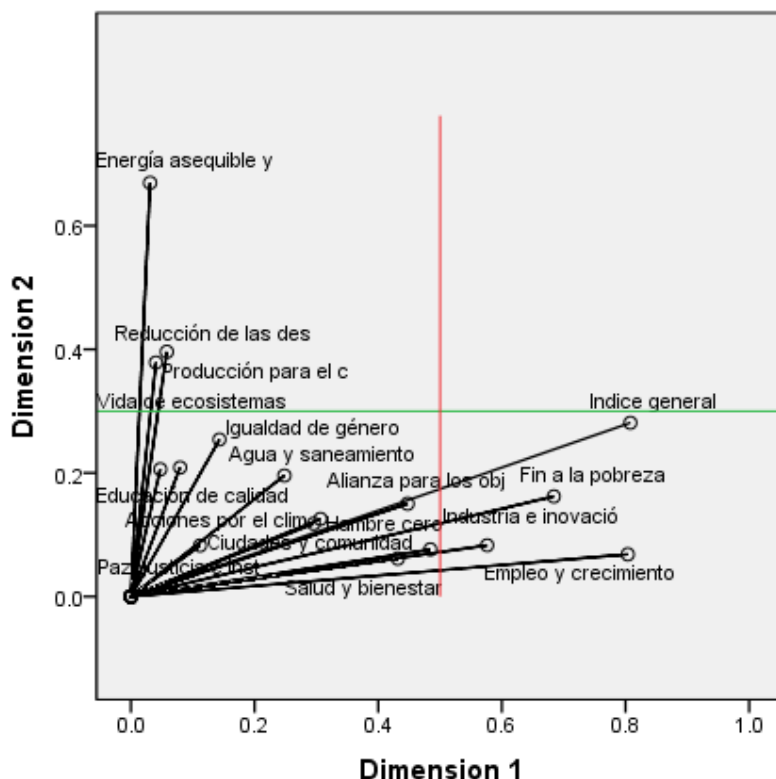
Figure 3: Bispatial scatterplot of sustainable cities and communities, 2020



Main normalization by variable.

Fuente: elaboración propia con base en INEGI (2023).

Figure 4: Discrimination measures of sustainable cities and communities in Mexico, 2020



Normalización principal por variable.

Fuente: elaboración propia con base en INEGI (2023).

Group 2 that was affected by the pandemic and social policy, which was criticized for its late response to the health crisis, includes Aguascalientes, which curiously stood out in the first scene as part of the group with the greatest convergence (see Figures 3 and 4). This was followed by the Valley of Mexico (56), Guadalajara (17), San Luis Potosí (45), Chihuahua (7), Querétaro (41), Monclova-Frontera (21), Mérida (27), Monterrey (30), Saltillo (44), La Laguna (21), Juárez (20), Xalapa (59), Cuernavaca (12), Tepic (50), Tijuana (51), Pachuca (36), among others (see Figure 4). The sustainable development goals (SDGs) for 2030 that generated their divergence relate to responsible production and consumption, driven by confinement, collaboration to achieve the goals, access to water and sanitation

(which marks the beginning of the water crisis), affordable energy, gender equality, the development of sustainable cities, as well as industry and technological innovation (see Figure 4).

The third set of sustainable cities and communities in the context of Covid-19 included: Ciudad Victoria (9), Colima-Villa de Álvarez (10), Campeche (3), Tampico, Cancún, Nogales (32), Nuevo Laredo (33), Matamoros (25), Puerto Vallarta (40), Zacatecas-Guadalupe (60), Morelia (31), Piedras Negras (37), Mexicali (28), Culiacán (13), Durango (15), Hermosillo (19), Ensenada (16), Cuernavaca (12), Reynosa (42), Veracruz (57), among others. During the pandemic, these cities aligned with the convergence group in relation to the objectives of living on land ecosystems, reducing inequalities, peace, justice and strong institutions, among others (Figures 3 and 4).

The fourth group of sustainable cities and communities that were impacted by the pandemic includes: Chilpancingo (8), Acapulco (1), Tapachula (47), Rioverde (43), Tlaxcala-Apizaco (52), Tecomán (48), Cuautla (11), Chetumal (6), Guaymas (18) and Villahermosa (58). These localities, as well as their metropolitan areas, presented divergences in the objectives related to the eradication of poverty, the promotion of decent work and economic growth, as well as health and well-being, which had an impact on the general index of that year, the fight against hunger and educational quality, all as a consequence of confinement (Figures 3 and 4).

Third scene of sustainable cities and communities for the year 2023, 5 years after the fourth transformation

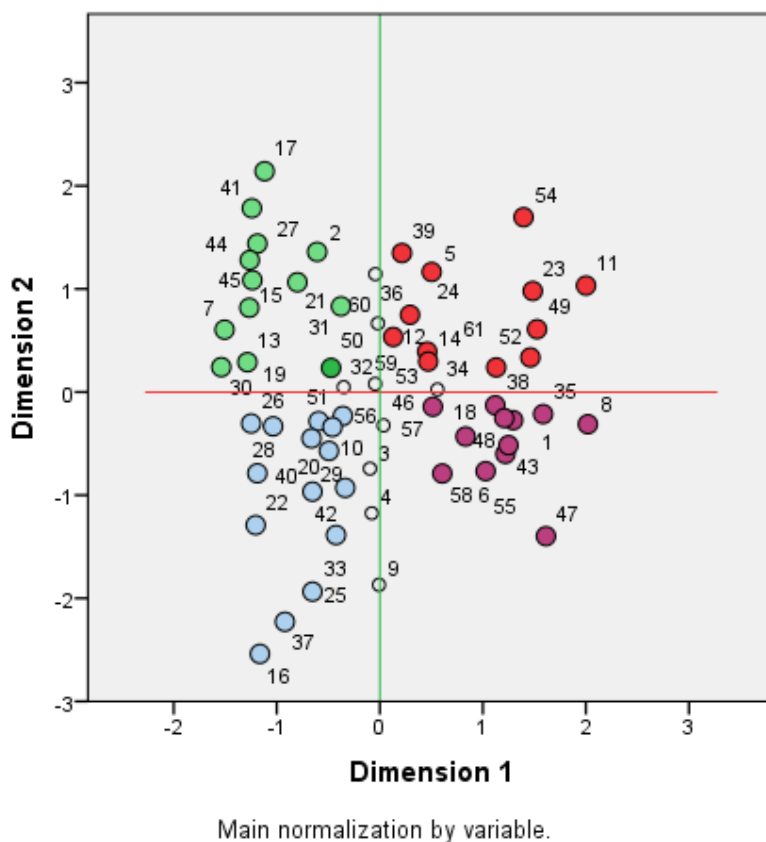
Following the Covid-19 pandemic and five years into the self-proclaimed government of the fourth transformation, significant changes have been observed in the habitats of metropolitan areas, as well as in the sustainable cities and communities of Mexico, in relation to the objectives established for 2030. Compared to the year 2020, the Constitutional President of Mexico has highlighted in his morning conferences the historic decrease in poverty.¹ These changes are the result of the State reform, which has prioritized the internal market and the most vulnerable populations. In this sense, it has sought to reduce poverty and promote fair development, transforming the political and economic dynamics of the country towards a Welfare State with a progressive approach, similar to the best times of the

¹ See Poverty reduction, the most important achievement of the 4T. President AMLO conference, available at, <https://www.bing.com/videos/riverview/relatedvideo?q=AMLO,%20disminuci%C3%B3n%20de%20la%20pobreza%20en%20m%C3%A9xico,%202018%20a%202023,%20la%20jornada&mid=99D8CC3EA1284430417599D8CC3EA12844304175&ajax-hist=0>

Institutional Revolutionary Party (PRI), which promoted inward-oriented development, which implied a change in social policy (Ortega, 2022).

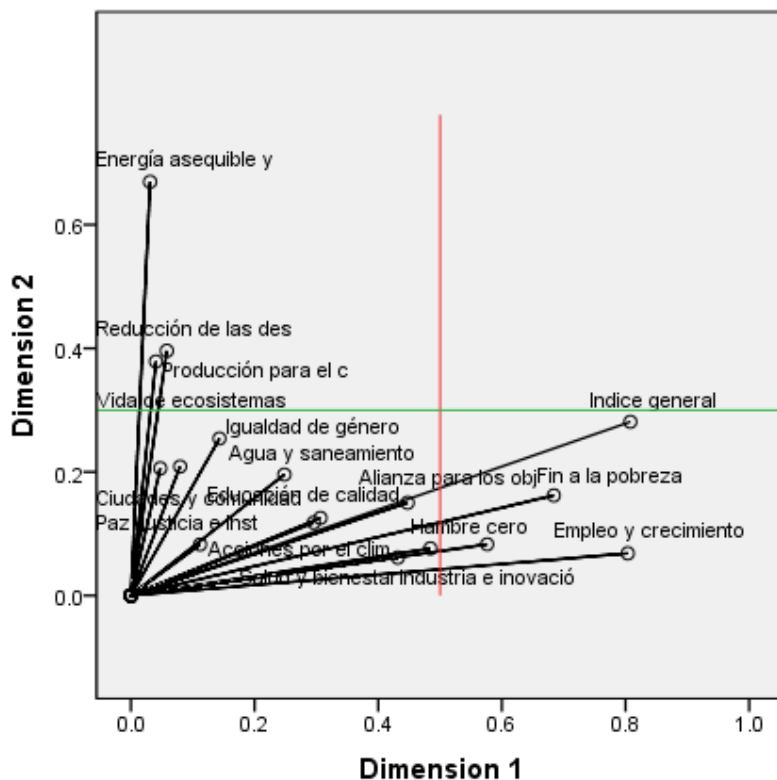
In the context of the transformation of Mexico's economic model, changes are evident in the positions of convergence and divergence of the Sustainable Development Goals (SDG) in sustainable cities and communities for the year 2020. The first group (highlighted in red) includes Tula-Tlancingo (54), Cuautla (11), La Piedad-Pénjamo (23), Puebla-Tlaxcala (39), Celaya (5), León (24), Tehuacán (49), Tlaxcala-Apizaco (52), Zamora (61), Oaxaca (34), Pachuca (36), Cuernavaca (12) and others (Figure 5). This convergence is justified by the general index, which includes the summary indicator of the 17 millennium goals (Figure 6).

Figure 5: Bispatial scatterplot of sustainable cities and communities in Mexico, 2023



Fuente: elaboración propia con base en INEGI (2023).

Figure 6: Discrimination measures of sustainable cities and communities in Mexico, 2023



Main normalization by variable.

Fuente: elaboración propia con base en INEGI (2023).

The second group of sustainable cities and communities that exhibit variations with positive progress include: Guadalajara (17), Querétaro (41), Saltillo (44), La Laguna (21), Aguascalientes (2), San Luis Potosí (45), Mérida (27), Morelia (31), Durango (15), Zacatecas-Guadalupe (60), Cuernavaca (13), Tepic (50) and others. These variations are reflected in access to affordable and clean energy, production focused on responsible consumption, the reduction of inequalities and the conservation of terrestrial ecosystems.

The third group that shows convergence (negative sign) is made up of sustainable cities and communities, which include: Piedras Negras (37), Ensenada (16), Matamoros (25), Nuevo Laredo (33), Reynosa (42), La Paz

(22), Puerto Vallarta (40), Monclova-Frontera (29), Mexicali (28), Juárez (20), Hermosillo (19), Colima-Villa de Álvarez (10), Valle de México (56) and other metropolitan areas. This convergence is reflected in 10 of the 17 goals set for 2030, such as gender equality, access to water and sanitation (an issue that will demand attention due to climate crises), quality education, climate actions, as well as peace and institutional justice, among others (see Figures 5 and 6).

The fourth group is made up of the sustainable cities and communities of Tapachula (47), Chilpancingo (8), Acapulco (1), Orizaba (35), Rioverde (43), Chetumal (6), Villahermosa (58), Tuxtla Gutiérrez (55), Tecomán (48), among others (Figure 5). The divergence variables cover the general index, poverty eradication, industry and technological innovation, as well as employment and economic growth (Figure 6).

DISCUSSION OF RESULTS

First of all, the importance of carrying out research on the 2030 agenda in the cities of the world and specifically in our country must be recognized. The work of Sobrino and his co-authors is recognized; They are the most far-reaching at the moment regarding sustainable cities (2015). Which implies a great challenge to apply a methodology that brings together the greatest number of dimensions that are considered in the 2030 objectives. For this reason, we believe that the urban-demographic approach used here is a small advance because with its multiple correspondence methodology it makes a kind of zoom or graphic summary that in other presentations would be a very long list of indicators that are difficult to follow graphically (IMCO, CityBanamex and Centro Molina (2023). What is presented here is like a flash that makes it easier to recognize groups of cities with similarities and divergences in the indicators of sustainable development.

But, in addition, it is suggested to carry out interdisciplinary and multidisciplinary work in such a way that it includes the majority of possible dimensions and readings on the advances and setbacks of the indicators of the 2030 objectives. This is clear if the information is available, because until the time this document was written there was no information about the 2025 intercensal survey.

At the core of this work, it is highlighted that large cities are moving away from meeting the 2030 Sustainable Development Goals. This is done by evaluating the sustainable development indices in 61 metropolitan areas through the previously mentioned sustainable, environmental, social and economic development indicators. Regarding this, there is a coincidence

with other studies carried out in our country under the argument of the Covid-19 pandemic, wars on other continents and other crises of the current capitalist system (Ayala, 2024; UN, 2024).²

At the core of this work, it is highlighted that the large The results derived from here are consistent with the “Catalogue of Initiatives 2024” of the UNDP (2024) in Mexico, a sample of the collective effort towards the development of Mexico and its inhabitants with the previous ones, but in addition a greater number of research is required on the 2030 agenda in cities and in Indices of sustainable cities and states, in such a way that allows comparison of what was obtained in the present study. One of the pending studies would be the indicators of sustainable development in rural areas in such a way that it allows evaluating the social policy of the fourth transformation.

Additionally, working on sustainability indicators undoubtedly presents limitations and great challenges. Because for some cities they have not yet reported their indicators and in this way their objectives cannot be monitored. Although the goodness of said indicators developed by INEGI is also highlighted. It is also recognized that a systemic theoretical approach is needed that allows most of the dimensions and indicators of the sustainable development of cities to be brought together, as well as a systemic methodology (González and Olguín, 2020). Finally, it is argued that any hypothesis expressed here under the approach and methodology with its results can be subjected to what Karl Popper calls falsification of the hypotheses, which is a criterion of scientificity (cited in Castro 2022).

CONCLUSIONS

The Sustainable Cities and States Indices constitute a methodology developed by the UN that allows governments to obtain a detailed vision of urban complexity. This indicator translates into the observance of (dis)well-being since it is presented in a quantifiable metric, at the same time, it allows evaluating the efficiency of the city or metropolitan area, as well as the impact of the public policies implemented.

The adoption of these guidelines by an international organization such as the ONU points out the need to establish a new paradigm of urban governance and to promote coordination between institutions to address the challenges of urban inequalities. This is essential to promote public action

² The UN recognizes failures in meeting the sustainable development goals, available at <https://noticiaslatam.lat/20240629/la-onu-reconoce-fallos-en-el-cumplimiento-de-los-ob-jetivos-de-desarrollo-sostenible-1155809471.html>

and unleash the potential of the country's cities, in order to create a model of urbanization and territorial development that is inclusive, safe, resilient and sustainable, as established in the National Development Plan (PND) 2013-2018 and 2019-2024, as well as in the country's state and municipal plans.

The three scenes presented in this context, in relation to the sustainable development indicators, were initially implemented under the neoliberal model, and the first indicators began to be published in 2015. These indicators reflected the situation of the 17 goals for 2030. In turn, in 2020, they were impacted by the Covid-19 pandemic on the 17 sustainable development goals with regard to sustainable cities and communities.

The delayed response to the Covid-19 pandemic, together with the lack of a national policy that promotes sustainable cities and communities, covering various development sectors at the national, state and local level, and that is coordinated between the three levels of government, has resulted in notable divergences in the SDG General Index. This includes indicators such as End Poverty 2020, Zero Hunger, Health and Wellbeing, Quality Education, Gender Equality, Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation and Energy, Reducing Inequalities, Responsible Production and Consumption, Climate Action, Life on Earth, Peace, Justice and Strong Institutions, as well as Partnership to Achieve the Goals. These inequalities reflect a spatial-demographic expression and represent other significant obstacles to the sustainable prosperity of cities and metropolitan areas.

In the year 2023, in the era after the Covid-19 pandemic, some cities that had experienced progress, such as Guadalajara, Monterrey and San Luis Potosí, suffered a setback, evidenced by their displacement from quadrant three to quadrant two. This change suggests a growing divergence compared to other cities that are in the first and fourth quadrants, according to the graphs that present data from 2015, 2020 and 2023. The suggestion is to monitor which indicators have influenced the setbacks and, based on this, that the State's social policy addresses its deficiencies or seeks to reduce its divergence.

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Author's resume

Juan Gabino González Becerril

Master in Population Studies from El Colegio de la Frontera Norte. He is a full-time professor-researcher at the Center for Research and Advanced Population Studies of the Autonomous University of the State of Mexico (CIEAP/UAEM) and is director of the magazine Papeles de Población published by the same institution.

Email address: gonzalezg2012@hotmail.com

ORCID registration: <https://orcid.org/0000-0003-4274-4203>