The World Towards the Future. Global Initiative for Healthy Cities. **Piura, Peru**

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Abstract

Today, more than half of the world's population live in urban areas. To achieve sustainable and healthy development, it is essential to rethink the way cities are built and organized. Health means much more than the physical situation of a person or a community or the health care system; A healthy city is based on a commitment to improve the living conditions of all its inhabitants. However, in practice, many of them continue to be planned and designed without considering its citizens' needs and scales of well-being. This research is based on the work of the MGI Morgenstadt Global Smart Cities Initiative in Piura, an intermediate city in Peru that is strongly affected by the consequences of climate change. Through a City Lab, the initiative seeks to generate replicable and viable solutions and strategies using advanced technologies and an in-depth analysis of local development demand. Based on a selection of indicators and their impact factors, comparative data is used to evaluate Piura's performance holistically, supporting the concept of a healthy city and the local action needed to comply with the SDGs and the New Urban Agenda. The analyzed data and its results help to define urban projects at the local level that aim to address the challenges identified in the city and building on the achievement of a long-term vision development. The proposed solutions are based on aspects of health in its different dimensions, combining with opportunities for social and economic innovation that support sustainable urban development.

Keywords: healthy city, wellbeing, City Lab, sustainable development, Piura

Introduction

As of 2018, more than half of the world's population lived in urban areas. It is expected that in 2050 cities population reaches near 2.5 billion people leading to a rapid urban sprawl together with dense and congested cities, mainly in countries of the Global South (UN, 2018). Market-driven trends have contributed to increasingly unhealthy lifestyles as well as unequal living conditions in cities, leading to overwhelmed and underprepared planning authorities when addressing these emerging urban challenges. (Barton and Grant, 2013). An example is the rapid urban expansion, resulting in increasing car-dependency of citizens (Rao *et al.*, 2007) as well as areas without access to basic services (Fekade, 2000), which new concepts of sustainable urbanism seek to improve. Several international bodies have recognized the key role of an integrated sustainable urban development vision, most notably through the UN 2030 Agenda for Sustainable Development, its Sustainable Development Goals (SDGs), and the New Urban Agenda (NUA) adopted in 2018 at the Habitat III UN Conference. This outlook has been promoted

by the research and innovation policies of various international bodies, such as the European Commission with its smart cities and nature-based solutions programs, the incorporation of city-based initiatives and projects within the International Climate Initiative (ICI) of the German Federal Ministry for Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), or the Healthy Cities initiative of the World Health Organization (WHO), even though it was originally conceived in the 1970s, has become more prominent for the implementation of the SDGs and the WHO health promotion agendas. While there is an understanding that supporting sustainable urban development could improve the health of the city's population (Portney and Sansom, 2017), it is essential to rethink the way cities are built and organized to achieve it.

To comprehend the relationship between healthy city and sustainable city, defining the meaning of health is required. From one part, the term *health* in general is often related to physical health, or the absence of illness on a person. It appears as a human right in several legal structures and first-level international agreements such as the Universal Declaration of Human Rights since its creation in 1948 (OHCHR, 2008). However, health encompasses many more areas of a person's life than merely physical, as reflected by the WHO as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1946). Mental health is linked to the emotional, psychological and social well-being, as it affects how people think, feel and act when facing life. This concept incorporates the prevention, treatment and rehabilitation of people suffering several conditions related to mental disorders (WHO, 2019). Furthermore, social health was identified as the ability to adapt and self-manage towards environmental changes and challenges, including the capacity of developing satisfactory relationships with others (WHO, 2021). Additionally, the concept of environmental health arises, and it is determined by the and environmental factors with an impact people´s lives. This last concept is based on the disease prevention and creating environments for an improved health (WHO, 2018).

Within the UN Agenda 2030 and the SDGs, health appears as a key element to achieve sustainability, specifically within the objective 3 that is related to good health and well-being. The SDGs have built a functional framework to have a common global approach while supporting local mechanisms for implementation to close the disparities in the distribution of health gains. Health can be found in all 17 objectives as an overarching concept that needs to be considered in all aspects of planning strategies.

Cities play a key role in achieving the SDGs. They are account for about 70 % of global carbon emissions (Eames *et al.*, 2013) and consume more than 60 % of the natural resources (Williams, 2019). Rural-urban migration is driven by the advantages, services and benefits for their inhabitants, such as job creation and educational opportunities, becoming centers of innovation, modernization, and wealth creation (Ichimura, 2003). Rapid urbanization results in an increasing number of inadequate and overburdened infrastructure and services such as waste collection, water and sanitation systems, roads and transport, worsening air pollution and unplanned urban sprawl (UN, 2015a). SDGs are considering the urban challenges, aiming at designing more inclusive, safe, resilient, and sustainable cities and human settlements, as referred within the SDG number 11. Ensuring access for all to adequate housing and urban infrastructure are essential when building a holistic healthy society, as it takes in consideration aspects from social,

mental and environmental health (Ramirez-Rubio *et al.*, 2019). There are several cases where green and public spaces are frequently not enough and the physical activity levels of their inhabitants are under the healthy recommended average (Mueller *et al.*, 2017; Nieuwenhuijsen, 2020a). Due to the strong interlinkages between the 17 SDGs and their 169 targets, it is considered essential to establish integrated approaches to effectively implement and operationalize the SDGs at the local level.

Furthermore, cities are key players on decarbonization and meeting the Paris Agreement targets (Wei, Wu and Chen, 2021) on rapid emission reduction, resilience building and local action (UN, 2015b). A healthy city then is based on a commitment to improve the wellbeing of all its inhabitants. According to WHO (2018), a healthy city refers to a process where cities become conscious of health and strives on its direction to improve its performance towards it.

A large part of health afflictions is produced by living in an urban environment. Cities are susceptible to several health risks related to basic infrastructure, such as food and water insecurity, neighborhoods designed to discourage social interaction, air and water pollution, extreme temperatures, flooding and droughts aggravated by climate change. Gasparrini et al. (2015) expose that extremely high temperature may be related to 0.4 % of annual premature mortality worldwide. According to the research of Cohen et al. (2017) an approximate amount between 5.7 million to 7.3 million people die each year because of high air pollution levels, and there are also 3.2 million death related to inadequate physical activity. Stevenson et al. (2016), conducted an urban modeling to reflect the health impact of the compact city concept which considers the enhancement of land-use density and variety and the distance reduction to public transportation to lower motorized mobility, such as walking, biking, and public transport. This modeled compact city resulted in health improvements for all cities, especially for diabetes, cardiovascular and respiratory disorders, this translates into a global health gain from 420 to 826 DALYs[1] per 100,000 people. Commitment for urban health improvement, a process and structure to achieve it needs to be reflected within urban plans and strategies. A healthy city creates and improves continually its physical and social environments, enabling people to support each other to build communities.

According to Nieuwenhuijsen (2020b) several cities still lack a clear vision of a sustainable, livable, and healthy city or how to transfer this vision into concrete standards, policies, plans, and procedures. Many cities continue to be planned and designed without considering its citizens' needs and scales of well-being. Health disparities and inequities are often related to factors such as access to and quality of available public spaces, representation and participation degree in shaping processes, and urban environment maintenance. Current growth rate worsen urban problems and challenge planning institutes, e.g., green spaces accessibility tends to reduce as cities grow, directly affecting the people's experience of urban nature and decreasing mitigation capacity (Fuller and Gaston, 2009). Fragkias et al. (2013) highlight a close direct relationship among inhabitants and the amount of CO_2 emissions in a city. Even though behavior and

[1] Disability-adjusted life year (DALY) is a measure developed by Harvard University in 1990 for the World Bank to track overall health and life expectancies based on the potential years lost due to premature death or healthy life lost (WHO, no date).

acquisition power have a higher influence on it, population rate and economy growth have a direct incidence on how fast the city is expanding, challenging urban planning and strategies to adapt to the new boundaries.

There is a need to move from data and information to knowledge and action for urban sustainability and human well-being when understanding large urban infrastructure systems (Ramaswami *et al.*, 2016). The influence of infrastructure on the health of and in cities is addressed by different authors, for instance, Nieuwenhuijsen (2020b) argues that a design of a city with large infrastructure for vehicles, will produce eventually that people decide to drive even more, generating several impacts such as a higher amount of air pollution, noise and stress levels, rise of the urban temperatures (urban heat island), lack of exercise, and to an increase of related diseases such as cardiovascular and respiratory disorders, decreased cognitive performance and thus premature mortality. On the contrary, a city designed with an investment in infrastructure for cycling will produce eventually more people using bikes. As well as argued by Gehl (2010), it is important to invite the people using healthier infrastructures and thus improving cities life. As cities are complex entities, there is no general solution recipe that can be applied in all cities to fulfill their needs. Thus, every strategy and intervention should be tailored and specified for each city.

This research is based on the work of the Morgenstadt Global Smart Cities Initiative (MGI), a project funded by the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) through the International Climate Initiative (IKI) increasing urban resilience to tackle climate change impacts, as well as to support their greenhouse gas (GHG) emission reduction efforts. In order to overcome these challenges and ensure a healthy, safe and prosperous place to live, City Labs are implemented to identify possible areas to intervene and co-create project ideas with various stakeholders, improve resilience and climate change adaptation potential. The initiative levers on the analysis, identification and development of sustainable cross-sectoral solutions to optimize urban infrastructures, processes or services in cities of India, Mexico and Peru.

In Peru, project action takes place in Piura (Figure 1), the fifth largest city in the country with around 480,000 inhabitants (INEI, 2017) and strongly affected by the consequences of climate change. The city experienced an exponential growth driven by the need for housing and the occupation of urban land through invasions or illegal land markets (Cockburn, 2019), challenging all urban services. The Metropolitan Development Plan developed in 2020 as part of the Reconstruction with Changes Plan after the last El Niño and financed by the Ministry of Housing, Construction and Sanitation (MVCS) of Peru is still in process of approval. So far, Piura does not have any valid urban development plan or other tools supporting spatial development. Although, health aspects in city planning are not part of the local agenda yet, their importance is mentioned at the national level with the SDGs and their identified contributions. However, there are no guidelines focusing on concreate measures on how to follow them or requiring their implementation at local level.

Figure 1. Location of Piura. Source: Authors based on National Georeferenced Data Platform Geo Peru (Gob.pe, 2022)

This research paper seeks how a quantitative and qualitative data-based analysis of Piura's challenges and opportunities can contribute to the design of project ideas driving a health-oriented sustainable urban development. The paper explores the MGI approach and its proposing solutions in relationship with healthy city aspects, combining different opportunities for social and economic innovation that support sustainable urban development.

Methodology

The City Lab is a framework (Radecki, 2019) for designing individual sustainability strategies for cities based on innovation aspects, promoting the use of clean technologies, and establishing a broad interdisciplinary dialogue with local stakeholders. This methodology consists of an in-depth city analysis based on performance indicators that assess quantifiable sustainability performance and key action fields essential for sustainable development. In addition to these quantitative elements, expert interviews and workshops are conducted with key stakeholders from the public, private and academic sectors to identify the unique impact factors influencing the urban system of each city, ensuring a high degree of local participation and complementing the quantitative analysis and the co-creation of sustainable projects for the city development.

According to this methodology, the research focusses on healthy city planning solutions and consists of three parts:

First, a considerable amount of information is analyzed regarding the city performance. The indicators are selected according to the concept of a healthy city planning. Considering for example, indicators directly related to the health system of the city, also considering health in a wider context including indicators that measure the access to public spaces, basic services or

infrastructure. Benchmarks used are rather on national or international basis, or following proposed standards defined on global level. The data is used to evaluate Piura's performance holistically. Second, based on the on more than 30 interviews with local stakeholders and its correlation with reliable performance indicators data, a total of 24 impact factors were revealed that have a substantial influence on health-oriented development and systematically seek to understand the unique and characteristic elements of the city. Third, a prioritization to arrange the project ideas are derived, based on the SDGs, the Agenda 2030 goals for a sustainable and healthy city, and other components such as the alignment of the ideas with the city's objectives and vision, the engagement of local stakeholders identified during the City Lab activities, the potential for replicability within the region, as well as their potential regulatory constraints and risk of approval. This way, projects are arranged according to its relevance to address the challenges identified in the city and building on the opportunities on the achievement of a long-term vision to boost sustainable and healthy development of Piura.

Results

This section shows the main results of the quantitative and qualitative data-based analysis of the City Lab and the relationship of selected project ideas with each other and towards a development of Piura that supports aspects of a healthy city planning. Moreover, three project ideas are presented that help the transformation of Piura.

Indicators

The analysis of the indicators has been carried out based on a benchmarking system, where each value is evaluated against a specified range to determine its performance in terms of low-medium-high compared to the average and later defined as below average, average or above average. Data for the indicator analysis have been collected using primary and secondary sources, including remote data collection, evaluation of various statistical reports such as policy documents and Piura development plans, along with information obtained during interviews with local experts and stakeholders, as well as knowledge shared by local partners.

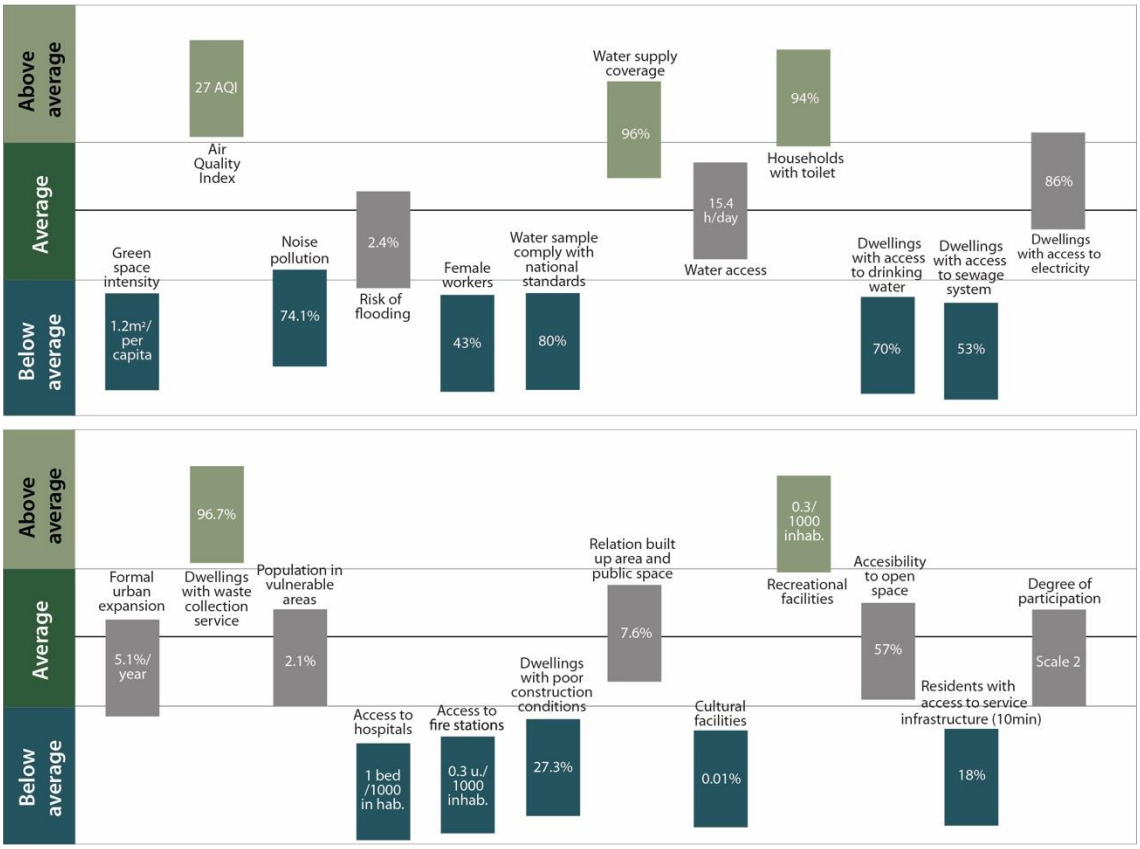

Figure 2. Indicator data of Piura related to benchmarking system.
Source: Authors

A list of 24 indicators assesses different dimensions that relate to a healthy city, including its social, environmental and economic aspects. The analysis reveals that, in Piura, 13 indicators are performing satisfactorily, while 11 indicators are in a critical state and require action. Figure 2 shows the results of this first phase of the work. The photographs of Figure 3 demonstrate the local situation in Piura related to the indicators of formal urban expansion, dwelling with poor construction conditions and population in vulnerable areas.

Figure 3. Photographs of Piura (1) informal urban expansion in the Southwest of the city informal settlement Villa Chulucanas, (2) poor construction conditions in the humane settlement of Las Dalias and (3) vulnerable living conditions in the human settlement of Santa Julia.
Source: Authors

Findings shows that Piura has distinctive strengths and weaknesses in terms of sustainability. As main results, the highest percentage of the population resides in inadequate physical housing and has at least one unmet basic need, highlighting the vulnerability of its resident population. In addition, the city has been growing over the last 10 years, which has been increasing exponentially and will continue this trend. In this sense, as has happened at the national level, the informal urban sector in Piura has been emerging due to the constant urban growth, first carrying out subsistence activities such as the sale of their own crops, handcrafts, etc. According to local information it is estimated that about 70 % of the city's urbanized land is occupied by informal or spontaneous constructions.

Piura has a sanitation coverage of 94 % (INEI, 2017), corresponding to an optimal scenario, as for the classification above. It is worth mentioning that from this percentage, only 66.4 % of the inhabitants are connected to the public sewage network inside their dwelling. In the area of sanitation, access to toilets is a highly relevant indicator for defining part of a healthy city. This parameter represents the percentage of the population with access to toilets. UNICEF and the WHO (2015) define the following benchmarks for this indicator: critical = < 50 %, average = 50 - 90 % and optimal = > 90 %, considering that people have the right of access to a decent sanitation facility. This definition includes the public sewage network inside the dwelling, the public sewage network outside the dwelling but inside the building, the septic tank, the septic tank or biodigester, the latrine and the cesspit.

Another challenging indicator identified is the green space intensity, with 1.3 m^2 per inhabitant. This indicator points out the challenging situation in Piura on this matter, as the city has a very low level compared to the WHO recommendation that establishes a minimum green area of between 10 m^2 to 15 m^2 per inhabitant, distributed proportionally in relation to population density. Many other deficits can be observed in the technical and social infrastructure of the city, access to hospitals or fire stations, adequate access to schools, hospitals, as well the deficit of cultural facilities.

Overall, the indicator analysis shows that Piura has made some important steps towards becoming a sustainable and healthy city, but still has some challenges to address moving towards this goal.

Impact Factors

Within the Fraunhofer Morgenstadt methodology employed by MGI, a sensitivity analysis was conducted that seeks to represent a partial set of variables that affect a complex system such as an entire city. For this analysis, 87 impact factors were identified for Piura, which were evaluated according to their correlation with each other and are represented in an illustration based on Frederic Vester's sensitivity model. This system allows understanding the behavior of the city system as a whole, for which a distinction is made four factor categories. The first one called "drivers" refers to factors with a high influence on other factors but that are independent of other factors. Other factors are the levers that have a high impact in and from other factors. The third category refers to indicator factors that have low influence on other factors but instead are

influenced by other factors. However, these factors are important to consider as they are the ones that shows changes in the systems, so they are mostly used to identify transformation processes. The latter category includes those that do not have a great influence are not influenced and have a low influence in other factors, being therefore consider as inactive or buffer factors. Nevertheless, these are not explained in detail, as they do not have a great impact on urban transformation (Onyango, 2016).

While these factors analyze the city as a system, the following are highlighted as related to the healthy city concept for the city of Piura. Figure 4 demonstrates the model of all three impact categories.

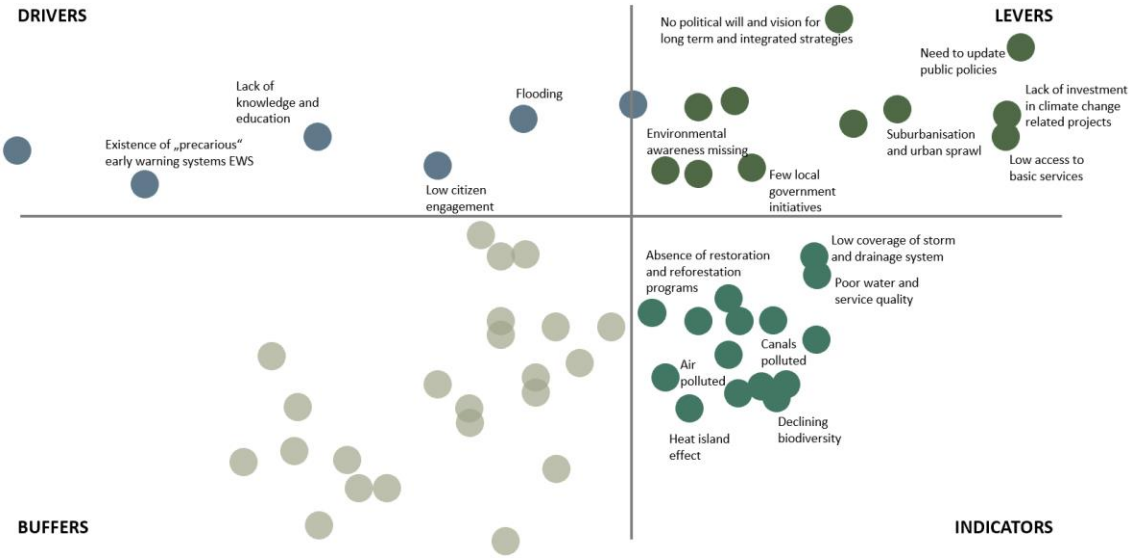

Figure 4. Model of all three impact categories related to the healthy city concept.
Source: Authors

Levers factors: Within the lever factors, they are found in two main thematic areas on urban strategies and accessibility. The first area includes factors related to the strengthening or need for long-term and integrated plans or strategies, need to update of public policies, lack of an environmental commissions, lack of governmental initiatives, lack of investment in climate change adaptation and mitigation projects and lack of environmental awareness. The second area refers to the rapid growth of the city, which has meant an increase in informal housing and self-constructed dwellings, lack of maintenance of public spaces, limited reach of the municipality within the most vulnerable areas and low coverage or access to basic services such as water, electricity and sewage connection as well as inadequate infrastructure for the proper functioning of the city. It is considered essential to work on these two major areas in order to strengthen the transformation towards a healthy city. These factors will become strong for urban development and bring stability for the implementation of long-term and integrated plans and strategies.

Drivers factors: In the case of drivers factors, four main factors are identified, of which two are directly related with the population, and two to the physical characteristics of the city. The first area contemplates lack of knowledge and education, understanding its contribution to people's capacities to solve the problems posed by climate change and urban sprawl. Also, it includes the inequality, poverty, segregation and social exclusion that exist in the city today. The second theme contemplates flooding factors, which multiply urban problems and that although they cannot be stopped, it is possible to work on prevention and adaptation of the city in the same and that must be supported by early warning systems (EWS), which are currently considered precarious due to their lack of precision. Supporting projects and plans into the direction of these drivers factors strengthen the city capacities, especially building upon social sustainability and its geographic conditions that cannot be changed.

Indicator factors: It is in these areas that citizens will recognize that development occurs in the first place and affect the city's quality of life. In relation to the healthy city, the factors of polluted waterways, declining biodiversity together with the absence of restoration and reforestation programs, air pollution, poor solid waste management together with ineffective management of the water and sewerage service provider are identified, poor service and water quality being considered a risk to the health of the population, the existence of unconventional sources of drinking water supply, isolated solutions for storm drainage and the existence of heat islands resulting from the increase in air temperature mainly due to the growing urban sprawl and the scarcity of vegetation. These factors have a strong relationship with the indicators developed in 3.1. However, their condition within the city is considered a factor, as they are influenced by other but highlights changes within the system.

City Projects

One of the biggest challenges when planning a city is to translate the main gaps and vulnerabilities of a city into specific measures, planning strategies and local orientated project ideas.

Project ideas in Piura focus on improvements to prevent settlement in vulnerable areas of the city, better access to basic needs and social infrastructure system, as well as new green areas. Three of the prioritized projects are presented in this paper because of their high potential to create healthy and sustainable cities. Table 1 sums up the relation to the indicators defined and analyzed in an earlier step of this work and that are supposed to be improved by the implementation of the project. In addition, the projects are aligned with the different goals, targets and indicators of the SDGs enabling them to relate and comply with the Agenda 2030 goals for sustainable and healthy cities. Projects are described highlighting the key components of the project ideas, including their objectives, demonstrating how it can influence the urban development of healthy cities in a positive way).

Table 1: Project Ideas Related to SDG Targets and Indicator System Presented in 3.1

Projects	Related UN SDG	Related SDG Target	Related SDG Indicator	Relation to MGI indicators
Decentralized system for sustainable water management	**SDG6:** Clear water and sanitation	**Target 6.1:** By 2030, achieve universal and equitable access to safe and affordable drinking water for all	**Indicator 6.1.1:** Proportion of population using safely managed drinking water services	Dwellings with access to drinking water
				Water access
		Target 6.2: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	**Indicator 6.2.1:** Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water	Households with toilets
		Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	**Indicator 6.3.1:** Proportion of domestic and industrial wastewater flows safely treated	Water sample comply with national standards

		Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	**Indicator 6.4.1:** Change in water-use efficiency over time	***no indicator suitable***
			Indicator 6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	***no indicator suitable***
		Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	**Indicator 6.5.1:** Degree of integrated water resources management	***no indicator suitable***
	SDG3: Good health and well-being	**Target 3.9:** By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	**Indicator 3.9.2:** Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)	Dwellings with access to sewerage system
	SDG9: Industry, innovation and infrastructure	**Target 9.1:** Develop quality, reliable, sustainable and resilient infrastructure, including regional	***no indicator suitable***	***no indicator suitable***

		and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all		
	SDG11: Sustainable cities and communities	**Target 11.1:** By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	**Indicator 11.1.1:** Proportion of urban population living in slums, informal settlements or inadequate housing	***no indicator suitable***
		Target 11.5: By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	I**ndicator 11.5.3:** (a) Damage to critical infrastructure and (b) number of disruptions to basic services, attributed to disasters	Water supply coverage
	SDG13: Climate action	**Target 13.1:** Strengthen resilience and adaptive capacity to climate-related hazards and	***no indicator suitable***	Population in vulnerable areas
				Risk of flooding

		natural disasters in all countries		(drainage system)
Reforestation of urban green corridors – arborizing the city	**SDG11:** Sustainable cities and communities	**Target 11.6:** By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	**Indicator 11.6.2:** Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)	Air quality index
		Target 11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	**Indicator 11.7.1:** Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities	Accessibility to open space
				Green Space Intensity
				Residents with access to service infrastructure (10min)
				Recreational facilities
	SDG3: Good health and well-being	**Target 3.9:** By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	**Indicator 3.9.1:** Mortality rate attributed to household and ambient air pollution	***no indicator suitable***
	SDG13: Climate action	**Target 13.1:** Strengthen resilience and adaptive capacity to climate-related hazards and	***no indicator suitable***	Risk of flooding (drainage system)

		natural disasters in all countries		
		Target 13.2: Integrate climate change measures into national policies, strategies and planning	**Indicator 13.2.2:** Total greenhouse gas emissions per year	Air quality index
	SDG15: Life on land	**Target 15.3:** By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	**Indicator 15.3.1:** Proportion of land that is degraded over total land area	Relation built-up area and public space
		Target 15.9: By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	***no indicator suitable***	***no indicator suitable***
Tactical urbanism, including pocket parks	**SDG11:** Sustainable cities and communities	**Target 11.3:** By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and	**Indicator 11.3.2:** Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically	Degree of participation

		management in all countries		
		Target 11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	**Indicator 11.7.1:** Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities	Accessibility to open space
				Green Space Intensity
				Residents with access to service infrastructure (10min)
				Recreational facilities
	SDG3: Good health and well-being	**Target 3.9:** By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	**Indicator 3.9.1:** Mortality rate attributed to household and ambient air pollution	Air quality index
	SDG5: Gender equality	**Target 5.c:** Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels	**Indicator 5.c.1:** Proportion of countries with systems to track and make public allocations for gender equality and women's empowerment	Female workers
	SDG10: Reduced inequalities	**Target 10.2:** By 2030, empower and promote the social, economic and political inclusion of all,	**Indicator 10.2.1:** Proportion of people living below 50 per cent of median income, by sex,	***no indicator suitable***

		irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	age and persons with disabilities	
	SDG13: Climate action	**Target 13.b:** Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	**Indicator 13.3.1:** Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment	Degree of participation
	SDG17: Partnerships for the goals	**Target 17.16:** Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular	**Indicator 17.17.1:** Amount in United States dollars committed to public-private partnerships for infrastructure	***no indicator suitable***

		developing countries		

Source: Authors

Decentralized System for Sustainable Water Management

As Piura is located in a desert region; natural water sources, both underground and atmospheric (rain), are scarce. Adequate management of water resources is important, as the water management cycle in the city is deficient. This situation is the result of a lack of sustainable planning and the lack of consciousness when using this resource (e.g., using drinking water for irrigating green areas). Thus, the project focuses on the implementation of a decentralized wastewater treatment systems to avoid irresponsible drinking water consumption (i.e., where drinking quality water is not necessary). Moreover, this new decentralized system can secure access for sustainable water management, aiming to motivate the private sector to move towards a circular economy and increase interest in its replication in other areas. In addition, implementing this type of system promotes environmental awareness around using water in a responsible way. This project seeks to improve the sewage system of the city as it has a direct relation to the urban water system. Furthermore, it contributes to the vision of an inclusive city by providing and ensuring access to drinking water, focusing on citizens who don't have access yet. The project direct impacts the SDG6 on clear water and sanitation, however, it is expected that it contributes to better living conditions for its inhabitants (SDG3), improving the existing water infrastructure (SDG9), facilitating access to water for those most in need (SDG10) and supporting sustainable urban development (SDG11) and climate action (SDG14).

Reforestation of Urban Green Corridors – Arborizing the City

Reforesting the city contributes to mitigating urban heat islands - areas with an increase of temperatures as a result of the built environment, enhancing the thermal comfort of microclimates to reduce energy consumption through the shade provided by the planted trees. At the same time, the project focuses on urban corridors, representing an opportunity to promote sustainable mobility (e.g., combined with bike lanes) while contributing to a better air quality. The intervention fosters the potential of Piura´s main streets and the river corridor to increase urban vegetation cover within these areas and become green corridors. Therefore, this project aims to not only improve the quality of the urban infrastructure, but it will contribute to the citizens´ well-being as it improves access to a public recreation space. From the environmental point of view, it introduces native species that are representative of the region or climate adapted ones, greening the corridors, providing shade as a very important element to enhance its use in a desert City like Piura and improving the appearance and attractiveness of the city. The project aims mainly to enhance the sustainable urban development in Piura (SDG11). It also improves thermal comfort (SDG14) and life conditions in the city (SDG3) and support biodiversity and species conservation through green corridors (SDG15).

Tactical Urbanism and Pocket Parks

Through tactical urbanism as a fast, low-cost and scalable approach temporarily changing the urban environment, the project seeks the transformation of the public spaces in Piura, making them more environmentally friendly and pleasing to the population. In this way, with the creation of pocket parks as a small intervention in several areas within the city, the project reinforces the idea of an inclusive and sustainable city with better access to recreation spaces and cultural activities, that can be offered by these new public spaces.

Part of the proposal includes the creation of new job opportunities for the vulnerable; the socially and occupationally excluded population, as they can make use of the space by vending local products or offer gastronomic services. This aspect of the project can strengthen local food markets and access to groceries, supporting the concept of a 15-min city, promoting walking and cycling. The program includes education and training tools around the generation of these kind of interventions, replicating the interventions over time, thus contributing to local development and relying on the talent of the community. Moreover, tactical urbanism includes aspects of public engagement, as it involves the community in decision making and design and use of the space.
The design of these interventions proposes using viable, sustainable, low-cost, flexible construction systems and methods for reusing greywater, since water resources are scarce in the city. Considering all the above, the project aims to provide quality public spaces for everyone starting with one intervention to be replicated in several areas covering the whole city. While the project focuses on creating new green spaces in the city for a more sustainable Piura (SDG11). This new place will improve the life quality of its inhabitants (SDG3), will offer a new public space (SDG10). Partnerships with the neighbors and local businesses around the intervened site will be initiated to use and maintenance of the space (SDG17), fostering activities with productive activities, such as urban gardening, with minority groups and women (SDG5).

Conclusions

People´s health is the result of a large number of inter-related factors that include social, economic, political, physical and environmental aspects. Any deficit in the city can influence the health of the community as a whole. The ultimate goal of both, healthy cities and sustainable development is to provide a framework for the application of a participatory and inclusive process to grant access to basic needs to improve citizens' living standards for all and create a truly healthy community. However, this implies that both neighbors and decision-makers, recognize and work together in processes that favor adequate sustainable urban development. Furthermore, the concept of healthy cities is not new, but it has a potential to support other urban concepts such as smart or resilient cities, combining efforts for a better environment.

The definition of the 17 SDGs has a strong relevance for all governmental levels and are recognized targets to reach prosperous development worldwide. However, cities at local level are the ones with the capacities to have a direct influence climate change adaptation and mitigation by protecting the environment and improving well-being of its inhabitants. Although cities are mostly represented in SDG 11 on sustainable urban and community development, it is important

to work with them for their development at the local level, and to understand that they are not isolated goals, but interlinked and mutually reinforcing. While working with the SDGs, it is considered crucial for local governments and identify indicators to measure the city performance linked to them. The SDG targets and indicators can support them, however, the framework has challenges when referring to local actions, as their focus are still conceived with filling gaps and addressing challenges on a national level. Tools as the Morgenstadt MGI framework focus on solutions that have a bigger impact on the local level. This way, cities can focus their efforts to reduce the gap of the sectors supporting sustainable urban development.

The results presented in this paper include a quantitative and qualitative data-based analysis of the city's challenges and opportunities and action-oriented project ideas. The study thus is looking for opportunities and understanding problems as new challenges, while maintaining a multi-sectoral approach. The proposed solutions combine ecological and resilience objectives with opportunities for social and economic innovation that support the concept of a sustainable and healthy urban development. In this vein, political commitment and intersectoral action are indispensable for the progress and further step for project implementation. Furthermore, connecting the indicators with the proposed solutions highlights more than just their performance and impact in a specific area. They reflect their interdisciplinary nature and relevance to other urban sectors, contributing to a city's environmental, social and economic sustainability.

Situations such as the Covid-19 pandemic or natural disasters as a result of geographic location, climate change, or both, such as the extreme flooding event in Piura due to the, the ENOS (El Niño–Southern Oscillation), force cities to think about strategies to prevent and keep the wellbeing of their citizens. In both cases, planning strategies and actions with an understanding of the urban system performance to bridge the gaps are considered essential. Cities will benefit from measuring and monitoring urban indicators to comprehend the complex urban ecosystem, as well as to better identify which areas to intervene in, thus distributing efforts and available resources more efficiently.

As a next step, the MGI project continues detailing each one of the pilot project ideas and develops a smart financial report to find suitable financial mechanisms and seek for possible funding options and investors. Furthermore, the project will work on the implementation of one pilot project in the city, as part of the initiative considers a brief seed funding for it. The project selected relates to concepts of tactical urbanism, converting one problematic space of the city into a new public area with green areas, vegetation with little water demand and an integrated irrigation system, supporting the healthy city concept. The whole process is accompanied by participatory workshop for sensibilization with the local population living close to the area, schools and neighborhood associations.

Further research includes focusing on healthy cities as a governance transformation process to reach the SDGs, to understand the appliances of the concept within all government levels. This scope could also focus on how these institutions are transforming their way, to conceive planning and designing their urban strategies after the definition of a healthy city concept. Furthermore, new efforts could be oriented around the application of this concept in a city who has to include it

within its urban or metropolitan development plan to validate its performance, the opportunities and challenges when implementing it. Finally, further research to understand how illnesses, or for instance the effects of the Covid-19 pandemic on a healthy city is recommended as a research focus to look into next.

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