Dynamic model for establishing policies of attention to the street dwellers

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Abstract*– The collective well-being as well as the expansion of opportunities for all citizens are two of the most important goals of any society because the guaranteed opportunity for individual and collective growth for all is necessary to guarantee the sustainability of society. However, many countries have a significant number of people who are homeless, figures that get worse amongst others by the crises caused by the Covid-19 pandemic. This proves an unequivocal state of vulnerability and the carelessness on the part of the governments who ignore the magnitude of this social problem. This leads to other problems such as micro-trafficking businesses, insecurity, unhealthiness, increased consumption of psychoactive substances; without counting other intangible issues derived by the little recognition and inequality in which the street dwellers live. What could countries with few economic resources do to mitigate this problem to balancing assistance with strict control, and at the same time privilege prevention. The ARCOSES research group in its line of social problems proposes alternatives through continuous simulation models to ensure social sustainable development, and the proper use of limited resources. For this, it uses its own methodologies for the acquisition and representation of knowledge, finding that before implementing models used in developed countries, a detailed study of the context of street dwellers in each region must be carried out, as well as it was shown that the best strategy to implement in the Colombian case covers simultaneously preventive and corrective politics.

***Keywords*-- Street dwellers, integral attention, prevention, and correction policies.**

I. Introduction

The World Report on Human Settlements prepared by the United Nations (UN) [1], indicates that: "People who sleep outdoors –that is, on the street, in public places or in any other place not intended for human habitation– constitute the nucleus of the 'homeless'". In the definition "it is said of a person without a home, so he usually lives on the street" [2]. The term "street dweller" has different definitions and translations because it varies depending on the language and the context in which it is found, however, they all have in common defining the term as any person who lives in places not suitable for the human life. On the other hand, the UN defines "indigence" or "extreme poverty" as "the situation in which the resources are not available to satisfy at least the basic food needs. In other words, "extremely poor" are considered to be those who reside in households whose income is not enough to purchase a basic food basket, even if they are used entirely for that purpose" [3]. According to the United Nations Development Program (UNDP, indigence is conceived as a form of absolute poverty, defined as lack of people far below a minimum level that severely hinders their subsistence [4]. Homelessness could refer to the absence of opportunities for the development of a decent standard of living. Thus, it can be deduced that all street dwellers are without home, but not everyone without home is a street dweller. This conceptual distinction is an issue that can be dealt with economic policies for the case of homeless, while street dweller must be handle as a social problem [5].

At a global level, different efforts have been developed to reduce the number of street dwellers, all focused in two ways: a preventive one (preventing the high-risk population from becoming street dwellers and studying the factors that cause this problem). And the corrective way, (making the street inhabitant stop having this condition by studying how they live). This can be seen in different articles and studies; In the Melbourne Institute, Australia one, it is shown that the separation of parents in poor households significantly increases the probability that children under 12 years of age will become street dwellers in the future, as it reduces the quality of life of the children and their stability as they grow [6]. This same institute also shows the nature of the relationship between homelessness and substance use, showing that street dwellers are more likely to be SPA users and at the same time, have a high probability of being residents of the streets in the future [7]. At the University of Porto, they developed a corrective study, in which an eco-product is manufactured so that street dwellers who recycle have another source of income through the creation of marketable products; in this way, they achieve a stable economy over time, causing them to leave the condition of street dweller [8].

In Latin America there are several studies focused on the behaviors and consequences of living on the street. In [9] they studied the psychosocial risk suffered by young women between the ages of 11 and 20, as a result, they found factors such as abuse of psychoactive substances, environments of constant sexual danger and criminal activities motivated mostly by social pressure. In the work of [10] who develops his work in the city of Quito-Ecuador, it introduces the variable Habitus, which is the system of structures of past and present experiences and determines the actions of each agent. It is exposed that a street dweller not only enters this environment for economic reasons, but also for sentimental issues or traumas that drive the agent to take refuge in the world of drugs, adapting new strategies to be able to consume, taking a person with a Habitus of family and work, to another of habitability in the street and illicit businesses to obtain drugs. In [11] it is indicated that in Buenos Aires-Argentina, as well as in Latin America in general, large cities are adapted to a neoliberal model, which has generated major changes in the urban management and spatial organization, which has resulted in an increasing existence of private spaces and

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decreasing the public ones. This is something that street dwellers cannot afford; and thus, through the policies implemented by the governments, plus the attitudes that citizens take when observing these policies, they seek to prevent street dwellers from inhabiting public spaces where they could live or sleep. It is pointed out that it is important transforming the perspective, both from the civil population as well as from the administration, so that they do not see street dwellers as an urban problem but recognize they are human beings.

In the case of the city of Bogotá for many years this phenomenon has grown due in part to the generalized violence in the countryside, forcing many families to settle in marginalized sectors of the city where basic services are scarce or non-existent; in addition, the work conditions do not allow them to achieve any improvement. According to [12], street dwellers see the street as their home since they can go from one point to another without any type of restrictions. At the same time, with the intention of appropriating and building themselves on these streets to live with all the freedom. Thus, the phenomenon that occurs in Bogotá is explained; where in a specific place called "La Calle del Cartucho", it became the home of drug addicts, street dwellers and the most deprived of the city confirmed in [13]. All of this created a space of urban and architectural deterioration, violence, and unsafety; this place was intervened in 1998 to build a park, but only a small percentage of its inhabitants were relocated, the rest of them were scattered throughout the city, which allowed the emergence of a new lifestyle for many, because although they did not have with a specific space to live in, they already had possibilities to earn a living through both legal and illegal activities [14]. In 2016, the main new location of these inhabitants called "La Calle del Bronx" was intervened, revealing one of the many realities that citizens did not want to see.

As evidenced in [15], the number of homicides recorded in recent years in Bogotá is alarming, as are the recorded aggressions towards homeless people by the police force. One of the biggest problems revolves around the consumption of psychoactive substances (SPA), 90.4% of this population is an active consumer, with amounts of hundreds of millions of pesos a day that go to the hands of these illegal organizations [16], a generalized situation throughout the world as confirmed by [17]. According to [18], the interconnected causes for someone to decide to live on the street are poverty, abuse (intrafamily violence) and a dysfunctional family; in other words, these reasons are connected and in constant interaction, which is why it can be deduced that when evaluating why someone would leave their home to survive on the street, most of the time it is not a single reason but several reasons that are in constant interaction. For all the above, the rulers, civil society and of course the academy show their interest and make multiple efforts towards the issue. In Colombia for example, the Law 1641 of 2013 was created, to carry out censuses and studies to facilitate the implementation of a public policy that will achieve an effective rehabilitation of the inhabitants of the street, always considering the will that the individual has [19]. Among the variables to be evaluated when looking for the possible causes that lead to people ending up being homeless, the following stand out: Addiction to SPA, economic problems, displacement, family disintegration, intra-family violence, sexual abuse, bad friends, and school exclusion.

II. Material and Methods

Given the complexity of the system under study, the use of the methodology described in [20] is proposed, which is structured and reflected in Figure 1. This methodology is made up of three major stages of knowledge acquisition, knowledge representation and decision making, these are described below...

A. Knowledge Acquisition Stage

In the first phase of this stage, is necessary to define what is the purpose of study, in this case, the phenomenon of street habitability is defined as a problem of interest. Its objective is to study the main problems that cause this condition, and for this purpose, it is intended to develop a model of simulation that allows the representation of the social problem of the population inhabiting the street, and from this, to formulate strategies for its reduction. For this, 105 documents were analyzed, taken as expert sources of knowledge. Of which 44 are referred to the Colombian context, 21 from Latin American environment and the remaining 40 from an international context; it should also be said that another 58 documents were worked on as indirect expert sources. 60% of the sources are from the last 5 years, 75% of the documents refer to studies from the last 10 years and 25% are older documents.

Regarding the description of the problem in an abbreviated way, it can be said that although Colombia is a social state of law, and therefore, it is obliged to serve the community, promote general prosperity and provide guarantees of well-being to all inhabitants [21], it is a country that has a large number of people in conditions of extreme poverty, censuses classified as informal refer to at least 40,000 people in these conditions [22], with Bogotá being the city with approximately a third of those [23] who are in a state of vulnerability and neglect by the state. All this leads to generating a social problem with repercussions on micro-trafficking businesses, insecurity, unhealthiness, increased consumption of PAS (psychoactive substances). It also includes problems of recognition and inequality, which leads to the absence of voting in electoral times and neglect of their basic rights. In short, it can be said that the phenomenon of street habitability is the result of a chain of different problems, revealing the helplessness of the state in the face of situations such as addiction to psychoactive substances, domestic violence, the consequences of the armed conflict, school desertion or the lack of access of young people to quality

education, mental illness, among other causes made invisible by society, but that in any case, are very present in everyone's daily life..

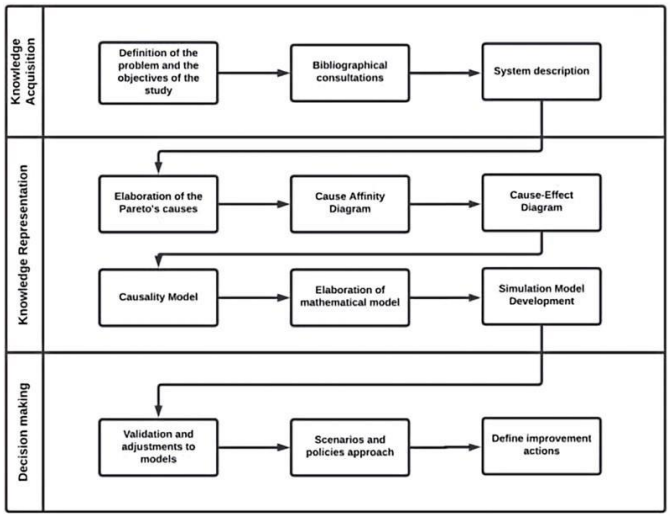

Fig. 1 Methodology used (Taken from the ARCOSES Research Group.

B. Knowledge Representation Stage

Once the study of the direct and indirect sources has been carried out, it can be observed that the causes of family conflicts and the use of psychoactive substances present the accumulated 58.14% of all present causes. A total of fifteen causes are detected, with some degree of representation, that thirteen causes represent 41.86% of the origin of homeless people. When performing an affinity grouping, two major factors are found: biographical (personal) and structural factors. In the former, there are family causes (conflicts, threat of physical risks and sexual abuse) and those of use of psychoactive substances (consumption, bad friends, dropping out of school and recreational), and in the structural factors there are the economic causes (loss of relatives, economic difficulties, job loss, victim of the conflict and displacement or because they have always lived there) and finally other multiple causes that have a 2.5% of participation, see figure 2.

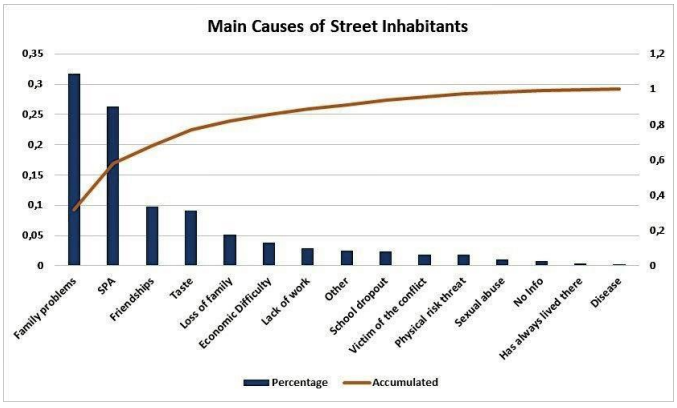

Fig. 2 Pareto Causes.

From this Pareto diagram, a cause-effect diagram was constructed that allowed the creation of the causality model that later gave the basis for the continuous simulation model. This causal model is showed in figure 3. In this, is evident that it is possible to identify the input factors of the system, that is , the causes that feed the entry of homeless people to this condition, among these, the levels of addiction and the difficulty in accessing economic resources or academic and work opportunities, promote the increase of street dwellers.

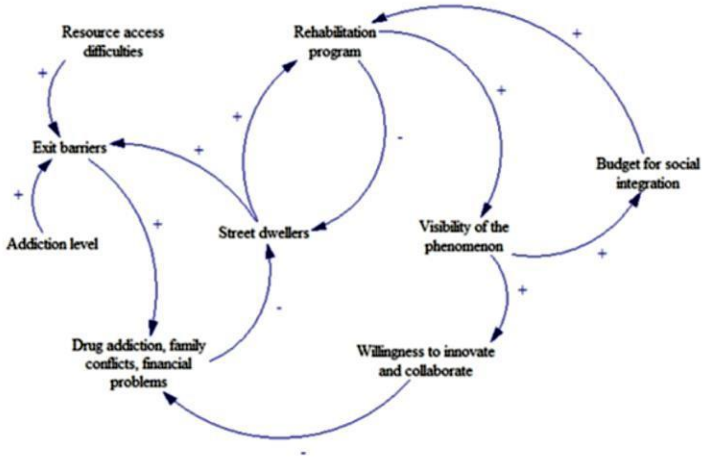

Fig. 3 Causal Diagram.

On the other hand, rehabilitation programs are identified as an exit factor from the system, fueled by the budget allocated for this purpose and the service of entities and individuals from the civilian population willing to help and dignify the lives of this vulnerable population. From the causal model, the simulation model of the system is developed, designing the policies as independent systems that directly affect the exit of homeless people, depending on the scenario that is evaluated. The causal model in figure 3 is developed in the I-Think tool.

Following there are important aspects to keep in mind during the development of the simulation model: 1) The letter N will be used to denote the levels; the letter T represents the rates or flows and the variables by the letter V. 2) The time unit is defined in years. 3) The horizon of the simulation run represents from the year 2001 to 2050. 4) The simulation step selected is equal to one year. 5) The integration method used is the first order Euler. Also important for modeling are aspects such as factors of the causal model as the number of simulated street dwellers, as well as the behavior of the system. All elements to consider in the street dwellers simulation model are represented in figure 4.

- N_Street Inhabitants: Number of street inhabitants in Bogotá.
- F_Increase Hab Calle: Increase and entry into the model of inhabitants of the street.

- F_Decrease Street Inhabitants: Decrease and output of the model of street inhabitants.
- V_HCModule: Variable defined by the previously described equations.
- V_Delay: Variable that will represent the value n-1 of V_HCModule in time.
- V_FcDeyCre: Conditional that will define whether the number of homeless people increases or decreases in a year.
- V_Base Inhabitants: Variable that represents N_Inhabitants Street.

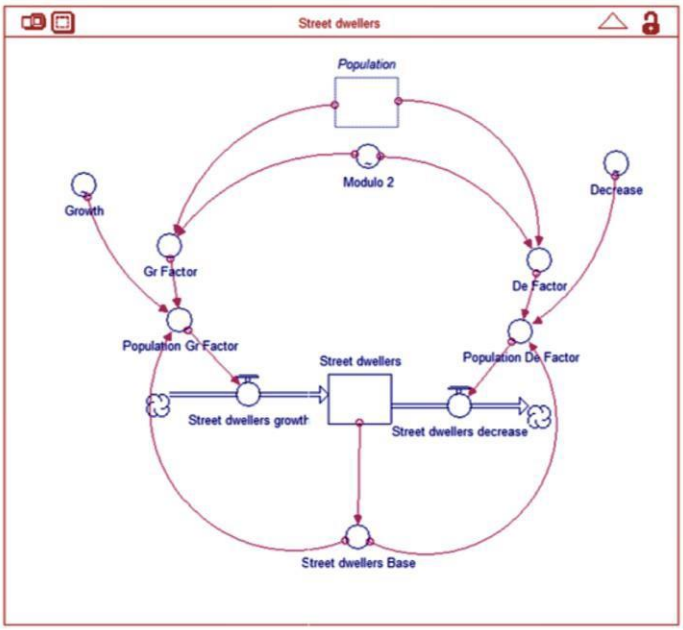

Fig. 4 I-Think model.

C. *Decision Making Stage*

For this stage, the validation of the model must be considered first, for which the demographics of homeless people are taken as a performance measure. From the censuses, the information corresponding to the number of homeless inhabitants in the city of Bogotá is extracted, indicating that the official figures for Bogotá do not have continuous traceability and therefore it is necessary to build a mathematical model for this purpose. Data ranges from the year 2001 to 2017, the information collected is recorded in Table 1.

TABLE I
DATA RECORDED IN THE CENSUS OF HOMELESS PEOPLE IN BOGOTÁ SINCE 2001

Census year	Value of t	No. of street inhabitants
2001	1	10,477
2004	4	8,547
2007	7	8,385
2011	11	9,614
2017	17	9,538

The data is plotted and adjusted to the polynomial regression line with degree 3, as it is the one that fits best, which is evidenced by its coefficient of determination (R^2) with a value of 99.96%. Finally, the regression is performed for the information of the years where there are no registered censuses through the equation, and the number of homeless people is identified from the year 2001 to 2017. See equation 1.

$$y = -5.872x^3 + 175.26x^2 - 1411.1x + 11729 \quad (1)$$

This way, the lost values are calculated, obtaining continuous data from 2001 to 2017, so then it is possible to generate the projection of the data until the year 2050 as follows: The 17 data collected year by year from homeless people in Bogotá are grouped into 3 groups of 7 periods, due to the segmentation of the graph between the periods with a positive slope and the periods with a negative slope, representing the cyclicity of the process. The models (equations 2 to 4) are generated.as well as and the corresponding representation coefficients (R^2) for validation.

$$y = -335.17x + 10270 \quad R^2 = 0.7865 \quad (2)$$
$$y = 271.92x + 8437.8 \quad R^2 = 0.9815 \quad (3)$$
$$y = -435.73x + 10726 \quad R^2 = 0.9474 \quad (4)$$

For the implementation of the different policies in the model, different alternatives are sought worldwide. These alternatives are strategies, projects and movements that have occurred in different parts of the world. The idea is to evaluate the budgets that these measures have set and seek an approximate effectiveness to prevent the growth of the number of homeless people. Two large blocks of strategies are distinguished: the corrective and the preventive policies.

The corrective policies that aim to implement actions to eliminate or minimize the effects of street habitability are Housing First (HF), Critical Time Intervention (CTI) and Continuum of Care (COC). On the other hand, two preventive policies are considered, focused on eliminating or reducing the consequences derived from the factors associated with family, economic and PAS consumption causes: Reconnect (REC) is a policy focused on improving interpersonal relationships and strengthening the family nucleus, while There's a Better Way (BW) seeks to reach homeless people and users at risk of becoming homeless due to economic or social problems or SPA addiction problems. A summary of these policies is presented.

• Housing First (HF) addresses the problem that homelessness is a pervasive social problem, the factors of which differ widely according to the conditions of each country. This model is designed for people who need significant levels of help to get out of homelessness. Some cases of application of the HF are people with mental health problems, problematic drug and/or alcohol consumption, limiting illnesses and disabilities, [24]. HF's strategy involves

providing individuals with rapid assistance in finding and obtaining safe, permanent housing, without the obligation to first demonstrate that they are "housing ready". Users can choose between the location and the type of housing they receive; their choice may be limited by local availability and affordability, in addition to being concerned with meeting basic needs, it supports the recovery of individuals through strategies that allow them to nurture and maintain social, recreational, educational, occupational, and vocational activities, so it is a user-oriented approach that recognizes that individuals are unique, and so are their needs. People must be provided with "a range of treatment and support services that are voluntary, individualized, culturally appropriate and portable. Part of HF's strategy is to help people integrate into their community and this requires a commitment to social support" and the opportunity to participate in meaningful activities.

• Critical time intervention (CTI): This is a method of care for a limited time that seeks to improve and strengthen the support provided to a vulnerable person during a critical period. The objective of the program is to close the gap between the care service and the transition times, creating a network of professional and emotional support for the patient [25], under the hypothesis that people located in shelters would find more sustainable success if they were connected to the long-term support of this network. A group of doctors, researchers, and human rights advocates in 19890 in New York, began to meet to propose possible strategies to provide housing and improve the services provided to the homeless and mentally ill population. It was in this context that the idea of CTI was conceived, as a support method for the individual to remain in their permanent home once their process in transit shelters is over. Since in the transition periods a conventional system, which are more complex and fragmented, it becomes more difficult in implementation and less efficient than CTI.

• Continuum of Care (COC): This is the program created by the US Department of Housing and Urban Development in the mid-1990s to coordinate the distribution of various homeless assistance programs. It was also designed to bring together a broader collection of stakeholders such as public agencies, religious and business communities, and mainstream service providers. On the other hand, COC divides its local programs into urban and rural zones. A complete COC system includes prevention, outreach, and assessment activities to identify housing and service needs at an appropriate level such as: emergency shelter as an immediate and safe alternative, transitional housing to develop skills to maintain permanent housing, and finally, permanent supportive housing, in addition to supportive services in all components [26].

• Reconnect (REC): This strategy has been in operation since 1999 in Australia and is funded by the government. It is an early intervention and prevention program for youth ages, 12 to 21, who are currently or in the immediately future at risk of homelessness, with family conflict, or living or attending school in an area impacted by delinquency [27]. REC identifies people to enter the program and determine different variables as the quality of life, health, recognition, relationships, security, community, future security, level of control of life, support obtained in times of crisis, money that the family must have to meet their needs and the comfort of their homes, among others. Thus, these people are classified as having normal, challenging, or high-risk well-being. Reconnection sites employ a variety of interventions including counseling, group work, mediation, and practical support for both the youth and their family, to help break the cycle of homelessness. The Reconnection system also provides other services to meet individual client needs, such as housing and specialty mental health services.

• There's a Better Way (BW): This program was created in 2015 by mayor of the city of Albuquerque (New Mexico, USA), who launched this program together with the non-profit organization St. Martin's (Hope Works), focused on providing opportunities for change and to dignify the lives of homeless people by offering them a daily job. This specific program worked with the drivers of the Solid Waste Department, in charge of supervising the work sites and providing each worker with their cash payment at the end of their five-hour workday, in addition to providing the necessary tools and equipment for the respective work [28]. This program not only quickly and efficiently helped homeless people interested in working, but also connected them to the St. Martin Hospitality Center to access various services and night shelter. Despite this, 4 years later and due to inconsistencies and lack of controls to help reduce the risk of fraud, the program failed to deliver results with its full potential and ceased to function.

The application of the policies is based on their nature, for example, the policies that were promoted by public entities have a budget established for their implementation. In this way, in some policies a model is carried out based on capacity, determined by the available budget and the percentage of effectiveness, and in others only effectiveness is considered. In the case of policies with budgets, a search is made of how much budget the policy has had from 2001 to 2020 and they are projected for the following years. In case of not finding the official information, the following steps are followed:

1. The conversion to COP is made through the average exchange rate of the year and of the currency in question, data provided by the Banco de la República.
2. Through the information on inflation in Colombia, the value that money would have in each year is calculated.
3. This money is divided over the total number of people served, in this way the money invested in each one is determined.
4. The budget that Bogotá had for homeless people in the respective year is divided on money invested per person. This provides the maximum service capacity that Bogotá would have that year using the respective policy.
5. Finally, this capacity is divided by the number of homeless people in Bogotá for the respective year. In this way, the percentage of attention capacity that the policy would have been determined.

This process is carried out to avoid working with the loss of purchasing power over time of money, since it is a very complicated variable to forecast. On the other hand, the number of homeless people who would like to enter the policy program is considered as another variable of the model. This indicates that if the desire to participate in the proposed programs exceeds Bogotá's attention capacity, only the available capacity will be worked on. Otherwise, it will be worked with the number of inhabitants who want to enter the process.

III. Results

Table 2 presents the results of people to serve according to budget availability for each of the evaluated policies. It is worth noting that the BW policy mainly affects homeless people who enter for economic reasons or for consumption of SPA. This model does not depend on the budget that Bogotá allocates to homeless people, but on the number of jobs per year that it can provide to homeless people. The results can be seen in Figure 5

TABLE II
COVERAGE OF POLICIES

Year	Street Dwellers	Budget thousands USD	People served HF	People served CTI	People served COC	People served REC
2001	10,477	6,707	598	1,844	1,260	763
2002	9,561	4,787	437	1,349	886	548
2003	8,914	4,430	433	1,337	800	541
2004	8,547	5,869	495	1,529	1,041	613
2005	8,320	5,169	367	1,132	888	450
2006	8,303	5,401	373	1,152	897	455
2007	8,385	7,430	428	1,322	1,203	526
2008	8,650	10,361	529	1,632	1,612	656
2009	8,944	10,790	578	1,786	1,677	690
2010	9,271	11,324	523	1,616	1,714	626
2011	9,614	7,089	308	951	1,057	369
2012	9,886	8,330	342	1,055	1,206	406
2013	10,102	8,139	340	1,050	1,159	403
2014	10,211	7,879	343	1,057	1,105	409
2015	10,177	9,811	557	1,720	1,366	673
2016	9,965	8,762	515	1,589	1,211	623
2017	9,538	12,343	672	1,862	1,671	816

To determine if the model meets the initial objective, it imitates the behavior of the system and its characteristics, in each time. Therefore, a comparison will be made between the graphic representation of the real system and the simulated model, waiting to obtain similar results; the coefficient of determination was used for the series of real and simulated data whose results were 99.96% and 86.26%, respectively. The validation is carried out using the *expost* simulation method (prediction of the past) using the historical data obtained from the different sources of information and with experts' opinions. For the validation of the models, the magnitude of the mean relative error (MRE) is calculated, these values are in %. This error which is given by the average of the total relative errors (RE), for each observation i, the magnitude of RE and MRE are given in equations (5) and (6). Table 3 shows the real and simulated values for the time series from 2001 to 2017.

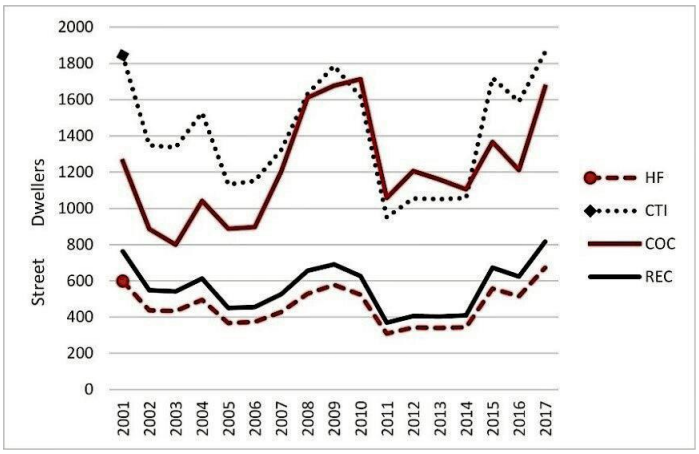

Fig. 5 Coverage of Attention Policies for Street Dwellers.

$$RE_i = 100 \times \frac{|Estimado_i - Real_i|}{Real_i} \quad (5)$$

$$MRE = \frac{\sum_{i=1}^{n} RE_i}{n} \quad (6)$$

TABLE III
DATA FOR BOTH REAL AND SIMULATED STREET DWELLERS

Year	Real value	Simulated Value	RE (%)	Year	Real value	Simulated Value	RE (%)
2001	10,477	10,118	3.4	2010	9,272	9,406	2.6
2002	9,561	9,807	2.8	2011	9,614	9,760	3.5
2003	8,914	9,496	6.8	2012	9,886	10,114	3.6
2004	8,547	9,185	7.6	2013	10,102	10,468	3.2
2005	8,321	8,874	6.7	2014	10,211	10,983	1.8
2006	8,303	8,563	3.2	2015	10,177	10,537	1.8
2007	8,385	8,344	1.6	2016	9,965	10,091	0.2
2008	8,650	8,698	1.4	2017	9,538	9,645	0.2
2009	8,944	9,052	1.9				

From this it is shown that the mean relative error is 3.1%. On the other hand, when obtaining the real and simulated data, it is found that real mean is 9.345 compared to the simulated one of 9.59, and with real variance of 541.13 and simulated one of 556.4. It is sought to contrast them to determine if there are significant differences or not between the parameters of the two samples, and in this way affirm if the simulated model satisfactorily represents the real system. By means of the Fisher-Snedecor F test for the homogeneity of variances, it is possible to check if there are significant differences between the variances of the two groups. The critical values of the statistician for an α=0.05 indicates that the tabulated value is (2 .33) and is greater than the value of F found (1.0282); To identify if there is a significant difference between the means of the two groups, the Student's t-test will be performed. This

tabulated value for an error α=0.05 with 32 degrees of freedom is (2.03), which is greater than the statistic found (0.98). Then, the null hypothesis is not rejected, and it is concluded that there are no significant differences between the number of homeless people, both simulated and real, given by the census data along with estimates ones.

Once the system dynamics model has been designed and validated, the experimentation process begins, that is, to evaluate the behavior of the system through the period between 2025 and 2050, this period was considered to have all the conditions to adopt as well as the different strategies to apply. In addition, different scenarios that affect the selected variables were considered, and consequently, the functioning of the policies towards street dwellers. To propose the scenarios, the following variables were altered in respect to the current model called trend scenario: Variation of the growth rates and variation of the percentage of how many street dwellers of the total of these can be served with the policy and its budget according to each scenario, this is reflected in Table 4.

TABLE IV
VALUES OF THE SCENARIOS CONSIDERED AGAINST THE POPULATION OF STREET DWELLERS

Scenario	% Variation of Street Dwellers	% Variation in attention capacity
Very pessimistic (VP)	20% increase	6% decrease
Pessimistic (P)	10% increase	3% decrease
Trend (T)	None	None
Optimistic (O)	10% decrease	3% increase
Very optimist (VO)	20% decrease	6% increase

The desire variables change for each policy, for example, the percentage of homeless people who wish to enter the policy analyzed. It is worth noting that the values of the trend scenario were taken of the references studies about each policy. Other variation occurs in respect to the rate of success of the policy that again its trend value is given with respect to the studies already carried out. These values are shown in Table 5.

TABLE V
VALUES OF THE SCENARIOS CONSIDERED AGAINST THE EFFECTIVENESS OF THE POLICIES

Politics	Variables	High (H)	Regular (R)	Low (L)
HF	Desire	95%	80%	60%
	Effectiveness	40%	35%	25%
CTI	Desire	30%	24%	20%
	Effectiveness	30%	23%	15%
COC	Desire	35%	30%	25%

The simulation model is executed based on the experimental design in Table 5 and with several runs equal to 15 times and showing the different scenarios to facilitate the decision-making process. The coverage results of each of these show accumulated values of street dwellers in a period between 2023 and 2043 and the totality of inhabitants treated in each of the policies and their variations according to the proposed scenarios, these results are shown in Table 6.

TABLE VI
RESULTS IN THE COVERAGE OF STREET DWELLERS FOR EACH POLICY

Run	Scenario / Effectiveness	Population 2023 to 2043	Served HF	Served CTI	Served COC	Served REC	Served BW
1	VO – H	260,480	11,905	28,219	27,597	20,183	13,542
2	O – H	239,232	12,170	28,667	28,017	20,184	13,978
3	T – H	217,984	12,434	29,093	28,414	19,899	14,406
4	P – H	196,736	12,683	29,435	28,803	19,764	14,846
5	VP – H	175,488	12,934	29,746	29,189	19,621	15,275
6	VO – R	260,480	10,744	22,681	22,054	14,029	16,935
7	O – R	239,232	10,950	22,921	22,248	13,859	17,467
8	T – R	217,984	11,154	23,143	22,431	13,681	18,008
9	P – R	196,736	11,349	23,347	22,603	13,494	18,550
10	VP – R	175,488	11,541	23,544	22,764	13,308	19,088
11	VO – L	260,480	10,214	18,931	19,917	11,678	17,378
12	O – L	239,232	10,399	19,054	20,025	11,500	16,907
13	T – L	217,984	10,573	19,166	20,138	11,315	16,315
14	P – L	196,736	10,748	19,268	20,232	11,153	15,634
15	VP – L	175,488	10,910	19,360	20,327	11,020	14,951

Likewise, the results are shown in Figure 6 in each selected scenario. These values also refer to the aggregate amount of street dwellers who are served both in each policy as in each of the proposed scenarios.

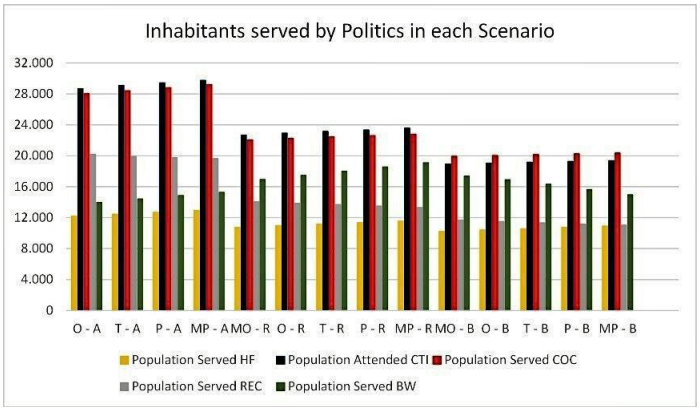

Fig. 6 Coverage of the Attention Policies for Street Dwellers from 2023 to 2043.

IV. DISCUSSION

Next, the results of the proposed experimental design process are analyzed. These scenarios seek to show the variations in the system in the face of changes in the population of street dwellers. In each scenario, the changes in the variables described in the previous section are evaluated.

In each of the scenarios, it is verified that the policy reacts to the data obtained in each context, that is, it behaves similarly to the city in which it was implemented. It is observed that HF, having so little capacity, ends up somewhat softening the first two high peaks of homeless inhabitants, but with a higher-than-expected growth trend. While REC and BW share negative results in the first years, since it is a preventive policy, then it does not act directly on current homeless people. Although REC does not have the best results

at the end of the run, the fact that its slope is increasing stands out, contrary to what happens with BW, which has better results and shares a decreasing slope. On the other hand, CTI and COC are the ones with the best results. CTI has the best start keeping the data the same as expected, through the years it always has a better performance than COC, except in the last years in which it seems that both achieve the same results.

Thus, the best policy in this case is CTI, since, although COC has a greater desire and effectiveness, the greater capacity of CTI achieves better results. Preventive policies obtain worse results during the first 10 periods considered as the time necessary for the heating of the system. From there, they achieve a constant and almost linear decrease in the number of inhabitants, allowing REC to achieve the lowest value of street dwellers in all the runs (approx. 7,600), and just achieve it in what would be the period with a higher number of homeless people.

TABLE VII
RESULTS IN THE COVERAGE OF STREET DWELLERS FOR EACH NEW POLICY

Run	Scenario / Effectiveness	Population 2023 to 2043	Population Served	Run	Scenario / Effectiveness
1	MO - A	260,480	19,437	91,241	121,608
2	O - A	239,232	19,144	88,057	119,751
3	T - A	217,984	18,833	84,855	117,790
4	P – A	196,736	18,531	81,751	115,879
5	MP - A	175,488	18,235	78,527	114,014
6	MO - R	260,480	11,671	52,770	71,723
7	O - R	239,232	11,280	48,378	69,313
8	T - R	217,984	10,894	43,958	66,912
9	P - R	196,736	10,509	39,240	64,524
10	MP - R	175,488	10,127	34,531	62,162
11	MO - B	260,480	6,205	12,924	37,965
12	O - B	239,232	5,961	18,981	36,407
13	T - B	217,984	5,730	6,129	35,008
14	P - B	196,736	5,549	4,523	33,934
15	MP - B	175,488	5,446	33,402	33,934

Observing the results obtained in the application of the different scenarios, it is possible to propose new policies, which consist of simultaneously applying both preventive policies such as BW and corrective policies, for example, the case of CTI. These combined policies yielded the best results in the scenarios already proposed. The summary of the values obtained is shown in Table 7 and Figure 7.

First, a new model must be developed which combines the two policies and allows them to work simultaneously. To do this, it is necessary to find the new year-to-year capacity that CTI would have in order to apply it to the model, since this is an annual variable capacity (depending on the budget available to Bogotá each year); meanwhile BW is a program that has a fixed cost. This capacity is found by evaluating the budget and the desire to belong to policies, but the number of homeless people who can be served during that year is considered. It is calculated based on the corresponding Bogotá budget, less the fixed cost that is worth the application of BW. The model treats these programs as mutually exclusive, whereby an inhabitant who is in CTI cannot participate in BW and vice versa.

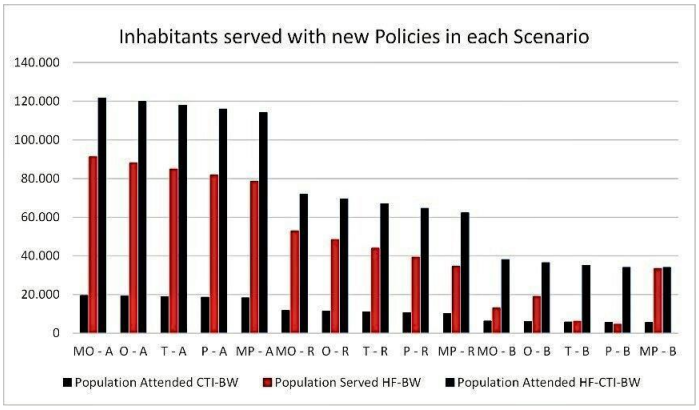

Fig. 7 Coverage of the new Attention Policies for Street Dwellers from 2023 to 2043.

The results provided by the model have similar behaviors between each application scenario. That is, the behavior of policies in the realistic (trend), pessimistic and optimistic scenarios are similar in any of the scenarios already presented. This policy provides a unique result among all of them, since, in a pessimistic application, whatever the scenario, as shown in Figure 7, the first eight periods of time, BW+CTI has similar results to the simulated value. And after this moment, it achieves a decreasing behavior in all cases, better results than the simulated one and much better results than any other policy. In addition to this, if the trend line of the simulated model is increasing, the policy makes it decrease, and if it is decreasing, it continues with this trend.

V. CONCLUSIONS

To achieve the success of the policy there must be a balance between the capacity, the desire and the effectiveness of the policy to be applied. This means that the less capacity there is for the application of the policy, it must have a higher effectiveness so that it also achieves results that reduce the number of street dwellers people. If the desire to participate in the programs is higher than the attention capacity, then it must be large enough to be able to offer its services to a large part of the homeless who want to access them.

On the other hand, if the desire is less than the capacity, it is advisable to develop campaigns that publicize all the benefits of the programs, that generate strategies to persuade and have a greater approach to this population, identifying the needs of each person and the reasons why they are not interested in the programs. Therefore, unproductive resources are mitigated, and the budget allocated for this purpose is used to the maximum.

An example of the results of the imbalance between the three variables mentioned is evident in the HF policy. The HF corrective policy requires a high budget in its application, despite having the greatest effectiveness and desire, so its results are not the desired ones due to the low capacity that

Bogotá has for its application. On the other hand, policies such as CTI and COC that do not have a high effectiveness, have a greater attention capacity, thus achieving the best results in their execution against the proposed scenarios. In other words, the program that can generate the best results in the city of Bogotá must prioritize attention capacity.

Before implementing programs to reduce the number of street dwellers in Bogotá, a detailed study of the context of the system must be carried out to achieve a correct application, since otherwise the results would give an increase in the population of homeless people, and an undesirable loss of budget.

Lastly, the simultaneous implementation of preventive and corrective programs, which fall within the allocated budget, makes it possible to mitigate the source of the problem, reducing the increase in the population due to new admissions to life on the street. While, on the other hand, citizens who participate in a corrective program are reintegrated into social life, reducing the number of street dwellers in the short and long term.cc

SUGGESTIONS

It is vitally important that censuses of homeless people are carried out regularly and collect detailed information, not only about their life on the street, but also information about the programs they have attended, the duration of permanency in each one of them, the reasons why they stopped participating. All of that allows a robust analysis of the strategies that are implemented. This recommendation arises as a result of the bibliographical consultation developed in the present investigation, since no official information was found on the number of served people per year, nor on the number of people who decide to return to life on the street. In addition, there is a six-year gap between the census that was published in 2011 and the last census of 2017, for which regressions were used to estimated street dwellers in this time.

Although it is true that the people who live on the streets make up a population characterized by its diversity, so it is important that these variables are considered to channel actions and adjust the programs that are decided to be implemented. In addition to the programs that are implemented, it is recommended to unify Information and Communication Technologies to the strategies for reducing street dwellers, in order to update information in databases in real time, identify critical sectors where this population is concentrated, denounce acts of human rights violations, and involve the civilian population in the problem, recruiting volunteers and promoting spaces for dialogue and education on the subject, seeking to reduce acts of discrimination.

Finally, it is recommended to implement controls and follow-up activities to the policies, mainly if the service is outsourced, in order to reduce mismanagement, corrupt activities or simply keep an updated record of the services provided to the homeless population.

REFERENCES

[1] Hábitat, O. N. U. (2011). del Programa de las Naciones Unidas para los Asentamientos Humanos. Economía, 3(348), 6.

[2] J Nieto, C., & H Koller, S. (2015). Definiciones de habitante de calle y de niño, niña y adolescente en situación de calle: Diferencias y yuxtaposiciones. Acta de investigación psicológica, 5(3), 2162-2181.

[3] Jacobsson, J. (2019). United Nations Development Programme (UNDP) and UN Conference on Trade and Development (UNCTAD). In Research Handbook on the European Union and International Organizations. Edward Elgar Publishing.

[4] PNUD, P. D. (2019). Programa de las Naciones Unidas para el Desarrollo. Recuperado el, 18.

[5] Silva, L. M., Aristizábal, A. I., Gómez, M. C., González, Y., Acevedo, C. M., Ortiz, Y., ... & Campo, N. M. (2018). Reconstrucción de experiencias y percepciones propias de jóvenes habitantes de calle. Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud, 16(2), 809-823.

[6] McVicar, D., Moschion, J., & van Ours, J. C. (2019). Early illicit drug use and the age of onset of homelessness. Journal of the Royal Statistical Society: Series A (Statistics in Society), 182(1), 345-372.

[7] McVicar, D., Moschion, J., & Van Ours, J. C. (2015). From substance use to homelessness or vice versa? Social Science & Medicine, 136, 89-98.

[8] Carriço, D., & Rangel, B. (2015, June). Designing for the homeless in the Product and Industrial Master at FEUP. In 2015 Conference on Raising Awareness for the Societal and Environmental Role of Engineering and (Re) Training Engineers for Participatory Design (Engineering4Society) (pp. 72-75). IEEE.

[9] Castaños-Cervantes, S., & Vélez-Agosto, N. M. (2018). Psychosocial risk behaviors in Mexican young women experiencing homelessness. Children and Youth Services Review, 95, 235-242.

[10]Álvarez, W. A. Á. (2018). Una etnografía sobre consumidores consumados, habitus y trayectorias de uso y abuso de pasta base de cocaína en Ecuador. Revista Colombiana de Sociología, 41(1Supl), 165-187.

[11]Cecilia-Rosa, P. (2018). Exclusiones del espacio público de los habitantes de la calle en la ciudad de Buenos Aires. Territorios, (39), 157-173.

[12]Cifuentes Avellaneda, A. M. Se muere en el Cartucho pero se nace en la L (Bronx). Un estudio sobre los significados de la calle y la olla en los habitantes de calle de Bogotá. Sociología.

[13]Garavito Rojas, P. A. (2017). Estudio comparado de la relación entre la inclusión social de los habitantes de calle en Bogotá y la implementación de la política pública de hogares de paso en los gobiernos de Samuel Moreno y Gustavo Petro (Doctoral dissertation, Universidad del Rosario).

[14]Soacha, B. Y. (s. f.). IV CENSO SECTORIAL HABITANTES DE LA CALLE. Gov.co. Recuperado 12 de agosto de 2021, de https://www.idipron.gov.co/sites/default/files/repositorio/docs_conocimiento/2004-IDIPRON-IV-Censo-Habitantes-de-Calle.pdf

[15]Los Nunca Nadie: Informe Sobre la Situación de Derechos Humanos de Habitantes de Calle En Colombia. (s. f.). Issuu.com. Recuperado 12 de agosto de 2021, de https://issuu.com/temblores/docs/los_nunca_nadie_informe_sobre_la_s/38

[16]Aguilá, A. B. (2016). El consumo de drogas entre adolescentes: Prevención en la escuela y en la familia (Vol. 207). Narcea Ediciones.

[17]Tyler, K. A., & Melander, L. A. (2015). Child abuse, street victimization, and substance use among homeless young adults. Youth & Society, 47(4), 502-519.

[18]Reza, M. H. (2016). Poverty, violence, and family disorganization: Three "Hydras" and their role in children's street movement in Bangladesh. Child abuse & neglect, 55, 62-72.

[19]Escalante Herrera, S. D. P. La exclusión y garantías al Ciudadano habitante de calle en Bogotá desde una visión normativa y social. Departamento de Derecho.

[20]Méndez, G. A., Fajardo, R., Peña, S. C., & Carantón, M. F. (2017). Asignación de recursos del Sistema General de Regalías, un análisis desde la perspectiva de la Dinámica de Sistemas. I+ D REVISTA DE INVESTIGACIONES, 9(1), 93-106.

[21]Coley Jaraba, M. A. Análisis de la política pública para el habitante de calle en la ciudad de Medellín con el fin de mitigar la problemática asociada a la limosna en esta ciudad.

[22]Panorama de los habitantes de calle en Bogotá. (s. f.). El Tiempo. https://www.eltiempo.com/bogota/cifras-habitantes-de-la-calle-bogota-207590
[23]Díaz, I. D. O. (2018). Habitantes de calle, una visión global para un problema local. El Espectador.
[24]Tsemberis, S. J. (2014). Housing First: The Pathways Model to End Homelessness for People with Mental Illness and Addiction Manual. January 2011.
[25]Valencia E, Susser E, Torres J, Felix A, C. S. (1997). Critical Time intervention for homeless mentally ill individuals in transition from shelter to community living. Breakey W, Thompson J (Ed). Mentally Ill and Homeless: Special Programs for Special Needs. Amsterdam, The Netherlands: Harwood Academic Publisher, 75-94.
[26]Burt, M. R., & Greenwalt, K. (2002). Evaluation of Continuums of Care For Homeless People: Final Report. Development.http://www.huduser.org/publications/pdf/continuums_of_care.pdf
[27]Community Grants (2018). Reconnect Grant Opportunity. Hub. https://www.communitygrants.gov.au/grants/reconnect-grant-opportunity
[28]Bramlett, K. (2019). Report of Investigation and Review, HopeWorks: Better Way Program. Office of Inspector General. https://www.krqe.com/news/albuquerque-metro/inspector- general-better-way-program-not-reaching-full-potential/.