DESIGN STRATEGIES TO REDUCE VULNERABILITIES IN THE EXTREMELY VULNERABLE COMMUNITIES OF CIUDAD JUÁREZ, MÉXICO

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ABSTRACT
Ciudad Juárez is a municipality in the Mexican state of Chihuahua which, with the U.S. city of El Paso, forms the second largest transborder agglomeration on the Mexico–U.S. border. A bloody war between cartels in the years 2007–2011 is among the main causes of important socio–environmental conflicts in the city. Although violence has declined sharply in recent years, these socio–environmental conflicts, aggravated by the current social, political, environmental and health crises, continue to afflict the population of Ciudad Juárez. Aware that civil associations are among the most important actors for the reduction of socio–environmental conflicts that arise in conditions of extreme vulnerability, the Vulnerable SocioEcotones research project has studied the needs for urban–architectural interventions highlighted by civil associations active in the vulnerable communities of Ciudad Juárez. Two different conditions were studied and compared: (1) urban–architectural interventions that civil associations are actually promoting; and (2) desires that civil associations would make to builders and designers in the hypothetical condition of being able to count with high economic resources. The results showed that the most requested interventions are those that allow individuals to appropriate public spaces to create a sense of belonging to the local community to which they belong. Furthermore, it emerges that the gap between implemented interventions and desired interventions remains wide, showing a structural powerlessness of the associations to be able to effectively affect reality as they could potentially do.
Keywords: ecotones; urban vulnerabilities; non-governmental organizations; urban design; social innovation.

1 INTRODUCTION
This paper presents a research, developed within the Vulnerable SocioEcotones project which aims to investigate future challenges for designers, when working in contexts of social and environmental vulnerabilities. Vulnerable SocioEcotones focuses on the geographic area of Ciudad Juárez–El Paso, which is the second largest transborder agglomeration along the Mexico–U.S. border. This area shows alarming levels of vulnerabilities which have been increasing more and more in the last decades and are projecting dark shadows on the sustainable future of the Mexican city. Moreover, the metropolitan area of Ciudad Juárez–El Paso generates several "ecotones", which are areas of transition between different ecological systems: the urban development expanded as a leopard spot in a natural area where the desert and the fourth longest river in the U.S. (Rio Grande river) meet, originating a fertile plain. Even the agricultural areas were gradually incorporated by a non-continuous urban growth. This created an archipelago of agricultural fields that continue to exist in the city to this day. Consequently, the distances within the city have increased, making it more difficult to travel by public transport, aggravating an already problematic situation of widespread vulnerability [1]. In this urban landscape, in which the actions of public actors are limited by a scarce availability of resources, it is of significant importance to understand how the civil organizations can find an ally in the urban–architectural design field, so as to facilitate its socio–environmental initiatives.

1.1 The concept of urban ecotones

An "ecotone" refers to the transitional area between two or more distinct communities, most commonly regarding ecological areas. The term indicates a place where these meet, having them either separated by a keen boundary line or having them merge gradually [2]. This concept was first introduced in the early 20th century, describing the edge between two ecological systems which disappear in a transition zone but in opposite directions [3]. Today, the existence of this phenomena can be witnessed encompassing most political borders around the world.

Borders are both breaks and junctures [3]. When boundaries are imposed and act as more than what they physically are, the touching regions are affected by the strident establishment of distinction and limitations. The areas throughout border zones suffer notorious transformations, both spatial and social. These changes can be generally attributed to migration, conflict and neglect. Such urban settings, overseeing diasporas and invasions all at once, provoke social vulnerability. Ecotones cause the redefinition of statuses and the recomposition of identities, therefore generating said vulnerability, turning these areas into: sociotones. Moreover, the relation between ecotones and social dimensions has already been highlighted by several researchers [4].

1.2 Ciudad Juárez, México

Ciudad Juárez is a Mexican city located in the border state of Chihuahua, in a large valley on the banks of Rio Bravo and just south of its neighbouring U.S. city, El Paso, Texas. Centred in these two large cities sits the transitional area between Mexico and the U.S., known as "Paso del Norte" (Fig. 1). The result of the conjunction of the two municipalities is the 2nd largest conurbation on the United States–Mexico border. As part of the Chihuahuan desert, this arid and extreme region has endured not only environmental and geographical hazards, but severe social complications as well, mainly as a consequence of organized crime and political disputes springing from Mexico and, too, as a result of the binational region that besets conflict between two distinctive nations (Fig. 2).

Figure 1:   Map of the Ciudad Juárez–El Paso geographical area (blue is Rio Grande and red U.S.A territory).

Figure 2: Aerial view of the Ciudad Juárez–El Paso border.

The Mexican border cities experienced a sustained growth from the fifties until well into the twentieth century. The cities of the northern border, especially Ciudad Juárez, received significant investments towards the manufacturing sector, due to their strategic locations in regards to commerce. This situation stimulated economic activities, as is the case of the boom in the maquiladora industry in all Mexican border states, causing an increase in the region's migration, for the most part because these cities served as commercial and transportation nodes. For that reason, Ciudad Juárez was subject to a rapid population and urban growth which, thereupon, generated a pattern of urbanization that presented a dire infrastructure deficit, mainly in the urban periphery [5]. As a consequence of both this deficiency and the unattended deterioration of the existing infrastructure, social vulnerability is and has been an alarming concern the population of Ciudad Juárez faces, placing them at social risk and exposing them to substantial inequalities.

1.3 Social and environmental conflicts in contemporary cities and the role of organizations

Contemporary society is facing important challenges that have never been encountered before. The main scenario for these challenges are the cities and territories in which we live. Destructive environmental changes require approaching the territory with a new stratagem, based on the principles of adaptation, mitigation and resilience [6]. In addition to climate change, human activities are the cause of increasingly polluted territories, contrasted by the "urban health" approach that is being exposed as necessary to an increasing extent [7]. The risk is that contemporary cities do not know how to change the direction of development that once created them and that it maintains an anachronistic destruction of the environment. At the same time, the social environment is also seriously endangered by a pushed individualism and by a political system that is critically unable to offer adequate and timely responses to new challenges [8]. The cultural, social, economic, political and economic crises, in fact,

have shown how the territorial government and contemporary cities are not – in most cases – adequately structured to give appropriate answers and safeguard the well-being of people. This is even more true in so-called *vulnerable communities*, that is, in those contexts in which some limitations (political, economic, technological, environmental, etc.) threaten the capacity to react to sudden changes.

In these contexts, the ineffectiveness of political responses, which often cannot or do not want to intervene effectively in these realities, is contrasted by the work of civil organizations and volunteers who offer platforms to create opportunities for civil participation and community empowerment. These actions represent an innovative way in managing social phenomena in a city, so that referring to the work of these organizations, we can speak of social innovation [9]. These innovative initiatives, which are directed both towards social and environmental issues, have the main purpose of reducing socio–environmental conflicts in a city. It is therefore true that the environmental, economic and social systems of a territory (1) create those conditions of social and environmental vulnerability that contribute to generating socio–environmental conflicts; and (2) participate in generating, thanks to civil organizations, social initiatives that aim to reduce socio–environmental conflicts. In this context (Fig. 3) it appears evident how the contribution of the architectural discipline can contribute to reducing socio–environmental conflicts and contemporary urban challenges, generating urban–architectural solutions capable of intervening in the two directions of (1) reducing social vulnerabilities and environmental issues in a territory; and (2) allowing social initiatives to have a greater impact on cities.
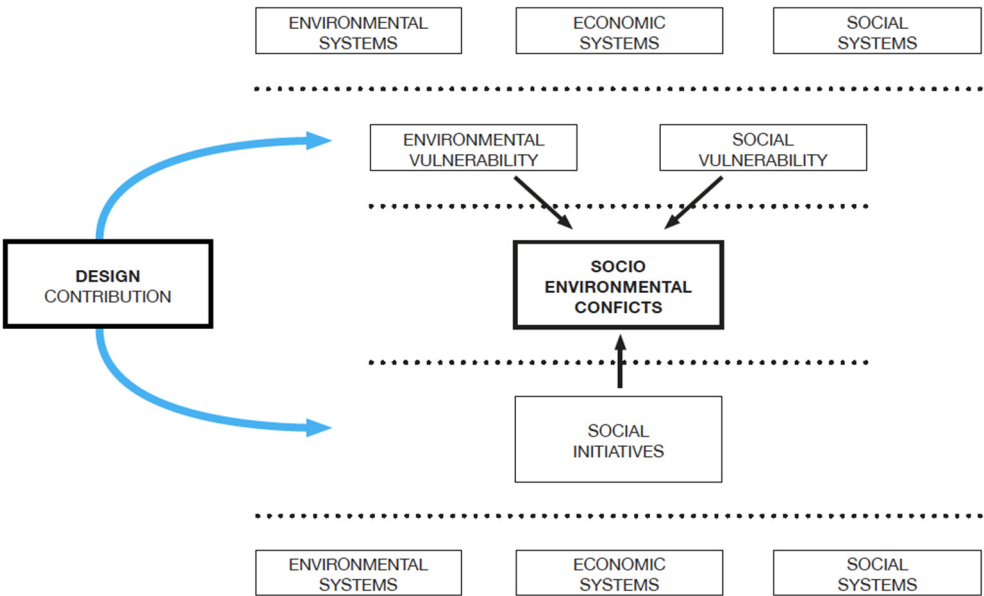

Figure 3:   Scheme of the design contribution in reducing socio–environmental conflicts in contemporary cities.

1.4 Designing urban–architectural interventions to improve the organizations' impact

Since the economic resources are often scarce, while the impact of these organizations' work is extremely high, it would be appropriate to understand how urban–architectural practice can intervene more effectively in our territories, so to enhance the organizations' impact and help reduce socio–environmental conflicts. The research presented in this article has studied the needs for urban–architectural interventions the civil organizations active in Ciudad Juárez highlight. Two different conditions were studied and compared: (1) urban–architectural interventions that civil organizations are currently promoting; and (2) actions that civil organizations would carry out with builders and designers in the hypothetical scenario of having sufficient funding to conduct the desired projects. The research instrument applied for this paper was a survey conducted by researchers from the School of Architecture, Art and Design of Tecnológico de Monterrey. It was handled as an online survey among the non-governmental organizations and other nonprofits from Ciudad Juárez.

2 MATERIALS AND METHOD

To answer this research question, the authors decided to submit a questionnaire to various civil organizations, so as to receive opinions about the state of vulnerability Ciudad Juárez is in and about the urban–architectural interventions that should be made in order to help reduce said problem. The method chosen for data collection for correlational research was a survey questionnaire. The choice of the survey by means of a questionnaire is because this research method, perhaps the most popular for the correlational research design, enables the researchers to gather an extensive amount of information [10]. Therefore, to carry out this activity: (1) a questionnaire was structured; and (2) the organizations were contacted to be invited to take part in the activity.

2.1 Survey design

In the design of the survey questionnaire, the main objectives and themes to be covered were defined primarily. A first series of questions concerned the characteristics of both the organizations and their work, while a second series of questions concerned the identification of the problems that cause social vulnerability in Ciudad Juárez. A final series of questions concerned the urban–architectural interventions to be made as an effort to improve such state, both feasible and desired. The questionnaire had four main sections, requesting information about:

Section I
Organization's features: Referring to baseline characteristics of the participants (name, focus, antiquity, reach and work area). These questions had the goal of classifying the organizations based on the mentioned features.

Section II
Organization's vision on Ciudad Juárez: In reference to the recognition of the most relevant problems that cause vulnerability in Ciudad Juárez.

Section III
Feasible interventions: Referring to the urban–architectural interventions that have been, are being or are planned to be carried out sometime during the present year in order to contribute or boost the efforts being made to help reduce the state of vulnerability.

Section IV

Desired interventions: Specifying the urban–architectural interventions that, if the necessary funding was provided, would be carried out by the civil organizations.

Subsequently, the response formats were defined, following these precautions: use of short and positive sentences (avoiding "not", "never", etc), using concepts that would be effortlessly understood and enabling the selection of certain possible answers to narrow them down. Only the first section of the questionnaire, regarding baseline characteristics, allows the entering of short text answers. Thus, in order to classify the associations based on their main focus and field, the succeeding questions provided only the selection of fixed answers. Again, this was applied in the following section concerning the identification of social issues in Ciudad Juárez, allowing the respondents to indicate the significance they believe each one of them has over the community. In the case of responses for the next two sections, specific urban–architectural interventions were given for the purpose of having the associations indicate which ones applied to the provided statements on a scale from 0 to 5.

The order of the questions was also organized, so as to follow the main themes previously defined and to display the easier questions at the beginning. Finally, the authors wrote a short presentation of the research and its objectives and invited participants to respond only and exclusively if they consented to participate in the research.

2.2 Survey

The authors sent the following questionnaire, resulting from the design described above, to the civil organizations previously mentioned. The questionnaire was created on the Google Forms online platform (www.docs.google.com/forms) (accessed in April 2022) and consisted of 13 questions, having open answers for the first few and closed answers for the rest of them. Out of the 13 questions, nine were considered for the purpose of this research, which are proposed below.

Baseline characteristics

1. Name of the organization

   Open question.

2. Towards whom or what is the mission of the organization directed to?

   Select from: Addiction; adolescents; third age adults; water; animals; support to the community; culture; child development; disabilities and illnesses; environment; education; family; migrants; children; protection and defense of human rights; shelter; health and wellness; violence.

3. Please indicate the number of the area belonging to the scope and/or work area of the organization.

   Select from: 1; 2; 3; 4; 5; 6.

4. What type of funding does the organization receive?

   Select from: Governmental support; donations; private funding; sponsorships.

Organization's vision on Ciudad Juárez

5. Which problems does the organization identify in Ciudad Juárez?

Select from: Murders and femicides; corruption; disorderly and scattered growth; deficiencies in health services; deficiencies in public services; distrust in government bodies and institutions; unemployment; discrimination; drug addiction; lack of education; lack of infrastructure; lack of environmental sustainability; insecurity in the streets and public areas; child abuse; migration; poverty; housing lag; droughts and an unstable climate; violence.

6. How relevant does the organization consider the previously mentioned problems?

Linear scale: 0 = Not relevant; 1 = Possibly relevant; 2 = Relevant; 3 = Somewhat relevant 4 = Quite relevant; 5 = Highly relevant.

7. For which of the previously mentioned problems has the organization. made efforts to help solve?

Select from: Murders and femicides; corruption; disorderly and scattered growth; deficiencies in health services; deficiencies in public services; distrust in government bodies and institutions; unemployment; discrimination; drug addiction; lack of education; lack of infrastructure; lack of environmental sustainability; insecurity in the streets and public areas; child abuse; migration; poverty; housing lag; droughts and an unstable climate; violence.

Feasible interventions

8. Which projects has the organization carried out in the past or plans on carrying them out during the present year?

Select from: Has been carried out in the past; is currently being carried out; it plans on being carried out in the future; has not been considered; it will surely not be carried out.

Fixed answers: Office construction for the organization; generation of public spaces; generation of workshop facilities; implementation of sustainable strategies; intervention in abandoned building; intervention in private spaces and housing; cleaning of public spaces; pedestrianization and intervention in streets; tree plantation; restoring of public spaces; restoring of parks and green areas; remodeling of the offices and/or facilities of the organization.

Desired interventions

9. If the organization had the necessary funding to carry out the previously mentioned projects and interventions, what priority would it give to each one of them?

Linear scale: 0 = None; 1 = Very low priority; 2 = Low priority; 3 = Medium priority; 4 = High priority; 5 = Top priority.

Fixed answers: Office construction for the organization; generation of public spaces; generation of workshop facilities; implementation of sustainable strategies; intervention in abandoned building; intervention in private spaces and housing; cleaning of public spaces; pedestrianization and intervention in streets; tree plantation; restoration of public spaces; restoration of parks and green areas; remodel of the offices and/or facilities of the organization.

Questionnaire surveys were conducted in April 2022.

2.3 Directorio de Asociaciones de Ciudad Juárez

This research contains civil organizations as a significant part of social improvement and innovation. Though the field in which they focus on may differ greatly from one and other, they all seek social change and improvement on social grounds. Civil organizations have the capacity to meet the needs of a vulnerable community and to fill in the gaps left by failure from the state. Even so, organizations sometimes face hardships and limitations due to various reasons, but the most common being: lack of funding.

Therefore, the involvement of civil organizations is crucial for the purpose of this research, that being to identify the urban–architectural interventions that could be potentially carried out in order to improve the impact and efforts the organizations make and to reduce the level of vulnerability in the community. Through the participation of these organizations in this research, it is possible to register which interventions are both the most desired and helpful and to potentially seek the necessary funding to carry them out. To attain such participation, a survey was provided to active civil organizations from Ciudad Juárez. For this reason, a directory provided by the state was used in order to contact and pursue said cooperation.

This directory is publicly available online through the government's page (https://www.juarez.gob.mx). It brings forth the information of 186 civil organizations, including name, address, contact information, objective and services. Thereupon, a recollection of the email addresses made possible the delivery of the invitation to participate in this research. All 186 organizations plus a few more, resulting in a total of 240, were contacted via email for the purpose of distributing the survey designed for their collaboration.

The survey collected data from 19 subjects. Since 240 associations were contacted and invited to participate, the overall response rate was 8%. This figure of low percentage can be partially explained by the fact that several of them had to suspend their activities during the COVID outbreak (in fact, when provided with an organization's phone number, the authors tried to made contact with those that did not participate in the survey but failed to do so, discovering that they had recently put an end to their activities and services). At the same time, the low response rate can be explained by the fact that several organizations had not had any previous contact with the research team. Ultimately, the result can also be an expression of a numb environment, barely inclined to share information.

3 RESULTS AND DISCUSSIONS

The authors took into account all the questions answered in the survey which revealed important information regarding the topic of interest to the research: urban–architectural interventions that could potentially help boost efforts being made by civil organizations and reduce the level of vulnerability of the community, which can ultimately be summarized in the perception of which interventions would be both helpful and carried out by these associations if the necessary funding was provided.

3.1 Section I: Organization's features

For this first section, from the responses obtained, the relevant and analyzed data includes towards whom or what are the organizations' missions directed to; the organizations' work area or reach capacity within the city; the people they directly help each year; and the type of funding each one of them receives.

As for the first topic of interest, 55.6% of respondents indicated that the organization works and focuses on *children*, followed by *family* and *adolescents,* both acquiring a

selection percentage of 44.4%. It is of equal importance to state that the succeeding highest percentage is 33.3%, belonging to *education*. This comes to show that most of the organizations in Ciudad Juárez aim their attention towards child development, family stability and security and education because, as far as it can be concluded, these matters are the core of social development.

The remaining features of the organizations that are discussed reveal that (1) 61.1% of the organizations have been in service from 10 to 20 years, showing that none of them are less than five years old; (2) the range of people they attend varies, being selected at an equal percentage of 22.2% from *50 to 100 people*, *500 to 1,000 people* and *over 1,000 people*; (3) that 88.9% of them receive their funding from donations which marks a substantial difference from the 22.2% that obtain governmental funding; and (4) that the work and help these organizations provide is evenly distributed in the 6 areas in the presented division of the city, shown in Fig. 4.
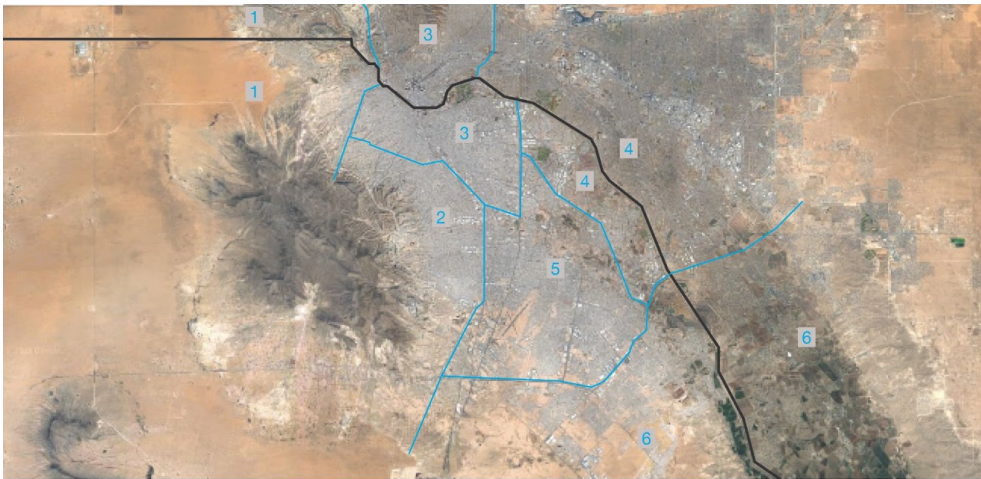

Figure 4: Map of Ciudad Juárez, with the six areas to refer to the NGO's activities.

3.2 Section II: Organization's vision on Ciudad Juárez

This next section of the questionnaire brings to light that the main issues Ciudad Juárez faces are violence related. Both *violence* and *child abuse* obtained a selection percentage of 73.7%, succeed by related matters such as, *drug addiction* (57.9%), *insecurity in the streets and public spaces* (47.4%), and *murders and femicides* (42.1%). Additionally, important social deficiencies and problems were too given their respective significance, having chosen *lack of education* (63.2%), *deficiencies in health services* (42.1%), *discrimination* (42.1%) and *poverty* (42.1%). The following concerns at hand according to the respondents are *migration* and *lack of infrastructure*, both at 36.8%. These results demonstrate that the previously mentioned problems are both highly visible and severe. In regards to the relevance each problem was given, most of the respondents consider them all strikingly important. Yet, as stated before, *violence* remains and is identified by the organizations as the most concerning and affecting of all.

3.3 Section III: Feasible interventions

On the subject of urban–architectural interventions, this section asked the respondents to select which ones of the given have they carried out, are currently working on or plan on executing during this present year, having too the options of choosing if they have never taken them into account or if they believe it is highly unlikely the intervention addressed will never be carried out.

The results show that a similar percentage of respondents selected that the organizations has either carried out the intervention or plans to. Both choices obtained a high and similar percentage from one another for most urban–architectural interventions presented. Though, said outcome is most evident for the *remodeling of the offices and/or facilities of the organization*, having selected, out of 19 respondents, 11 that they plan on doing so and seven that they have already have. The interventions that were chosen with the highest percentage to be carried out are: *remodeling of the offices and/or facilities of the organization, implementation of sustainable strategies* and *generation of workshop facilities*, successively. And, for the case of which ones have the organizations carried out before, the ones that received the most selections are: *cleaning of public spaces, restoring of parks and green areas, generation of workshop facilities, intervention in abandoned buildings, restoring public spaces* and *remodeling of the offices and/or facilities of the organization.*

3.4 Section IV: Desired interventions

This section reveals which urban–architectural interventions would be both helpful and carried out by the organizations if the necessary funding was provided, on such matter, those with the highest priority according to the organizations are: (1) *generation of workshop facilities*; (2) *implementation of sustainable strategies*; (3) *remodeling of the offices and/or facilities of the organization*; and (4) *office construction for the organization*. From these results, it is inferred that the organizations would not invest in public spaces as is expected, which can be due to a failed attempt at doing so because of neglect and proper design and integration of the community. Moreover, it is concluded that spaces for workshops are particularly important to these organizations, pointing out a necessity and calling into action those who have the power to make them happen.

4 CONCLUSIONS

A first observation lies in how civil organizations perceive problems and possible solutions: almost all associations see violence (homicides, femicides, mistreatment, etc.) and drug addiction as the two most serious issues. In the same way, the front on which the organizations work the most is education, which is recognized as the most important matter for solving these problems in depth.

Moving on to the physical dimension of urban–architectural interventions, it appears relevant how, in the past, the main actions have been directed towards interventions in public spaces and parks, with works involving the local community. Contradictorily, if we refer to the interventions that the organizations plan to implement in the course of next year, it is clear that the private spaces of the organizations assume importance. On the one hand, reference is made to the operational spaces of the organizations, as if to indicate the need to be able to rely on a more effective operational structure to manage and control activities. On the other hand, reference is made to spaces for workshops, where they may carry out work activities with the communities in a more protected and controlled environment. This trend is evident not only in the projects that are being considered for the next few months, but also

in the responses in reference to interventions that would ideally be carried out with the availability of elevated resources. In particular, in the latter scenario, the theme that appears most relevant is that of being able to count with spaces for workshops.

From these conclusions, it is evident that to reduce the socio–environmental conflicts present in our cities (particularly violence and drugs), civil organizations consider education to be the main tool. To encourage these educational activities and increase their impact, civil organizations themselves see the need to count with formal spaces. This would allow them to continue with their community engagement and empowering initiatives as has been done so far, mainly in public and open spaces.

Although this research started with a large number of organizations on which to research, the actual participation of the organizations proved to be limited. Undoubtedly, this low participation, even if it demonstrates the effective vivacity of the associative and volunteering world in Ciudad Juárez, also represents a partial limitation of the research as it did not allow to count with a larger sample. Expanding the sample and going deeper into the needs of these "indoor" interventions that the organizations raised represents the next steps of the research, which will also broaden the view towards the other side of the border, looking for a comparison between the two different national realities.

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