

## RESEARCH APPROACH ADOPTING TECHNOLOGIES TO CRIME AND FEAR AMONG HIGHER EDUCATION STUDENTS USING PUBLIC TRANSPORTATION IN CIUDAD JUAREZ, MEXICO

### RESEARCH APPROACH ADOPTING TECHNOLOGIES TO ADDRESS CRIME AND FEAR AMONG HIGHER EDUCATION STUDENTS USING PUBLIC TRANSPORTATION IN CIUDAD JUAREZ, MEXICO

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**Abstract** -- We propose to adopt a management engineering approach to investigate the profiles of crime and fear in higher education students in three higher education institutions in Ciudad Juarez and propose technological solutions to eliminate, prevent or control their incidence. An explanatory research that adopts quantitative methods is outlined to study a population N = 25,890 students, for which a random sampling scheme is proposed considering a sample n = 379. An ad hoc data collection instrument (questionnaire) will be designed seeking inter-institutional consensus and validation by expert judgment. Three objectives are established. The first is to know and examine the victimization experiences of students using public transportation in three higher education institutions. The second is to establish the conditioning factors for the incidence of victimization and fear of insecurity among these students. The third is to identify management avenues, through the adoption of technological solutions, aimed at reducing the incidence of crime and fear among higher education students who use public transportation. The deliverables and the forms of participation of collaborators and students are detailed.

**Keywords:** public space safety, victimization, smart solutions.

**Abstract:** It is proposed to adopt a management engineering approach to investigate crime and fear profiles in higher education students from three education institutions in Juarez and propose technological solutions to eliminate, prevent or control its incidence. An exploratory research is proposed adopting quantitative methods to study a population N = 25,890 students, for which a random sampling scheme is proposed considering a sample n = 379. An ad hoc data collection instrument (questionnaire) will be designed seeking the inter-institutional consensus. and validation by expert judgment. Three objectives are established. The first is to know and examine the victimization experiences of students using public transportation from three higher education institutions. The second is to establish the conditions for the incidence of victimization and fear due to the insecurity of these students. The third is to identify management ways, through the adoption of technological solutions, aimed at reducing the incidence of crime and fear in higher education students who use public transportation. The deliverable products and the forms of participation of collaborators and students are detailed.

**Key words** - security in public space, victimization, intelligent solutions.

## INTRODUCTION

Citizen safety is one of priorities in Mexico. In this sense, public space is the predominant scenario of victimization in the country. Streets, parks, squares or public transportation, that is, the common space [1][2] is a place of insecurity where people are victims of crime.

The "Politics and Government" section of the National Development Plan (PNG) 2019-2024 highlights the genuine complaint of Mexicans about the insecurity that has prevailed in the country for decades [3]. Considering the rate of adult victims per 100,000 inhabitants, the

The National Survey of Victimization and Perception of Public Safety (ENVIPE) revealed that in 2021 there was a victimization rate of 24,207. Robbery in the street or on public transportation ranked first nationally with 6,582 (21.) [4]. Regarding the state of Chihuahua, ENVIPE reports a rate of 23,819, in which the aforementioned item is in second place. This figure is 15.8% higher than in 2020, when victimization was reduced due to the health contingency.

With regard to crimes committed, ENVIPE reports a rate of 30,786 at the national level. The incidence is higher in the urban domain, where it reaches 35 240, while in the rural domain it only reaches 15 581. In Chihuahua the rate amounted to 26 432, with figures of 29 276 for the urban domain and 8975 for the rural environment. In category robbery in the street or on public transport, the national incidence of this crime decreased from 9091 in 2019 to 6582 in 2021, due to the stoppage of activities due to the COVID19 pandemic.

In Ciudad Juarez, the phenomenon of insecurity has been a systemic condition that has surpassed state and municipal governments. During the administration of President Felipe Calderón, insecurity and violence in public spaces reached unprecedented levels; the city came to be considered the most violent in the world [5][6]. The current rates of violence and insecurity in the city do not reach the levels of those times, but there is still a high incidence of crime [7]. Although the city's crime profile is different from the national one, the level of crime in public spaces is high, particularly crimes in the streets and on public transport [8]. In large metropolitan or sprawling cities, people spend considerable time traveling by public or private means from their origins to their destinations. In the different modes of public transport, it is common for crimes or acts of incivilities to occur that affect the victimization rate. This issue is referred to in academia as crime and fear in public space when moving [9]. Although studies are

In Mexico, the literature seems to suggest that the incidence of crime is due to the prevalent physical or social vulnerabilities of the user population and the lack of public policies with a gender perspective [10] [11] [12] [13].

For decades, Juarenses have suffered from a public transportation system that has been improvised, disarticulated, imprisoned by corporate mafias, lacking a vision and a professionalization strategy in its operation. The service providers have privileged profitability over service quality and people's safety, which in the end has deprived this service of what is considered an unavoidable premise in cities that aspire to be places of well-being.

people-centered: sustainability [13].

With the above framework, this research has three purposes. First, to know and examine the victimization experiences of students who use public transportation in three higher education institutions: Universidad Autónoma de Ciudad Juárez/Instituto de Ciencias Sociales y Administración (UACJ/ICSA), Tecnológico Nacional de México/IT de Ciudad Juárez (ITCJ) and Universidad Tecnológica de Ciudad Juárez (UTCJ). Second, to identify the conditioning factors for the incidence of victimization and fear of insecurity in public transportation among the aforementioned users. And third, to establish management avenues aimed at reducing the incidence of crime and fear in public transportation.

This project is justified because it addresses a high priority issue for the country. From the national perspective, it is essential that the State guarantees the safety of Mexicans, as established by the federal executive in the PND 2019-2024. From the state level, in the Sectorial Program of Territorial Ordering and Sustainable Development, actions are foreseen so that people spend less time in public transportation and move to their destinations in a reliable and safe way [14]. At the municipal level, without making direct reference to safety in

transportation, it addresses the need for good connectivity in the municipality by improving infrastructure and reducing the number of automobiles. Emphasis is placed on the need to use sustainable means, such as walking or cycling [15].

However, it is not known how many higher education students use public transportation to travel to higher education institutions in Ciudad Juarez. In this regard, a recent study found that 41.8% of the users surveyed reported using public transportation to attend school [10]. However, this study does not specify the proportion of users that corresponds to higher education students. Thus, there is considerable uncertainty about the forms of victimization that take place on public transportation in

The study also does not reveal their fears about insecurity in public transportation and its determinants. It is also unclear what their fears are regarding insecurity in public transportation and its determinants. Finally, there are no avenues of relevant efforts to victimization and fear in transportation. This research project attempts to reduce the prevailing uncertainty on these three issues.

### Background

The public transportation system in Ciudad Juarez has not evolved dynamically. In contrast to other sectors of the economy (such as manufacturing, restaurant and hotel services), public transportation maintains low levels of service quality and safety. In addition to the regulatory context referred to above, the problems of public transport in the city can be seen from two perspectives: that of the concessionaires providing the service and that of the users. Regarding the concessionaires, it is possible to mention deficiencies such as: limited territorial coverage, schedule delays, vehicles in poor condition, missing or inadequate identification and signage, inappropriate driving, poor presentation or bad behavior of operators, excessive noise sources and other minor incidents attributable to the concessionaire [10].

[10] [16]. In the users' domain, incivilities and crimes occur before, during and after the trip. It is common for users to mistreat the units, scratch the seats or the body of the unit, destroy the upholstery, improperly handle the doors and windows, spill liquids or body fluids, as well as other behaviors that threaten the unit or the stations. On the other hand, there are cases of victimization by robberies, assaults, insults or injuries, as well as sexual crimes, such as insinuating or intimidating approaches, touching, verbal offenses, exhibitionism, leering and other acts of sexual harassment [9]. According to data from the Juarez Strategic Plan (2021), the motor vehicle fleet has experienced a linear growth ( $y = 13\,655x + 406\,177$ ,  $R^2 = 0.921$ ).

since 2007, when 438,381 vehicles were circulating. In 2022, it is estimated that 624,657 vehicles will circulate, a figure that will increase to 638,312, which would mean an increase of

45.6% since the reference year. In this sense, 72.3

of households have at least one vehicle, which represents an average of 0.97 vehicles per household. This seems to explain why 51.8 % of people travel to their destinations by private vehicle and only 10.5 % of the households have at least one vehicle, which represents an average of 0.97 vehicles per household.

### General Objective

To develop a technology management model that affects the reduction of crime and fear profiles in high school students of three institutions in Ciudad Juarez.

### Specific objectives

This research aims to achieve three specific objectives:

1. To learn about and examine the victimization experiences of students using public transportation in three higher education institutions: Universidad Autónoma de Ciudad Juárez/Instituto de Ciencias Sociales y Administración (UACJ/ICSA), Tecnológico Nacional de México/IT de Ciudad Juárez (ITCJ) and Universidad Tecnológica de Ciudad Juárez (UTCJ).
2. To establish the conditioning factors for the incidence of victimization and fear of insecurity higher education students who use public transportation.
3. Identify avenues of technological management aimed at reducing the incidence of crime and fear among higher education students who use public transportation.

### Theoretical framework

The place where the most intense meaning of urban life is reflected is public space [17][18]. In this sense, streets and public transportation are the scenes of a large proportion of crimes in Mexico [4]. For decades, research by Hale (2016) revealed that people who feel fear of being victims of crime experience adverse emotional effects, such as isolation and vulnerability, the latter of which fosters extra disbursements due to people's need to protect themselves [19]. Likewise, fear of crime disrupts the quality of community life and decreases the ability to evaluate danger scenarios, which ultimately results in a reduced understanding of the phenomenon and a disarticulation of its management [21]. What is known about crime in Mexico is only the tip of the iceberg, because as has been mentioned [12][19], the dark figure or black figure in Mexico is around 90%, i.e., only one out of every 10 crimes is reported. In 2021, the black figure in the country reached 93.9%, one percentage point higher than in the previous year. 92.9% in 2020, when the SARS-Cov-2 pandemic was raging [4]. The black figure does not seem to be the exception in Mexico, but would be a constant in many Latin American countries [20].

Safety in public space, including public transportation, is an essential condition for urban sustainability and one of the priorities of societies that aspire to have a high quality community life [17]. The yearning for safer, more inclusive and sustainable cities is in line with the Global Agenda for Sustainable Development 2030 [13] and the Agenda 2025 for Public Space and Public Life in Mexico [22]. Of the five perspectives from which crime and fear in public space are approached, namely: the built environment, movement, user, indicators and intervention, this research adopts the second one, focusing on what the literature refers to as crime and fear in public space.

when on the move [9][17]. In this perspective, crime, the consequent victimization and fear are processual, i.e., this movement includes three processes: a) taking the transport (arriving, waiting and boarding the unit), b) traveling (moving in the unit), and c) arrival (getting off the unit and starting the march on foot). The journey, of course, may include transfers in which the above processes are replicated. During the transfer process, people experience a sense of captivity that is part of the dynamics of crime and fear associated with transit in which various vulnerabilities that promote crime are manifested, particularly in vulnerable groups, such as women, the elderly or people from the LGBT+ community [17].

The literature suggests that it is possible to establish a link between fear of crime at the community or collective level and at the individual level [23][24]. There are three theories at the individual level. The first states that those who have been victimized have higher levels of fear than those who not. In this sense, victimization is direct if a person suffers the crime, while it is indirect if it is suffered by those who know the victim or know of the crime [12][21]. There is abundant literature supporting the second theory, which states that physical vulnerability predisposes to fear of crime, i.e., that people with some physical weakness, whether because they are women, elderly, disabled, children, or of thin build, experience more fear of being victims of crime [12] [2] [2][25]. Social vulnerability theory reinforces the idea that individuals belonging to disadvantaged social groups are more likely to experience fear of being victims of crime [9]. This includes vulnerable groups, such as 60 and over, women, elderly or LGBT+ people, as well as people from marginalized socioeconomic strata and low educational levels or without employment. Two theories are identified at the collective level [12][19]. The first, related social disorder, was developed decades ago by Hunter (1971) and states that the physical conditions of communities and the practices that take place in them condition the levels of fear of crime. In more contemporary versions, this theory has been adapted to a new semantic field that considers the state of the built environment of the neighborhood or community as a causal mechanism of fear together with social phenomena, such as poor social control in terms of surveillance. Other social conditions play a role, such as crime rate or reputation [17] [24]. The second theory is related to the social communication networks established in the neighborhood or community [21]. Here, social cohesion, collective responses against crime scenarios and community communication with authorities play a preponderant role [12]. Referring to public transportation, the patterns of crime and fear while on the move among students in Mexico are almost unknown, in Ciudad Juarez in fact they are. Vilalta's (2011) work out in Mexico City (CDMX) highlighted the

importance of studying this issue. Although it does not highlight the student group as a target population, the research revealed the low quality of life experienced by people while traveling in the different modes of public transportation in CDMX. The findings include confirmation of the theories of fear of crime, with the exception of the one on social vulnerability, where it is argued that one should go deeper and not only use estimators or proxies to address it. A recent study on public transportation safety was conducted with a group of young professional students from an institution in eastern Mexico City [11][24]. The results confirmed four hypotheses a) women experience more victimization for sexual crimes than men, which decreases if a policy of women-only units is adopted; b) victimization varies according to the type of sexual crime and is dynamic along the route; c) users' perceptions of safety differ according to the type of transport, en route or at the terminal, or according to the time of the trip; and d) passengers take precautionary measures to avoid sexual harassment during transit on public transport, i.e., they adapt their clothing, transportable belongings and jewelry [26] cited by [11][24]. The two works mentioned above and that of Ampudia-Rueda and Limas-Hernández (2022), referred to in previous sections, would be the references in Mexico. In other countries, a study in India confirmed the prevalence of sexual harassment in public transport among female students, as well as the indifference of those who witnessed it [27]. In Japan, research by [28] with university students showed that young women suffer from sexual touching and groping. Also with university students, the research of [29] in Nigeria confirmed the processual nature of crime and fear when on the move by showing that undergraduate students, i.e., the youngest ones, expressed a high level of fear in the boarding (arriving, waiting and boarding the unit) and alighting processes (getting off the unit and starting to walk). Finally, the work of Nourani et al. (2020), who studied fear and safety on public transport among young women and people from the LGBT+ community in Rio Claro, Brazil, stands out. Their focus emphasized sexual harassment and assault in these two groups. Two hypotheses were confirmed: a) women make up the majority group of victims, b) among the LGBT+ community, victimization in women exceeds that of men by a 5.25:1 ratio. The results also confirmed that fear is procedural in nature, as 70 % of the students experienced fear while waiting for the transportation unit.

### Impact or benefit

In light of the National Strategic National Programs (PRONACES) of the National Humanities Council,

Science and Technology (CONAHCYT), this research project will provide a range of solutions to solve the prevalent problem in three higher education institutions, namely: UACJ/ICSA, ITCJ and UTCJ. The achievement of the three objectives entails not only the generation of new scientific knowledge, but also addresses a high priority problem for the city, especially for university students. The link between research and reality is more than evident, since the study of what CONAHCYT refers to as Structural Violence is a transcendental issue for the country. Violence derived from insecurity and the fear it implies, disrupts the social welfare of Mexicans, in this case, of higher education students. In this regard, the direct benefits of this research are listed below:

- Understanding of victimization and fear patterns of higher education students.
- Awareness of the conditioning factors of crime and fear in higher education students.
- A matrix of technology management avenues to influence the reduction of crime and fear in higher education students.
- Training of those responsible for security at each site.
- Development of an institutional plan for the control and reduction of the prevalence of crime and fear in higher education students based on technological solutions.
- In the long , reduction in the incidence of crime among higher education students using public transportation.

## DEVELOPMENT

A participatory, non-experimental, explanatory and cross-sectional action-research design is proposed. Quantitative methods are used, specifically, the survey technique. SPSS®, MINITAB® and MS-Office® software will be used for data analysis. The population includes 9600 students from UACJ/ICSA, 8090 from ITCJ and 8200 from UTCJ, for a total study population comprising 25,890 students. In order to achieve 95% confidence and no more than 5% error, a sample of 379 individuals proportionally distributed in the three institutions is established. The research goes through four phases:

Phase 1. Design of the measurement instrument. Based on an exhaustive literature review, a measurement instrument will be developed, that is, an ad hoc data collection questionnaire will be developed. Through an expert judgment session, the content validity of the instrument will be established. Once the instrument has been agreed upon and validated, it will be piloted and any necessary adjustments will be made.

Phase 2. Data collection. The survey will be applied simultaneously in three higher education institutions. With the participation of the students of social service and

residents, a module will be installed on each campus and a link will be posted on each institution's portal so that the questionnaire can also be completed online.

Phase 3. Data analysis and processing. Once the survey has been completed, the questionnaires will be debugged, discarding those that were not filled out properly; in this case, the lack of data will be corrected by applying additional questionnaires until the sample is complete. A data matrix will be developed in Excel® and then exported to SPSS® and MINITAB®.

Phase 4. Preparation of the final report. Once the data processing is finished, the final document will be prepared, the refereed article will be sent, the divulgation article will be sent and the final report will be registered in INDAUTOR with due credit to the Tecnológico Nacional de México/IT of Ciudad Juárez. The degree of progress of the doctoral student will be reported and the residency reports of the resident student will be finalized, as well the certificates of the social service students.

Finally, the results will be disseminated to the three institutions so that management actions can be taken accordance with their own internal policies.

## Link

The project approach is participatory action research. This research design involves intensive engagement with the object of research, in case the three institutions of higher education. Stakeholders have a high degree of interaction with each other. The participation of one graduate student (doctorate) and three undergraduate students (one resident and two for social service or complementary credits) is specified. A relationship will be established with the authorities of each institution. Data collection will be a participatory exercise of inter-institutional linkage in which students and eventually personnel from other institutions will participate. The document containing the results obtained, as well as the management avenues, will be registered as intellectual property in INDAUTOR granting recognition to TecNm/IT of Ciudad Juárez.

## Places where the project is to be developed

The project will be carried out in Ciudad Juarez, at the Graduate Studies and Research Division of the TecNM/IT of Ciudad Juarez, as well as in two other higher education institutions: Universidad Autonoma de Ciudad Juarez/Instituto de Ciencias Sociales y Administracion and Universidad Tecnologica de Ciudad Juarez. The cubicle assigned to the professor leader of the research project, located in the Graduate Studies and Research Division of the TecNM/IT of Ciudad Juarez, which has furniture and equipment, internet access, as well as computer infrastructure and software.

## DISCUSSION AND ANALYSIS OF RESULTS

As recommended by Vilalta, Payne and Taylor, the following figures show the location of the study units and the enrollment of each of them.

The forms of victimization of higher education students in the process of transportation from an origin to the main public institutions of higher education remain unknown in Ciudad Juárez. It is hoped that this research will reveal the patterns from a processual perspective, that is, considering public transportation as a system in which four fundamental processes are involved: moving to the destination station, waiting for the arrival of the unit, traveling by public transportation, and moving from the destination to the educational institution.

It is expected that the factors that the incidence of criminal behavior and the appearance of fear and dread in the use of public transportation will be identified. It should not be forgotten that the population to be studied is particularly important, because the future of the country lies in the hands of university students. With the development of this approach, a window of opportunity is opened to make incursions, from Administrative Engineering, and with inter and transdisciplinary visions in a subject of the highest importance for the country.

In particular, it is expected to reveal the typologies of criminality, that is, the forms of crime and the frequency of its occurrence. It is also expected to discover how this criminal incidence induces fear in the use of public transportation, one of the public space formats most used by the population, particularly students. Another expectation of the research approach developed here is to find the differences between the institutions studied. Given that the location of these institutions varies according to the socioeconomic profile of their geography, it is interesting to know these differences, since they would allow actions of prevention, control or improvement of management actions aimed at reducing crime and fear among this group of the student population.

A management plan using intelligent technologies, such as video cameras, facial recognition, lighting or monitoring, is expected. Technological alternatives have a scarce use in the city, their incursion is incipient, so a management scheme with concrete actions is desirable. Likewise, the coordination actions between the different levels of government and the authorities of the educational institutions are unknown. This coordination plays an important role in the incidence of crime and the fear associated with it.

Finally, it is expected that, as a result of the research, publications will be published in refereed and indexed journals, as well as registrations in INDUTOR. This is an important part of the scientific work, since the dissemination of the results allows the rapprochement with other disciplines, enriches the academic heritage and promotes the realization of

studies that broaden the scientific framework on the subject.

Table 1. Enrollment of Educational Institutions

| Educational Institutions | Registration |
|--------------------------|--------------|
| (UACJ/ICSA)              | 9,200        |
| (ITCJ)                   | 8,090        |
| (UTCJ)                   | 9,000        |

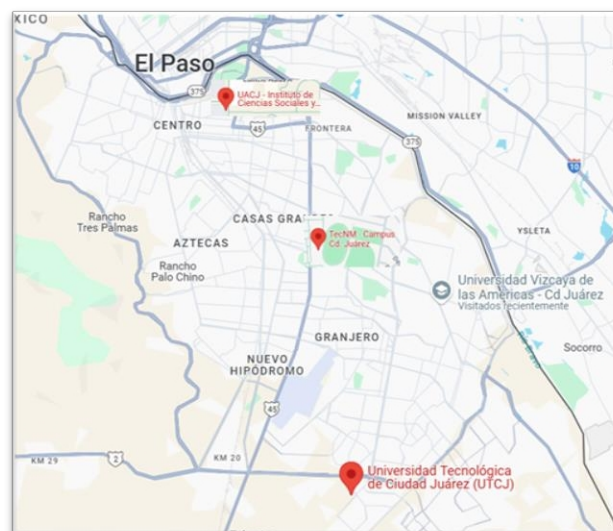


Figure 1. Location of Educational Institutions

## CONCLUSIONS

The main conclusion is that the approach developed is feasible to be applied; no spatial, time or depth limitations are perceived that would prevent the project from being carried out. It is also concluded that the approach outlined is robust in that it has methodical rigor and theoretical support. In addition, the program of activities leaves no room for ambiguity and the goals are achievable.

Another important conclusion is that the development of this work makes clear the importance of the engineering approach with its different disciplines for the treatment of recurrent social problems, such as crime and violence in the country. Technological approaches offer management alternatives that allow proactive guidelines aimed at the elimination or prevention of crime and, in case of a consummated criminal act, the rapid reaction and control of its consequences.

For future research, it is recommended to consider a public policy agenda resulting from this research. To this end, it is important to know the victimization profiles and forms of crime, which will result in the development of intelligent management measures to mitigate the incidence of crime and fear in public transportation in this important group of society.

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